



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

**B.Sc. (Hons. / Hons. with Research)
Artificial Intelligence & Machine Learning
(Syllabus)**

W.E.F. ACADEMIC YEAR: 2024-25

MGM University

Vision

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

Mission

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

विद्यापीठ गीत

अत्त दिप भव भव प्रदिप भव,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

अत्ताहि अत्त नो नाथो ,

अत्ताहि अत्त नो गति

अत्त मार्गपर अप्रमादसे है तुझे चलना

सब्ब का कल्याण हो ,

वो कार्यकुशल करना

सब्ब का उत्तम मंगल , पथप्रदर्शक हो

अत्त दिप भव भव प्रदिप भव ,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

बुद्धमं शरनं गच्छामि :

धम्मं शरनं गच्छामि :

संघं शरनं गच्छामि :

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 Sambhajanagar.

Vision

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

Mission

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

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

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

Name of Program – B.Sc. (Hons. / Hons. With Research) AI & ML

Duration – Four Years

Eligibility -

- He / She Must have passed the Higher Secondary 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).

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 Faculty: Basic and Applied Science

Name of the College/Institute/Department/School: Dr. G. Y. Pathrikar College of Computer Science and Information Technology

Name of the Programme: B.Sc. (Hons. / Hons. With Research) AI & ML

Programme Type (UG/PG): UG

Duration: Four Years

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

Major	
Artificial Intelligence & Machine Learning	
Core Major	Core Elective

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

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

	Energy management					
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MGMUNIVERSITY

Name of Faculty: Basic and Applied Science

Name of the College/Institute/Department/School: Dr. G. Y. Pathrikar College of Computer Science and Information Technology

Name of the Programme: B.Sc. (Hons. / Hons. With Research) AI & ML

Programme Type (UG/PG): UG

Duration: Four Years

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	GAM41MM L101	Operating System	Lecture	2	2		30	20	50		8	20
MM	GAM41MM L102	Design Thinking and Innovation	Lecture	2	2		30	20	50		8	20
MM	GAM41MM P101	Practical based on Operating System	Practical	1		2	30	20	50		8	20
MM	GAM41MM P102	Practical based on Design Thinking and Innovation	Practical	1		2	30	20	50		8	20
IKS	GAM41IKL 101	Indian Psychology and yoga	Lecture	2	2	-	30	20	50		8	20
AEC	MGM54AE L104	Functional Marathi	Lecture	2	2	-	30	20	50		8	20
OE	OE-1	*OE-1 University Basket	Lecture	2	2	-	30	20	50		8	20
OE	OE-2	*OE-2 University Basket	Lecture	2	2	-	30	20	50		8	20
VSC	GAM41VSP 101	Programming Logic and Design	Practical	2		4	30	20	50		8	20
SEC	GAM41SEL 101	Mathematical Foundation	Lecture	2	2	-	30	20	50		8	20
VEC	MGM21VE L101	Environmental Studies	Lecture	2	2	-	30	20	50		8	20
CC	MGM85CC P107	Cultural Activities	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	GAM41MM L103	Data Structure	Lecture	2	2		30	20	50		8	20
MM	GAM41MM L104	Python	Lecture	2	2		30	20	50		8	20
MM	GAM41MM P103	Practical based on Data Structure	Practical	1		2	30	20	50		8	20
MM	GAM41MM P104	Practical based on Python	Practical	1		2	30	20	50		8	20
MI	Minor	*Minor University Basket	Lecture	2	2	-	30	20	50		8	20
AEC	MGM54AE L102	Functional English	Lecture	2	2	-	30	20	50		8	20
OE	OE-3	*OE-3 University Basket	Lecture	2	2	-	30	20	50		8	20
OE	OE-4	*OE-4 University Basket	Lecture	2	2	-	30	20	50		8	20
VSC	GAM41VSP 102	Advance Excel	Practical	2		4	30	20	50		8	20
SEC	GAM41SEL 102	Statistical Methods	Lecture	2	2	-	30	20	50		8	20
VEC	MGM56VE L102	Constitution of India	Lecture	2	2	-	30	20	50		8	20
CC	MGM82CC P103	Sports	Practical	2	-	4	50	-	50	20	-	20
Total				22	16	12	380	220	600			

Note:

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

Second Year - Semester III												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	GAM41MM L201	AI and ML Essentials	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MM L202	Regression Analysis & Optimization Technique	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MM P201	Practical Based on AI and ML Essentials	Practical	1	-	2	30	20	50	-	08	20
MM	GAM41MM P202	Practical Based on Regression Analysis & Optimization Technique	Practical	1	-	2	30	20	50	-	08	20
OE	OE-5	*OE-5 University Basket	Lecture	2	2	-	30	20	50	-	08	20
MI	Minor	*Minor University Basket	Lecture	3	3	-	60	40	100	-	16	40
MI	Minor	*Minor University Basket	Practical	1	-	2	30	20	50	-	08	20
AEC	MGM54AEL 103	Functional Hindi	Lecture	2	2	-	30	20	50	-	08	20
VSC	GAM41VSP 201	Exploratory Data Analysis	Practical	2	-	4	30	20	50	-	08	20
FP	GAM41FPJ 201	Field Project - I	Practical	2	-	4	50	-	50	20	-	20
CC	MGM82CCP 201 / 101 / 102	Health and Wellness / National Cadet Crops / Yoga	Practical	2	-	4	50	-	50	20	-	20
Total				22	13	18	460	240	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

Second Year - Semester IV												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	GAM41MML203	Machine Learning Engineering	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MML204	Data Mining in AI	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MMP203	Practical Based on Machine Learning Engineering	Practical	1	-	2	30	20	50	-	08	20
MM	GAM41MMP204	Practical Based on Data Mining in AI	Practical	1	-	2	30	20	50	-	08	20
OE	OE-6	*OE-6 University Basket	Lecture	2	2	-	30	20	50	-	08	20
MI	Minor	*Minor University Basket	Lecture	3	3	-	60	40	100	-	16	40
MI	Minor	*Minor University Basket	Practical	1	-	2	30	20	50	-	08	20
AEC	MGM54AEL203	Communication Skill	Lecture	2	2	-	30	20	50	-	-	20
SEC	GAM41SEP201	Intelligent Data Management Systems	Practical	2	-	4	30	20	50	-	08	20
CEP	GAM41CEP201	Community Engagement Program	Practical	2	-	4	50	-	50	20	-	20
CC	MGM82CCP104/ MGM73CCP105/ 106	NSS / Fine Arts / Visual Arts	Practical	2	-	4	50	-	50	20	-	20
Total				22	13	18	460	240	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

Third Year - Semester V												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	GAM41M ML301	Deep Learning	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41M ML302	Computer Network for AI and ML	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41M MP301	Practical Based on Deep Learning	Practical	1	-	2	30	20	50		08	20
MM	GAM41M MP302	Practical Based on Data Visualization	Practical	1	-	2	30	20	50		08	20
ME	GAM41MEL301	Big Data	Lecture	3	3	-	60	40	100		16	40
	GAM41ME L302	Predictive Analytics										
ME	GAM41ME P301	Practical Based on Big Data	Practical	1	-	2	30	20	50		08	20
	GAM41ME P302	Practical Based on Predictive Analytics										
MI	Minor	*Minor University Basket	Lecture	3	3	-	60	40	100		16	40
MI	Minor	*Minor University Basket	Practical	1	-	2	30	20	50		08	20
VSC	GAM41VS P301	R Programming	Practical	2	-	4	30	20	50		08	20
FP	GAM41FPJ 301	Field Project - II	Project	2	-	4	50	-	50	20	-	20
Total				22	13	18	460	240	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

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	GAM41M ML303	Applied Large Language Model Development and Deployment	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41M ML304	Cloud Computing for AI & ML	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41M MP303	Practical Based on Applied Large Language Model Development and Deployment	Practical	1	-	2	30	20	50		08	20
MM	GAM41M MP304	Practical based on Cloud Computing for AI & ML	Practical	1	-	2	30	20	50		08	20
ME	GAM41M EL303	Big Data Analytics	Lecture	3	3	-	60	40	100		16	40
	GAM41M EL304	AI in Business Intelligence										
ME	GAM41M EP303	Practical Based on Big Data Analytics	Practical	1	-	2	30	20	50		08	20
	GAM41M EP304	Practical Based on AI in Business Intelligence										
MI	Minor	*Minor University Basket	Lecture	3	3	-	60	40	100		16	40
MI	Minor	*Minor University Basket	Practical	1	-	2	30	20	50		08	20
OJT	GAM41JT P301	On Job Training – I	Practical	4		8	60	40	100		16	40
Total				22	13	18	460	240	700			

Note:

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

Fourth Year - Semester VII												
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	GAM41MM L401	Computer Vision	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MM L402	Natural Language Processing	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MM L403	Edge AI	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MM P401	Practical Based on Computer Vision	Practical	2	-	2	30	20	50		08	20
MM	GAM41MM P402	Practical Based on Natural Language Processing	Practical	2	-	2	30	20	50		08	20
MM	GAM41MM P403	Practical Based on Edge AI	Practical	2	-	2	30	20	50		08	20
ME	GAM41MEL 401	AI in Healthcare	Lecture	3	3	-	60	40	100		16	40
	GAM41MEL 402	AI in Social Media										
ME	GAM41MEP 401	Practical Based on AI in Healthcare	Practical	2	-	2	30	20	50		08	20
	GAM41MEP 402	Practical Based on AI in Social Media										
RM	GAM41RML 401	Research Methodology	Lecture	3	3	-	60	40	100		16	40
RM	GAM41RMP 401	Practical based on Research Methodology	Practical	2	-	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	GAM41M ML404	Explainable AI	Lecture	3	3	-	60	40	100		16	40
MM	GAM41M ML405	Sentiment Analysis	Lecture	3	3	-	60	40	100		16	40
MM	GAM41M ML406	Generative AI	Lecture	3	3	-	60	40	100		16	40
MM	GAM41M MP404	Practical Based on Explainable AI	Practical	1	-	2	30	20	50		08	20
MM	GAM41M MP405	Practical Based on Sentiment Analysis	Practical	1	-	2	30	20	50		08	20
MM	GAM41M MP406	Practical Based on Generative AI	Practical	1	-	2	30	20	50		08	20
ME	GAM41ME L403	AI With Cloud Services	Lecture	3	3	-	60	40	100		16	40
	GAM41ME L404	Recommendation System										
ME	GAM41ME P403	Practical Based on AI with Cloud Services	Practical	1	-	2	30	20	50		08	20
	GAM41ME P404	Practical Based on Recommendation System										
OJT	GAM41JTP 401	On Job Training – II	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.

Fourth Year - Semester VII (Honours with Research)												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	GAM41M ML407	Computer Vision	Lecture	3	3	-	60	40	100		16	40
MM	GAM41M ML408	Geospatial AI and GIS	Lecture	3	3	-	60	40	100		16	40
MM	GAM41M MP407	Practical Based on Computer Vision	Practical	1	-	2	30	20	50		08	20
MM	GAM41M MP408	Practical Based on Geospatial AI and GIS	Practical	1	-	2	30	20	50		08	20
ME	GAM41M EL405	Human Computer Interaction	Lecture	3	3	-	60	40	100		16	40
	GAM41M EL406	AI in Blockchain	Lecture									
ME	GAM41ME P405	Practical Based on Human Computer Interaction	Practical	1	-	2	30	20	50		08	20
	GAM41ME P406	Practical Based on AI in Blockchain	Practical									
RM	GAM41R ML401	Research Methodology	Lecture	3	3	-	60	40	100		16	40
RM	GAM41R MP401	Practical based on Research Methodology	Practical	1	-	2	30	20	50		08	20
RP	GAM41R PJ401	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	GAM41MML409	Cognitive AI	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MML410	Explainable AI	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MMP409	Practical Based on Cognitive AI	Practical	1	-	2	30	20	50		08	20
MM	GAM41MMP410	Practical Based on Explainable AI	Practical	1	-	2	30	20	50		08	20
ME	GAM41MEL407	Geo AI	Lecture	3	3	-	60	40	100		16	40
	GAM41MEL408	AI with Cyber Security Applications	Lecture									
ME	GAM41MEP407	Practical Based on Geo AI	Practical	1	-	2	30	20	50		08	20
	GAM41MEP408	AI with Cyber Security Applications	Practical									
RP	GAM41RPJ402	Research Project	Practical	8		16	120	80	200		32	80
Total				20	09	22	390	260	650			

Note:

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

Syllabus **Semester-I**

Course Code: GAM41MML101	Course Name: Operating System	
Course Category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2, P-0	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basics working of Computer System and their Applications		
Course Objectives:		
<ol style="list-style-type: none"> 1. Student can understand the concept of process management and scheduling, and various issues in Inter Process Communication and the role of OS in inter process communication. Student get familiar with 2. How to implementation Memory management policies and virtual memory. Student can understand the working of an OS as a process manager, memory manager and I/O Manager 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To study the Importance & types of Operating System		
CO2: To Understand the Process Management and concept of Concurrency		
CO3: To understand the process of Deadlock & Memory Management.		
CO4: Focusing on different types of file system and related concept.		

Contents –

Unit	Content	Teaching hours
1	OPERATING SYSTEMS OVERVIEW: Introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems. OPERATING SYSTEMS STRUCTURES: Operating system services and systems calls, system programs, operating system structure, operating systems generations.	6
2	PROCESS MANAGEMENT: Process concepts, process state, process control block, scheduling queues, process scheduling, multithreaded programming. CONCURRENCY AND SYNCHRONIZATION: Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writers problem, dining philosopher's problem, monitors.	8
3	DEADLOCKS: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm. MEMORY MANAGEMENT: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, allocation of frames, thrashing.	8
4	FILE SYSTEM: Concept of a file, access methods, directory structure, file system mounting, file sharing, protection. File system implementation: file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance.	8

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles,

7th edition, Wiley India Private Limited, New Delhi.
Reference Books:
2. Operating System, Stuart E. Mandnick, John J. Donovan Tata McGraw Hill Publication.
3. Operating System, H.M. Deitel ,Pearson Publication

Syllabus **Semester-I**

Course Code: GAM41MML102	Course Name: Design Thinking and Innovation	
Course Category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2, P-0	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Introduction to Computer Fundamentals		
Course Objectives:		
<ul style="list-style-type: none"> ● To introduce students to the fundamental concepts and principles of design thinking and strategic innovation. ● To develop students' ability to identify, define, and analyze complex problems from a user-centric perspective. ● To cultivate creative thinking and ideation skills through various techniques and methodologies. ● To provide students with practical experience in prototyping and testing ideas to gather feedback and iterate on solutions. ● To equip students with effective communication and presentation skills to pitch their ideas convincingly. ● To explore the role of strategic thinking and innovation in organizational contexts and industry trends. ● To encourage collaboration and interdisciplinary approaches to problem-solving and innovation. 		
Course Outcomes: Upon successful completion of the course, students will be able to:		
CO1: Apply design thinking principles and methodologies to identify and redefine problems effectively.		
CO2: Generate innovative solutions through divergent and convergent thinking techniques.		
CO3: Develop prototypes and minimum viable products (MVPs) to test and validate ideas.		
CO4: Utilize various ideation and prioritization techniques to evaluate and refine solutions.		
CO5: Present ideas and concepts persuasively using storytelling and effective communication strategies.		
CO6: Analyze industry trends and organizational challenges to identify opportunities for strategic innovation.		
CO7: Collaborate effectively in interdisciplinary teams to tackle complex problems and drive innovation forward.		

Contents –

Unit	Content	Teaching hours
1	Introduction and Background of Design Thinking : Introduction, Knowing the team and course, The strategy of Innovation in design thinking. Why is Design Thinking required? Industries in Design Thinking, what is Design Thinking? Design thinking is a way of thinking. Design Thinking Tips and	

	<p>Anecdotes, Design Thinking Mindset Design thinking vs Scientific approach, Analysis vs. Synthesis in design thinking, Divergent Thinking vs. Convergent Thinking in design thinking, key phases of the design thinking process, Case Studies on Design thinking, Fundamentals of Design Thinking, Stages of Design Thinking, Design Thinking Skills, The process of Design Thinking, Design thinking framework, Why Design Thinking Works, Incorporating design thinking into your work, Limitations of a design thinking process, Advantages of the design thinking approach, Examples of design thinking success, Planning a Design Thinking Project, Benefits of the design thinking approach, Applications of design thinking.</p>	
2	<p>Getting started with Problem Statement Introduction What is a Problem Statement? Initial questions, Case Studies, Problem Clarification, Role of the Stakeholders, Activities for Problem Clarification, Point-Of-View (POV) in Design Thinking, Empathy Map, Understand and Define Problem Statement, Problem Analysis, Root Cause analysis tools, Defining Metrics, Persona Identification, User Personas, Stakeholder Map, who are Stakeholders? What is their role? Stakeholders of Few Companies, Creating a Stakeholder Map, Example Scenarios, Dos and Don'ts During Problem statement identification, Reformulation of the Problem.</p>	
3	<p>Identifying real problem Introduction, what is a Design Thinking Problem Statement? steps to create a design thinking problem statement, Learn Why and How to Focus on User Problem, Observation Phase, The Power to Observe, Useful Instrument for Observation Sessions, Tips for Observing, Practice problem Identification using Empathetic Design, Methods for Empathetic Design, Inquiry Vs. Observation, Learn As -is-state, Practice problem Identification using As-is-state long answer, Point-of-View phase for defining a problem, Characterizing the target group, Top of Form, Description of customer needs.</p>	
4	<p>Deliver on Big Idea: Ideation and Prioritization Introduction, Ideation Phase, The Ideation Funnel, Divergent and Convergent Thinking, Techniques for Clearing the Mind, The creative process and creative principles, Understanding Creativity, Creative Principles, Creativity Techniques, Brainstorming, Example of a Brainstorming Session, Mind Mapping, SCAMPER, Random Word Association, Rapid Prototyping / Design Sprint, Learn various Idea Generation Techniques, Creativity and Idea Generation, Common Techniques, Reverse Brainstorming, Role Playing, Analogies, Real-life Examples, Forced Connection, Visual Thinking, Storytelling, Practice Ideation, Overcoming Creative Blocks, Unrealistic Expectations, The Right Way to Take Risks, Examples of Creative Thinking, Evaluation of Ideas, Criteria / Metrics for Evaluation, Testing the Ideas, Refining and Selecting the Best Ideas, Transparency in the Evaluation Process, Pass/Fail Method, Idea Evaluation Matrix, SWOT Analysis, Criteria for Prioritization, Idea Prioritization Techniques -</p> <ol style="list-style-type: none"> a. Dot Voting b. Impact vs. feasibility matrix c. Weighted Scoring d. Affinity Mapping e. Cost-Benefit Analysis (CBA) f. MoSCoW Method g. Kano Model h. Eisenhower Matrix 	

	Implementing Prioritization, Re-Prioritization, Learn To-be Scenario, To-Be Scenario Map, use a to-do list to plan, How to Write an effective to-do List, Using Technology for to-do lists, Strategies for practicing prioritization, Urgent vs. Important Matrix, ABC Analysis, Value-based prioritization, Time-based prioritization, The Pomodoro Technique, Time-Value Prioritization Funnel, Pareto Analysis, Time-blocking, Tips for maintaining focus and staying motivated when prioritizing tasks, How to adjust priorities as circumstances change.	
5.	<p>Model creation and Idea pitching</p> <p>Introduction, Prototyping Phase, Learn Wireframe and Model creation, Introduction to Minimum Viable Product, Benefits Of MVP Development, What is expected from Minimum Viable Product, Practice Wireframe creation, End to end connecting from Problem to MVP, Testing Phase, Types of Testing, White and Black Box Testing, Unit Testing, Integration testing, Unit Testing Vs Integration Testing, System Testing, System Testing Vs Functional Testing, Acceptance Testing, User Acceptance Testing (UAT), Operational Acceptance Testing (OAT), Contract Acceptance Testing, Alpha/Beta Testing, Performance Testing, Security Testing, Usability Testing, Testing Techniques, Test Cases and Test Scripts, Bug Tracking and Reporting, User Feedback and Testing, Continuous Testing, Challenges and Best Practices, Tips for Interviews and Surveys, Kano Model, Desirability testing, Storytelling and Idea Presentation.</p>	

Text Books:

1. "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value" by Thomas Lockwood
2. "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems" by Michael Lewrick, Patrick Link, Larry Leifer
3. "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days" by Jake Knapp, John Zeratsky, Braden Kowitz
4. "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown

- Reference Books:**
1. "Creative Confidence: Unleashing the Creative Potential Within Us All" by Tom Kelley, David Kelley
 2. "The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm" by Tom Kelley
 3. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries

Syllabus **Semester-I**

Course Code: GAM41MMP101	Course Name: Practical based on Operating System	
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0, P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basics of mathematics and working of Computer System		
Course Objectives:		
1. To impart basic introduction to Operating System		
2. To identify the Operating System and its Processing Life Cycle		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To study the Importance & types of Operating System		
CO2: To implement the Process Management and concept of Concurrency		
CO3: To apply the process of Deadlock & Memory Management using Programming language.		
CO4: Study of file system and related concept.		

Contents –

Unit	Content	Teaching hours
1	Different types of Operating System & it's features.	2
2	Process Creation and Management (Process Management)	2
3	CPU Scheduling Algorithm (Process Scheduling)	2
4	Thread Creation and Execution (Multithreading)	2
5	Solving Critical Section Problem Using Semaphores (Synchronization)	2
6	Deadlock Detection Algorithm (Deadlocks)	2
7	Paging Mechanism (Memory Management)	2
8	Page Replacement Algorithm (Virtual Memory)	2
9	File Operations (File System)	2
10	Implementing Directory Structure (File System)	2
11	Project	10

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition, Wiley India Private Limited, New Delhi.

Reference Books:

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

Syllabus **Semester-I**

Course Code: GAM41MMP102 Course Name: Practical based on Design Thinking and Innovation		
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0, P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Introduction to Computer fundamentals		
Course Objectives:		
<ul style="list-style-type: none"> ● To introduce students to the fundamental concepts and principles of design thinking and strategic innovation. ● To develop students' ability to identify, define, and analyze complex problems from a user-centric perspective. ● To cultivate creative thinking and ideation skills through various techniques and methodologies. ● To provide students with practical experience in prototyping and testing ideas to gather feedback and iterate on solutions. ● To equip students with effective communication and presentation skills to pitch their ideas convincingly. ● To explore the role of strategic thinking and innovation in organizational contexts and industry trends. ● To encourage collaboration and interdisciplinary approaches to problem-solving and innovation. 		
Course Outcomes: Upon successful completion of the course, students will be able to:		
CO1: Apply design thinking principles and methodologies to identify and redefine problems effectively.		
CO2: Generate innovative solutions through divergent and convergent thinking techniques.		
CO3: Develop prototypes and minimum viable products (MVPs) to test and validate ideas.		
CO4: Utilize various ideation and prioritization techniques to evaluate and refine solutions.		
CO5: Present ideas and concepts persuasively using storytelling and effective communication strategies.		
CO6: Analyze industry trends and organizational challenges to identify opportunities for strategic innovation.		
CO7: Collaborate effectively in interdisciplinary teams to tackle complex problems and drive innovation forward.		

Contents –

Unit	Content	Teaching hours
Hands-on Lab Activities:		
	Lab 1: Design Thinking Introduction & Mindset •Objective: Understand the core concepts and mindset of Design Thinking. •Task: In small groups, select a common societal problem (e.g., plastic waste, urban commute challenges). Discuss how a Design Thinking mindset (focusing on empathy, iteration, and experimentation) would approach this problem differently compared to a traditional, linear problem-solving method. Share brief examples of how Design Thinking has led to successful solutions in similar areas.	

<p>•Expected Outcome: A foundational understanding of Design Thinking principles, its advantages, and its contrast with other approaches.</p> <p>Lab 2: Divergent vs. Convergent Thinking Exercise</p> <p>•Objective: Practice divergent and convergent thinking techniques within a problem-solving context.</p> <p>•Task: Given a broad problem statement (e.g., "How might we improve the student experience on campus?"), individually generate at least 15 diverse ideas in 20 minutes (Divergent Thinking). Then, as a group, spend 30 minutes discussing, clustering similar ideas, and narrowing down to the top 3-5 most promising ideas for further exploration (Convergent Thinking).</p> <p>•Expected Outcome: Practical experience in applying both thinking styles and initial promising ideas for a given problem.</p> <p>Lab 3: Initial Problem Statement Generation</p> <p>•Objective: Formulate insightful initial questions to clarify a given ambiguous problem.</p> <p>•Task: Provide a high-level, somewhat vague problem scenario (e.g., "Customer satisfaction is declining"). In groups, generate 10-15 initial questions that aim to uncover underlying issues, different perspectives, and potential root causes. Focus on "who, what, where, when, why, and how" questions.</p> <p>•Expected Outcome: A comprehensive list of clarifying questions for a complex problem.</p> <p>Lab 4: Empathy Map Creation</p> <p>•Objective: Develop a deep understanding and empathy for a target user by creating an Empathy Map.</p> <p>•Task: Choose a specific user group related to a given problem (e.g., commuters facing traffic, online shoppers experiencing delivery issues). In groups, create an Empathy Map by detailing what the user "Says, Thinks, Does, and Feels" in relation to the problem.</p> <p>•Expected Outcome: A completed Empathy Map that visually represents user insights and pain points.</p> <p>Lab 5: Point-Of-View (POV) Statement Definition</p> <p>•Objective: Learn to synthesize user insights into a clear, actionable, and user-centric Point-Of-View (POV) statement.</p> <p>•Task: Based on the insights gathered from the Empathy Map created in Lab 4, formulate a "User + Need + Insight" POV statement. For example: "[Specific User] needs to [User's Need] because [Surprising Insight]".</p> <p>•Expected Outcome: A well-articulated POV statement that focuses the problem-solving efforts.</p> <p>Lab 6: User Persona Development</p> <p>•Objective: Create a detailed user persona to represent a segment of the target user base.</p> <p>•Task: Based on a problem scenario and insights from empathy mapping, develop a fictional but realistic user persona. Include demographics, goals, frustrations, behaviors, motivations, and a brief narrative.</p> <p>•Expected Outcome: A comprehensive user persona that aids in user-centric design decisions.</p> <p>Lab 7: Stakeholder Mapping</p> <p>•Objective: Identify and map all key stakeholders relevant to a problem and understand their relationships.</p>	
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<p>•Task: Given a specific problem (e.g., "improving healthcare access in rural areas"), identify all direct and indirect stakeholders. Create a stakeholder map, categorizing them by influence and interest, and illustrate their connections and potential impact on the problem.</p> <p>•Expected Outcome: A visual stakeholder map providing a holistic view of the ecosystem surrounding a problem.</p> <p>Lab 8: Root Cause Analysis (5 Whys)</p> <p>•Objective: Practice identifying the fundamental root cause of a recurring problem using the 5 Whys technique.</p> <p>•Task: Take a simple, observable recurring problem (e.g., "why is the team often late for morning meetings?"). Iteratively ask "Why?" at least five times (or until a clear root cause is identified) to delve beyond surface-level symptoms.</p> <p>•Expected Outcome: Identification of a core root cause and a deeper understanding of problem origins.</p> <p>Lab 9: Problem Reformulation</p> <p>•Objective: Learn to reframe an initial problem statement into a more precise, actionable, and inspiring challenge.</p> <p>•Task: Take a broad or vaguely defined problem statement (e.g., "Our product is not selling well"). In groups, reformulate it into a more specific, user-centric "How Might We...?" question that encourages innovative solutions (e.g., "How might we make our product more appealing to young professionals?").</p> <p>•Expected Outcome: A refined and impactful "How Might We" problem statement.</p> <p>Lab 10: Observation Practice</p> <p>•Objective: Develop keen observation skills to gather insights from user behavior in real-world contexts.</p> <p>•Task: Observe a simple activity or interaction (e.g., how people choose items in a cafeteria, how users navigate a public website, or a simple classroom activity) for 20-30 minutes without interaction. Document your observations in detail, focusing on "what people do," "how they do it," and "why they might be doing it" (inferred).</p> <p>•Expected Outcome: Sharpened observation skills and documented behavioral insights for a given scenario.</p> <p>Lab 11: "As-Is" State Analysis and Mapping</p> <p>•Objective: Understand and visually document the current "as-is" state of a specific process or user journey.</p> <p>•Task: Choose a common process (e.g., filling out a university application, booking an appointment online). Individually or in pairs, map out the "as-is" steps of this process, identifying user actions, touchpoints, pain points, and emotional highs/lows at each stage.</p> <p>•Expected Outcome: A visual representation of the current user journey or process flow, highlighting areas for improvement.</p> <p>Lab 12: Brainstorming Session using SCAMPER</p> <p>•Objective: Generate a wide range of innovative ideas using the structured SCAMPER brainstorming technique.</p> <p>•Task: Choose an existing everyday product or service (e.g., a smartphone, a coffee shop experience). Apply the SCAMPER framework (Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, Reverse) to brainstorm new features, uses, or improvements for it.</p> <p>•Expected Outcome: A diverse set of ideas, demonstrating the application of the SCAMPER technique.</p> <p>Lab 13: Mind Mapping for Idea Generation</p>	
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<p> •Objective: Utilize mind mapping as a visual and non-linear technique for expanding upon initial ideas. •Task: Start with a central problem or initial idea from a previous lab. Individually or in small groups, create a mind map, branching out with related concepts, keywords, questions, and solutions to explore different dimensions of the problem space. •Expected Outcome: A comprehensive and visually organized mind map, showcasing a broad exploration of ideas. </p> <p> Lab 14: Idea Evaluation Matrix •Objective: Systematically evaluate and compare multiple ideas using predefined criteria. •Task: Take 3-5 ideas generated from a previous ideation lab. Define 3-4 clear evaluation criteria (e.g., Feasibility, Impact, Novelty, User Value). Create a simple matrix and score each idea against these criteria (e.g., on a scale of 1-5). Discuss the results and identify the top idea(s). •Expected Outcome: A data-driven prioritization of ideas with clear justification for selection. </p> <p> Lab 15: Idea Prioritization (Impact vs. Feasibility Matrix) •Objective: Prioritize ideas based on their potential impact and feasibility of implementation. •Task: From a list of 10-15 brainstormed ideas, plot each one on an Impact vs. Feasibility Matrix. Discuss where each idea falls and decide which quadrant (e.g., high impact/high feasibility) represents the "quick wins" or strategic priorities. •Expected Outcome: A visually prioritized set of ideas, guiding strategic decision-making. </p> <p> Lab 16: Low-Fidelity Wireframe Creation •Objective: Create a basic visual representation of a solution's user interface and flow using low-fidelity wireframes. •Task: For a selected idea (e.g., a mobile app feature, a website page layout), sketch out a series of low-fidelity wireframes on paper or a simple digital tool. Focus on the core layout, key elements, and user flow, rather than detailed aesthetics. •Expected Outcome: A set of clear, actionable low-fidelity wireframes demonstrating the solution's structure. •Duration: 1:30 hours </p> <p> Lab 17: Minimum Viable Product (MVP) Definition •Objective: Define the essential features required for a Minimum Viable Product to test a core hypothesis. •Task: Based on a chosen idea and its wireframes, identify the absolute minimum set of features that would make the product usable and allow for testing its core value proposition. Distinguish these "must-have" MVP features from "nice-to-have" future enhancements. •Expected Outcome: A clear definition of the MVP scope, outlining its core functionalities and testable hypotheses. </p> <p> Lab 18: Basic Test Case Development •Objective: Understand the purpose of testing and develop simple test cases for a specific functionality. •Task: For a simple feature of an imagined product or service (e.g., "user registration," "password reset," "adding an item to a cart"), write 3-5 basic test cases. Each test case should include a test ID, a description, steps to reproduce, and the expected result. •Expected Outcome: An understanding of test case structure and initial practical experience in defining test scenarios. </p>	
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	<p>Lab 19: Storytelling for Idea Pitching</p> <p>•Objective: Practice presenting an innovative idea persuasively and memorably using storytelling techniques.</p> <p>•Task: Prepare a short (3-5 minute) pitch for an idea developed in previous labs. Structure your pitch as a compelling story that clearly outlines the problem, introduces your solution, highlights its unique benefits, and calls to action. Focus on engaging your audience emotionally and logically.</p> <p>•Expected Outcome: Improved public speaking and storytelling skills for effectively communicating ideas to stakeholders.</p>	
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Text Books:	
1.	"Design Thinking: Integrating Innovation, Customer Experience, and Brand Value" by Thomas Lockwood
2.	"The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems" by Michael Lewrick, Patrick Link, Larry Leifer
3.	"Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days" by Jake Knapp, John Zeratsky, Braden Kowitz
4.	"Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown
Reference Books:	
1.	"Creative Confidence: Unleashing the Creative Potential Within Us All" by Tom Kelley, David Kelley
2.	"The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm" by Tom Kelley
3.	"The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries

Syllabus Semester-I

Course Code: GAM41VSP101	Course Name: Programming Logic and Design	
Course Category: VSC		
Credits: 1	Teaching Scheme: L-0, P-4	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Understanding of the Programming Concept and problem solving steps.		
Course Objectives:		
<ul style="list-style-type: none"> • Programming Paradigm help students to create properly designed programs. Learning algorithms and practicing coding. • Come up with varieties of solutions to a single problem. • Programming concepts enforces good style and logical thinking 		
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 program		
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.		
CO4: Determine and explore the workings of decision making, looping, and array manipulation.		

Contents –

Unit	Content	Teaching hours
1	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. 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.	10
2	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.	10
3	Introduction to C, Syntax and basic structure of C program, Execution of C program.	2
4	Get students familiar with different data types in C, operators and expressions in C.	2
5	Understanding decision making using forms of IF statements	2
6	Understanding decision making using forms of switch, goto, break, continue etc. statements	2
7	Perform different programs to understand the concept of Array.	2

8	To apply the knowledge of array to upgrade it on multidimensional array	2
9	Programs to understand the concepts of loops in the programming.(For loop)	2
10	Programs to understand the concepts of loops in a program. (do and while loop)	2
11	Perform array Initialization and Storage of Array	2
12	Perform the Array Operations	3
13	Project	15

Text Books:

1. Programming Logic and Design Joyce Farrell Cengage Learning Seventh

2. Programming Language Design Concepts David A Watt Wiley India

Reference Books: 1. E. Balaburuswamy Programming in C, Tata Macgraw Hill

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

Syllabus **Semester-I**

Course Code: GAM41SEL101	Course Name: Mathematical Foundation	
Course Category: Skill Enhancement course		
Credits: 2	Teaching Scheme: L-2, P-0	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basics of Mathematical Concepts		
Course Objectives: Towards the end of the course, we will also cover a subset of topics from graph theory. Part of the course is also devoted to understanding what goes into mathematics.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Students will be able to use matrix operations, vector spaces, and eigenvalue decomposition for machine learning techniques like PCA and feature transformations.		
CO2: Students will be able to apply probability laws, Bayes' theorem, and probability distributions in algorithms like Naive Bayes and probabilistic models.		
CO3: Students will be able to use gradient descent and related optimization techniques in minimizing cost functions and performing backpropagation.		
CO4: Students will be able to construct logical rules, model knowledge using set-theoretic and Boolean operations, and evaluate logical conditions in AI algorithms.		

Contents –

Unit	Content	Teaching hours
1	Linear Algebra for Machine Learning: Scalars, Vectors, Matrices, and Tensors, Matrix Operations: Addition, Multiplication, Transpose, Inverse, Types of Matrices: Identity, Diagonal, Orthogonal, Symmetric, Vector Spaces, Basis, and Rank, Eigenvalues and Eigenvectors,	6
2	Probability and Statistics: Probability Theory: Conditional Probability, Bayes' Theorem, Random Variables: Discrete and Continuous, Variance, Covariance, Law of Large Numbers and Central Limit Theorem, Applications in ML: Naïve Bayes Classifier, Probabilistic Reasoning. Practical Applications: Spam classification using Bayes' Theorem, Gaussian distribution fitting in datasets	8
3	Calculus and Optimization: Functions, Limits, and Continuity, Differentiation: Partial Derivatives, Gradient, Optimization Techniques: Gradient Descent, Stochastic Gradient Descent, Convex and Non-Convex Functions.	8
4	Advanced Topics and Applications Set Theory, Logic, and Boolean Algebra for AI, Graph Theory: Nodes, Edges, Trees, BFS/DFS (for Graph-based ML models), Mathematical Modeling of AI Systems.	8

Text Books: 1. Linear Algebra and Its Applications – Gilbert Strang
2. Probability and Statistics for Engineers and Scientists – Walpole
3. Mathematics for Machine Learning – Deisenroth, Faisal, Ong (Cambridge)
4. Pattern Recognition and Machine Learning – Christopher Bishop

Reference Books: 1. BernandKolman, Robert C. Busby, Sharon Cutler Ross, Discrete Mathematical Structures, PHI

2. 5. Introduction to Probability – Bertsekas and Tsitsiklis

Online Resources: 1. NPTEL / SWAYAM lectures.

Semester: SECOND

Syllabus **Semester-II**

Course Code: GAM41MML103	Course Name: Data Structure	
Course Category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2, P-0	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic understanding of Data and its applications		
Course Objectives: Student get familiar with basic concepts about stacks, queues, lists, trees and graphs Student can implement practically searching and sorting techniques.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Student can analyze algorithms and the correctness of algorithm, can summarize searching and sorting techniques and describe stack, queue and linked list operation with knowledge of tree and graphs concepts		
CO2: Students demonstrate an ability to apply knowledge of computing and mathematics appropriate to the discipline including computer science theory.		
CO3: Students get competent in applying design and development principles in the development of software systems of varying complexity		
CO4: Students will implement various sorting, searching, and hashing algorithms. Students will build a substantial, complex data structure		

Contents –

Unit	Content	Teaching hours
1	Introduction: Basic Terminology, Data Item, fields, Records, Files, Entity, Attributes, Data organization and Data Structure. Arrays: Representation of Linear Arrays, Traversing, Insertion and Deletions, sorting and Searching Algorithms, Multidimensional Arrays 2D and M-D concept, Record, Record Structure, Representation in Memory.	6
2	Linear Data Structure: Stack, Queue, Linked list, Priority Queue, Deque, Doubly linked list, circular linked list Searching and sorting Techniques.	8
3	Non Linear Data Structure: Graphs: Introduction to Graph Theory, Graph isomorphism, Graph data structures: Adjacency lists, Adjacency matrices Elementary graph Algorithms: BFS, DFS, Topological sort, strongly connected components.	8

4	Trees: Introduction To Trees, Binary Trees , Complete Binary Trees , Extended Binary Trees: 2-Trees , Representing Binary Trees In Memory Tree Operations, Traversing Binary Trees (Preorder, Inorder And Postorder), Binary Trees. Traversal Algorithms Using Stacks Binary Search Trees, Searching And Inserting In Binary Search Trees	8
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Text Books: 1. Seymour Lipschutz, Data Structures, Tata McGraw Hill Publication. 2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithm, PHI Publication
Reference Books: 1. Jean Paul Tremblay and Pal G. Soresion, An Introduction to Data Structure And application, McGraw Hill Publication 2. Tannenbaum, Data Structure, PHI Publication
Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus **Semester-II**

Course Code: GAM41MML104		Course Name: Python
Course Category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2, P-0	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Fundamental Knowledge of computer programming language.		
Course Objectives:		
<ul style="list-style-type: none"> ● Introduce students to the Python programming language and its syntax. ● Cover essential programming constructs such as variables, data types, operators, and input/output operations. ● Explore control flow structures including conditional statements and loops for program execution. ● Provide an in-depth understanding of object-oriented programming principles and their application in Python. ● Familiarize students with error handling techniques and file input/output operations. ● Discuss advanced topics such as regular expressions, modules, libraries, graphical user interfaces (GUI), and web programming. ● Enable students to apply Python programming skills in networking, data processing, analysis, and database applications. 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Demonstrate proficiency in Python programming fundamentals and syntax.		
CO2: Implement control flow structures and loops for decision making and iteration.		
CO3: Design and develop object-oriented Python programs using classes, objects, inheritance, and encapsulation.		
CO4: Apply error handling techniques to write robust and reliable Python code.		
CO5: Utilize advanced Python features such as regular expressions, modules, and libraries for efficient programming.		
CO6: Create graphical user interfaces (GUI) and web applications using Python frameworks.		
CO7: Employ Python for networking, data processing, analysis, and database-driven applications.		

Contents –

Unit	Content	Teaching hours
1	Python Fundamentals and Control Flow Unit: Introduction to Python Programming, Python Fundamentals, Introduction to Python, What is Python?, Python's Popularity and Use Cases, Python Syntax and Structure, Python's Indentation and Block Structure, Writing Your First Python Program, Writing and Executing Python Programs, Using Python Interactive Mode (REPL), Running Python Scripts from Command Line, Python Basics, Variables and Data Types, Understanding Variables and Naming Conventions, Numeric Data Types (int, float), Text Data Type (str), Operators and Expressions,	6

	<p>Arithmetic Operators, Comparison Operators, Logical Operators, Input and Output Operations, Using input() for User Input, Printing Output with print().</p> <p>Control Flow and Loops: Control Statements, Conditional Statements (if, elif, else), Simple if Statements, elif for Multiple Conditions, Logical Operators and Conditions, Using Logical AND, OR, NOT, Complex Conditions, Switch-Case (if-elif-else), Implementing Switch-Like Behavior, Loops, While Loops, Using while Loops for Iteration, Controlling Loops with break and continue For Loops, Iterating Over Sequences (Lists, Strings), Using range() for Controlled Iteration, Loop Control Statements (break, continue), Breaking Out of a Loop, Skipping Iterations with continue</p>	
2	<p>Object-Oriented Programming (OOP) in Python: OOP Principles, Classes and Objects, Defining Classes and Objects, Constructors and Instance Variables, Inheritance and Polymorphism, Creating Subclasses, Overriding Methods, Encapsulation and Abstraction, Access Modifiers (public, private, protected), Achieving Abstraction through Interfaces, Advanced OOP Concepts, Constructors and Destructors, Parameterized Constructors, Destructor in Python, Method Overloading and Overriding, Overloading Methods, Overriding Methods with super(), Class Variables and Instance Variables, Understanding Class Variables, Using Instance Variables.</p> <p>Error Handling and Exception Handling: Exception Handling, Introduction to Exceptions, Understanding Exceptions in Python, Common Built-in Exceptions, Handling Exceptions with try and except, Using try-except Blocks, Handling Multiple Exceptions, Custom Exceptions, Creating Custom Exception Classes, Raising Exceptions, File Handling (I/O), Reading and Writing Files, Opening and Closing Files, Reading and Writing Text Files, Working with Text and Binary Files, Reading and Writing Binary Files, Text Encoding and Decoding, File Handling Best Practices, Using 'with' Statements, Error Handling in File Operations</p>	8
3	<p>Advanced Python Programming: Regular Expressions, Introduction to Regular Expressions, What are Regular Expressions?, Use Cases for Regular Expressions, Pattern Matching and Text Processing, Matching Patterns with re Module, Extracting Data from Text, Regex in Python, Using Regular Expressions in Python, Regex Functions and Methods, Modules and Libraries, Creating and Using Modules, Writing Your Own Modules, Importing Modules, Standard Library Modules, Exploring Built-in Modules (math, date and time), Working with OS and sys Modules, Third-party Libraries and Packages, Using pip for Package Installation, Popular Third-party Libraries (requests, pandas)</p> <p>Graphical User Interfaces (GUI) and Web Programming: GUI Development, Introduction to GUI Programming, GUI vs. Command Line Interfaces, GUI Frameworks in Python, Widgets and Event Handling, Creating Widgets (Buttons, Labels), Handling User Events (Clicks, Input), Web Programming with CGI, Introduction to CGI, What is CGI and Its Purpose, CGI in Web Development, Handling HTTP Requests, Receiving and Processing Requests, Generating HTTP Responses, Building Interactive Web Applications, Form Handling with CGI, Implementing Data Processing</p>	8
4	<p>Python Applications: Networking and Serialization, Networking Basics in Python, Introduction to Networking Protocols, Creating Client and Server Sockets, Socket Programming, Building Networked Applications, Data Transfer and Communication,</p>	8

<p>Serialization (JSON and Pickle), Serialization Overview, JSON and Pickle for Data Serialization, Data Processing and Analysis, Introduction to NumPy and Pandas, What is NumPy?, Overview of Pandas, Data Manipulation with NumPy, Creating NumPy Arrays, Array Operations and Manipulation, Data Analysis with Pandas, Working with DataFrames, Data Cleaning and Exploration, Database Applications, Database Connectivity in Python, Database Management Systems (DBMS), Connecting to Databases, SQL Queries and Database Operations, Structured Query Language (SQL), Executing SQL Queries from Python, Building Database-driven Applications, Integrating Python with Databases, CRUD Operations in Database Applications</p>	
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Text Books:

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| 1. "Python Crash Course" by Eric Matthes |
| 2. "Automate the Boring Stuff with Python" by Al Sweigart |
| 3. "Learning Python" by Mark Lutz |
| 4. "Fluent Python" by Luciano Ramalho |

Reference Books:

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| <ol style="list-style-type: none"> 1. "Python Cookbook" by David Beazley and Brian K. Jones 2. "Effective Python: 90 Specific Ways to Write Better Python" by Brett Slatkin 3. "Python for Data Analysis" by Wes Mc |
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Syllabus **Semester-II**

Course Code: GAM41MMP103	Course Name: Practical based on Data Structure	
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0, P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic understanding of Data and its applications		
Course Objectives: Student get familiar with basic concepts about stacks, queues, lists, trees and graphs Student can implement practically searching and sorting techniques.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Student can analyze algorithms and the correctness of algorithm, can summarize searching and sorting techniques and describe stack, queue and linked list operation with knowledge of tree and graphs concepts.		
CO2: Students demonstrate an ability to apply knowledge of computing and mathematics appropriate to the discipline including computer science theory.		
CO3: Students get competent in applying design and development principles in the development of software systems of varying complexity		
CO4: Students will implement various sorting, searching, and hashing algorithms. Students will build a substantial, complex data structure		

Contents –

Unit	Content	Teaching hours
1	Write and execute programs for insertion and deletion of n item from the Queues and Stacks	2
2	Write and execute a program for display a Linked List.	2
3	Write and execute a program for Circular Doubly Linked List	2
4	Write and execute a program for binary search algorithm	2
5	Write and execute BFS and DFS Traversing	2
6	Write and execute Tree traversals	2
7	Write and execute a program for Bubble sort Algorithm	2
8	Write and execute programs for traversing of n item from the linked list	2
9	Write and execute a program for implementation of insertion sort	2
10	Write and execute a program for demonstration of merge sort	2
11	Project	10

Text Books: 1. Seymour Lipschutz, Data Structures, Tata McGraw Hill Publication. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithm, PHI Publication

Reference Books: 1. Jean Paul Tremblay and Pal G. Soresion, An Introduction to Data Structure And

application, McGraw Hill Publication
2. Tannenbaum, Data Structure, PHI Publication
Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus **Semester-II**

Course Code: GAM41MMP104	Course Name: Practical based on Python	
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0, P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Fundamental Knowledge of computer programming language.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Demonstrate proficiency in Python programming fundamentals and syntax.		
CO2: Implement control flow structures and loops for decision making and iteration.		
CO3: Design and develop object-oriented Python programs using classes, objects, inheritance, and encapsulation.		
CO4: Apply error handling techniques to write robust and reliable Python code.		
CO5: Utilize advanced Python features such as regular expressions, modules, and libraries for efficient programming.		
CO6: Create graphical user interfaces (GUI) and web applications using Python frameworks.		
CO7: Employ Python for networking, data processing, analysis, and database-driven applications.		

Contents –

Unit	Content	Teaching hours
1	Hello, World! Program: Write a Python program that prints "Hello, World!" to the console.	2
2	Interactive Mode Basics: Use Python's interactive mode to perform basic arithmetic operations like addition, subtraction, multiplication, and division.	2
3	User Input and Display: Create a Python script that takes user input for their name and displays a personalized greeting.	2
4	Calculate Rectangle Area: Write a Python program that calculates and prints the area of a rectangle. Prompt the user for the length and width.	2
5	Temperature Conversion: Create a Python script that converts a temperature from Fahrenheit to Celsius. Prompt the user for the temperature in Fahrenheit and display the result in Celsius.	2
6	Even or Odd Checker Implement a Python program that checks if a given number is even or odd and prints the result.	2
7	Largest among Three Numbers Write a Python script that finds and prints the largest among three numbers entered by the user.	2
8	Factorial Calculation with a While Loop Create a Python program that calculates and prints the factorial of a number entered by the user using a while loop.	2
9	Sum of Prime Numbers Write a Python program that calculates and prints the sum of all prime numbers in a given range. Prompt the user for the range.	2
10	Simple Calculator Class Define a Python class for a simple calculator that has methods for addition and subtraction. Allow the user to perform calculations	2

	using objects of this class.	
11	Class Inheritance Hierarchy Create a class hierarchy with a base class and two derived classes. Demonstrate inheritance by accessing attributes and methods of each class.	2
12	Method Overriding Implement method overriding in a Python class. Create a base class with a method and override it in a derived class.	2
13	Encapsulation Demonstration Use encapsulation to restrict access to class attributes. Create a class with private attributes and demonstrate encapsulation principles.	2
14	Abstract Geometric Shape Class Create an abstract class representing a geometric shape with abstract methods like area and perimeter. Define derived classes (e.g., Circle, Rectangle) to implement these methods.	2
15	Project	2

Text Books:

1. "Python Crash Course" by Eric Matthes
2. "Automate the Boring Stuff with Python" by Al Sweigart
3. "Learning Python" by Mark Lutz
4. "Fluent Python" by Luciano Ramalho

Reference Books:

1. "Python Cookbook" by David Beazley and Brian K. Jones
2. "Effective Python: 90 Specific Ways to Write Better Python" by Brett Slatkin
3. "Python for Data Analysis" by Wes Mc

Syllabus **Semester-II**

Course Code: GAM41VSP102	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 Data and Excel functions		
Course Objectives: The Advanced Microsoft Excel course is designed to enhance the analytical and complex data management skills of learners by delving into the deeper functionalities of Excel.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Working with Advanced Data handling Excel Functions		
CO2: Understand the Main functions in Excels for Statistical Data measurement		
CO3: Apply the Excel functions for Data Analysis		
CO4: Data interpretation and Data Visualization using Advanced Excel functions		

Contents –

Sr. No.	Title	Practical Hours
1.	Practical based on Number Formatting	02
2.	Practical based on Data validation and Graph	
3.	Practical Based on Conditional formatting.	02
4.	Create a marksheet in Excel with following condition Heading – Dr. G. Y. Pathrikar College Subject – Any Five subject with Total, Percentage and Result Result condition – If Per ≥ 80 'A' Grade Per ≥ 60 'B' Grade Per > 45 'C' Grade Per ≥ 35 'Pass' Otherwise 'Fail'	02
5.	Practical Based on Filter Or (Apply Filter to above table).	02
6.	Practical Based on Chart with formatting.	02
7.	Practical based on Formula.	02
8.	Basic Formulas SUM, AVERAGE, COUNT, MAX, MEDIAN, MIN	02
9.	Time Formulas: TODAY, NOW, DATEDIF, YEAR, MONTH, DAY	02
10.	Logical Formulas: IF, OR, AND	02
11.	Create a sheet and apply Trace Precedent, Trace Dependent on that sheet.	02
12.	Practical based on VLOOKUP & HLOOKUP	02
13.	Practical based on Data validation	02
14.	Crate a worksheet and apply goal seek, subtotal on it.	02

15	Practical based on Import data from web, word etc. in excel	02
16	Practical based on Pivot table.	02
17	Practical based on Data Visualization	02
18	Practical Based on macros.	02
19	Study of Dashboard	02
20	Create Dashboard in Excel	02
21	Project	20

Text Books: All-In-One:: Master the New Features of Excel 2019 By Lokesh Lalwani ISBN-9789388511582 Publisher Walter de Gruyter GmbH

Reference Books: 1. Data Analysis with Microsoft Excel by Kenneth N. Berk, Partrick Carey ISBN-0534362788 Publisher S.Chand (G/L) & Company Ltd

Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus Semester-II

Course Code: GAM41SEL102	Course Name: Statistical Methods
Course Category: Skill Enhancement Course	
Credits: 2	Teaching Scheme: L-2, P-0
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic Knowledge of Mathematical Foundation	
Course Objectives: 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 is matter of science and logic. It 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-today life problem.	
CO3: Analyze the data to represent it graphically or tabulate and interpret it to generate information.	
CO4: Compare data to tabulate statistical information given in descriptive form.	

Contents –

Unit	Content	Teaching hours
1	Descriptive Statistics Introduction to Statistics: Role in AI and ML, Types of Data: Qualitative vs. Quantitative, Scales of Measurement, Measures of Central Tendency: Mean, Median, Mode.	8
2	Statistical Inference Measures of Dispersion: Range, Variance, Standard Deviation, Data Visualization: Histograms, Box Plots, Scatter Plots, Heatmaps.	8
3	Probability Probability Basics and Rules, Conditional Probability and Bayes' Theorem, Random Variables and Probability Distributions, Hypothesis Testing: Null & Alternative Hypotheses, p-value, t-test, z-test.	8
4	Correlation and ANOVA Correlation Analysis: Pearson, Spearman, Kendall, Goodness-of-Fit: R^2 , Adjusted R^2 , Residual Analysis, Analysis of Variance (ANOVA), Model Evaluation Metrics (MAE, RMSE, Accuracy, Precision, Recall).	6

Text Books: 1. Introduction to the Practice of Statistics – Moore, McCabe, Craig

2. Statistics for Machine Learning – Pratap Dangeti (Packt)

3. Applied Multivariate Statistical Analysis – Richard A. Johnson

Reference Books: 1. S. C. Gupta Fundamental of Statistics

2. All of Statistics: A Concise Course in Statistical Inference – Larry Wasserman

Semester: THIRD

Syllabus Semester-III

Course Code: GAM41MML201	Course Name: AI and ML Essentials	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: An introductory concepts of Artificial Intelligence and Machine Learning		
Course Objectives:		
<ul style="list-style-type: none"> • To Introduce fundamental concepts and historical evolution of Artificial Intelligence. • To explain logical reasoning, knowledge representation, and inference mechanisms in AI. • To develop understanding of probabilistic reasoning and Bayesian methods. • To familiarize students with evolutionary algorithms and optimization techniques. • To present essential machine learning models and learning paradigms. • To explain neural network fundamentals and deep learning architectures. • To introduce natural language processing techniques and applications. • To provide an overview of generative models and their ethical implications. • To enable students to analyze AI and ML systems conceptually and critically. 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain the fundamental principles and evolution of Artificial Intelligence.		
CO2: Apply logical and probabilistic reasoning techniques to AI problems.		
CO3: Analyze evolutionary algorithms for optimization tasks.		
CO4: Distinguish between different machine learning paradigms and models.		
CO5: Explain the working of neural networks, deep learning architectures and basic natural language processing concepts.		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Artificial Intelligence (AI) Introduction to Artificial Intelligence, Early AI Concepts, Key Milestones in AI Development, Influential AI Contributors, Logical Approach to AI, Propositional Logic and First-Order Logic, Knowledge Representation, Rule-Based Systems, Knowledge-Based Systems, Inference Engines, Case-Based Reasoning, Applications of Artificial Intelligence, Self-Evaluation Exercise, Checkpoints and Question Bank, Unit Summary	9
2	Probabilistic Approaches to Artificial Intelligence Probability Concepts in AI, Discrete and Continuous Probability Distributions, Bayes' Theorem, Bayesian Inference, Bayesian Inference using Markov Chain Monte Carlo (MCMC), Bayesian Network, Structure and Representation, Directed Acyclic Graphs (DAGs), Conditional Probability	9

	Tables (CPTs), Inference in Bayesian Networks (Exact and Approximate), Learning in Bayesian Networks (Parameter Learning, Structure Learning), Self-Evaluation Exercises 2 and 3, Checkpoints and Question Bank, Unit Summary	
3	<p>Evolutionary Intelligence</p> <p>Evolutionary Algorithms, Genetic Algorithms, Selection Operators, Crossover and Mutation, Evolutionary Strategies, Self-Adaptation in Evolutionary Strategies, Types of Evolutionary Strategies, Applications of Evolutionary Intelligence, Optimization Problems, Genetic Programming (GP), Tree-Based Representation in Genetic Programming, Evolution of Computer Programs, Checkpoints and Question Bank, Unit Summary</p>	9
4	<p>Introduction to Machine Learning</p> <p>Basics of Machine Learning, Types of Learning-Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning. Model Evaluation Metrics, Data Visualization in Machine Learning, Linear Regression and Gradient Descent, Logistic Regression, Decision Trees and Random Forests, Clustering Algorithms (K-Means, Hierarchical), Principal Component Analysis (PCA), Markov Decision Process (MDP), Challenges in Machine Learning- Model Selection, Overfitting and Underfitting. Self-Evaluation Exercise 4, Checkpoints and Question Bank, Unit Summary.</p> <p>Neural Networks and Deep Learning</p> <p>Neural Networks and Deep Learning Overview, Neural Network Fundamentals, McCulloch-Pitts Neuron, Activation Functions, Feedforward Neural Networks, Deep Learning Concepts, Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Transfer Learning and Fine-Tuning, Self-Evaluation Exercise 5, Checkpoints and Question Bank, Unit Summary</p>	9
5	<p>Natural Language Processing (NLP)</p> <p>Natural Language Processing Basics, Text Pre-Processing-Tokenization, Stopword Removal. Word Embeddings (Word2Vec, GloVe), Vector Similarity, NLP Applications-Sentiment Analysis, Text Classification, Named Entity Recognition (NER). Text Generation, Transformer-Based Models, Self-Evaluation Exercise 6, Checkpoints and Question Bank, Unit Summary.</p> <p>Generative Intelligence</p> <p>Introduction to Generative Intelligence, Generative Models, Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), Applications of Generative Models, Ethical Implications of Generative AI, Self-Evaluation Exercises 7 and 8, Checkpoints and Question Bank, Unit Summary</p>	9

Textbooks:

- Reference Books:**
1. Artificial Intelligence: A Modern Approach, Pearson India by Stuart Russell & Peter Norvig
 2. Pattern Recognition and Machine Learning, by Christopher M. Bishop, Springer India
 3. Deep Learning, by Ian Goodfellow, Yoshua Bengio, Aaron Courville, Pearson / MIT Press (India Edition)

Online Resources: 1. NPTEL / SWAYAM lectures.
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Syllabus Semester-III

Course Code: GAM41MML202	Course Name: Regression Analysis and Optimization Techniques	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basic knowledge of statistics, Understanding of simple data analysis concepts, Familiarity with basic machine learning terms.		
Course Objectives: To introduce students to the fundamental concepts of regression analysis and optimization, and to understand their importance in data analysis and enhancement of machine learning models, using simple concepts with minimal mathematical complexity.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the fundamental concepts of regression analysis and optimization techniques.		
CO2: Apply regression models to study relationships between variables and solve basic real-life problems.		
CO3: Analyze data using regression methods and interpret the results statistically.		
CO4: Understand and apply basic optimization techniques for improving regression models.		
CO5: Compare different regression and optimization approaches for effective data analysis.		

Course Contents –

Unit	Content	Teaching hours
1	Fundamentals of Regression Analysis: Definition, scope and importance of regression analysis. Difference between correlation and regression. Concept of dependent and independent variables. Types of regression analysis. Assumptions of regression analysis. Simple Linear Regression: meaning, objectives and applications. Regression equation and interpretation of regression coefficients.	9
2	Multiple Regression and Model Diagnostics: Multiple Linear Regression: concept and need. Estimation of regression coefficients. Interpretation of regression coefficients. Concept of error term. Goodness of fit of regression model. Introduction to coefficient of determination. Limitations of regression models. Concept of multicollinearity (introductory).	9
3	Statistical Inference and ANOVA in Regression: Concept of hypothesis testing in regression. Significance of regression coefficients. Confidence intervals for regression parameters. Introduction to Analysis of Variance (ANOVA). Use of ANOVA in regression analysis. Interpretation of ANOVA table.	9
4	Optimization Concepts in Regression Models: Concept of objective (loss) function. Error minimization in regression models. Overview of optimization techniques used in regression. Role of constraints in optimization. Introduction to regularization techniques. Bias–	9

	variance tradeoff.	
5	Model Evaluation and Performance Metrics: Introduction to evaluation metrics: Mean Absolute Error (MAE), Root Mean Square Error (RMSE), Accuracy, Precision and Recall. Application of ANOVA. Examples based on MAE, RMSE.	9

Textbooks:

Reference Books: 1. Introduction to Linear Regression Analysis--Montgomery, Peck and Vining
2. Machine Learning with Python—Abhishek Vijayvargiya BPB Publication
3. Applied Machine Learning---M Gopal McGraw Hill Education

Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus

Semester-III

Course Code: GAM41MMP201	Course Name: Practicals Based on AI and ML Essentials
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 and Artificial Intelligence	
Course Objectives:	
<ul style="list-style-type: none"> ● Conceptual understanding of AI and ML fundamentals ● Analytical skills for reasoning and decision-making under uncertainty ● Knowledge of optimization and evolutionary problem solving ● Familiarity with machine learning model evaluation ● Insight into neural networks and deep learning ● Practical understanding of NLP and generative models ● Awareness of ethical and responsible AI practices 	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Explain the fundamental principles and evolution of Artificial Intelligence.	
CO2: Apply logical and probabilistic reasoning techniques to AI problems.	
CO3: Analyze evolutionary algorithms for optimization tasks.	
CO4: Distinguish between different machine learning paradigms and models.	
CO5: Describe generative modeling techniques and their applications.	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Logic and Knowledge Representation: <ul style="list-style-type: none"> ◦ Solve logic problems using Boolean algebra ◦ Construct semantic networks to represent object relationships 	4
2	Probability Concepts in AI: <ul style="list-style-type: none"> ◦ Perform probability experiments using a six-sided die ◦ Compute probabilities of outcomes ◦ Apply Bayes' Theorem to update probabilities 	4
3	Bayesian Networks: <ul style="list-style-type: none"> ◦ Construct a simple Bayesian Network ◦ Define Conditional Probability Tables (CPTs) ◦ Perform inference based on observed evidence 	4
4	Machine Learning – Decision Trees: <ul style="list-style-type: none"> ◦ Build and interpret a decision tree model ◦ Classify simple datasets using attributes 	4
5	Neural Networks: <ul style="list-style-type: none"> ◦ Design a basic neural network architecture ◦ Train a feedforward neural network 	4

	<ul style="list-style-type: none"> ◦ Evaluate model accuracy 	
6	Natural Language Processing : <ul style="list-style-type: none"> ◦ Perform text tokenization and preprocessing ◦ Apply sentiment analysis on sample text ◦ Interpret sentiment analysis results 	4
7	Generative Intelligence – Creative Tasks: <ul style="list-style-type: none"> ◦ Explore generative concepts through image or pattern creation ◦ Experiment with shapes, patterns, and digital creativity 	3
8	Ethics in AI : <ul style="list-style-type: none"> ◦ Group discussion on fairness, bias, transparency, and societal impact ◦ Case-based exploration of ethical implications in AI systems 	3

Reference Book / Hand Books/ Lab Manual
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1. Stuart Russell & Peter Norvig

Artificial Intelligence: A Modern Approach, Pearson India

2. Daphne Koller & Nir Friedman

Probabilistic Graphical Models: Principles and Techniques, MIT Press (India)
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3. Lane, Howard & Hapke

Natural Language Processing in Action, Manning / Dreamtech India
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Syllabus

Semester-III

Course Code: GAM41MMP202	Course Name: Regression Analysis and Optimization Techniques
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0,P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Regression Analysis and Optimization Techniques (Theory) and Python basics	
Course Objectives: To implement regression models using real datasets, and to understand optimization techniques used in ML model training.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Implement linear and non-linear regression models using Python	
CO2: Apply regularization techniques to reduce overfitting	
CO3: Implement optimization algorithms such as Gradient Descent	
CO4: Evaluate and compare ML models using appropriate metrics	
CO5: Optimize Machine Learning Models	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Introduction to NumPy and Pandas	2
2	Implement linear regression using:Mathematical formulation	2
3	Implement simple linear regression using:Scikit-learn and Visualization of regression line	2
4	Implement Multiple Linear Regression for the Feature selection	2
5	Implement Polynomial Regression for the Feature transformation, Degree selection, Overfitting visualization and Bias–variance analysis	2
6	Implement Logistic Regression for the Binary classification problem, to describe Sigmoid function and Confusion matrix. Take any dataset.	2
7	Implement Gradient Descent.	2
8	To apply hypothesis testing and ANOVA in a real-world data set by considering any one of the data set (sales prediction, student performance, housing prices) and Interpret ANOVA table	2
9	To visualize loss function behavior by plotting loss values for different parameter values and identify minimum loss point.	2
10	To apply L1 regularization and feature selection to fit Lasso regression model.	2
11	Mini Project on the Student performance prediction for identifying the Problem definition, Dataset selection,Regression / Classification model development,Optimization and tuning Performance evaluation and report	10

Reference Book / Hand Books/ Lab Manual

1. Regression Analysis Recipes: With Tools and Techniques to Solve Problems Using Python and R — Geetha Subramanian

2. Linear Algebra and Optimization for Machine Learning — Charu C. Aggarwal

3. Data Science and Predictive Analytics — Ivo D. Dinov

Syllabus

Semester-III

Course Code: GAM41VSP 201	Course Name: Exploratory Data Analysis		
Course Category: Vocational Skill Course			
Credits: 2	Teaching Scheme: L-0,P-4	Evaluation Scheme:	CA-30, ESE-20
Pre-requisites: Basics of Python or R Programming			
Course Objectives: Apply fundamentals of data analysis and to analyze data sets to identify patterns and issues. To interpret data visualizations and statistical summaries			
Course Outcomes: At the end of the course, the students will be able to -			
CO1: Understand the importance and steps of EDA.			
CO2: Import and inspect real-world datasets.			
CO3: Handle missing values and outliers effectively.			
CO4: Compute and interpret descriptive statistics.			
CO5: Visualize data using appropriate plots.			

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	To Understand EDA concepts and its role in data analysis.	4
2	To Learn how to load and inspect datasets.	4
3	To Identify and handle missing data.	4
4	To Compute and interpret statistics: Mean, Median and Mode	4
5	To Compute and interpret statistics: Variance, standard deviation, Percentiles and range	4
6	To Visualize single variable distributions: Plot histograms, Box plots, Bar charts (for categorical data)	4
7	To explore relationships between two variables: Scatter plots, Correlation matrix and Heatmaps	4
8	To Detect and treat outliers: Identify outliers using boxplots and IQR, Treat outliers (remove or transform)	4
9	To Apply transformations for better distribution: Apply log, square root transformations, Compare histograms before and after	4
10	To Encode categorical data for analysis: Apply One-hot encoding, Label encoding.	4
11	Mini EDA Project on Sales Data: Load dataset, Clean and preprocess, Perform descriptive and visual EDA, Prepare a report	20

Reference Book / Hand Books/ Lab Manual

1. Python for Data Analysis by Wes McKinney
2. R for Data Science by Hadley Wickham & Garrett Golemund
3. Data Wrangling with Python by Jacqueline Kazil & Katharine Jarmul

Semester: FOURTH

Syllabus

Semester-IV

Course Code: GAM41MML203	Course Name: Machine Learning Engineering	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: An introductory concepts of Artificial Intelligence and Machine Learning		
Course Objectives:		
<ul style="list-style-type: none"> ● To understand the fundamental concepts of machine learning. ● To learn about various machine learning algorithms and techniques. ● To apply machine learning techniques to solve real-world problems. ● To evaluate the performance of machine learning models. ● To understand the ethical and societal implications of machine learning. 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Identify suitable machine learning techniques for a given problem.		
CO2: Prepare and preprocess data for machine learning.		
CO3: Implement machine learning algorithms using appropriate tools and libraries.		
CO4: Evaluate the performance and interpret the results of machine learning models.		
CO5: Understand the ethical and societal implications of machine learning.		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to machine learning: Introduction, Motivation for machine learning, Applications, Machine learning, Classification, Regression, The origin of machine learning, Time line of machine learning techniques, Uses and abuses of machine learning, How do machines learn, Abstraction and knowledge representation, Generalization, Assessing the success of learning, Steps to apply machine learning to data, Input data and ML algorithm, Machine learning methods, Unsupervised learning, Semi-supervised learning, Clustering, What are we looking for? Classification of machine learning algorithms, General ML architecture, Reinforcement learning, Supervised learning, Unsupervised learning, Semi-supervised learning, Regularization algorithms, Clustering algorithms, Deep learning algorithms, Ensemble learning, Matching data to an appropriate algorithm.	9
2	Simple linear regression: Introduction, Supervised learning, Regression, Regression examples, Regression models, Steps in regression analysis, Linear regression, Simple linear regression, Least squares estimation, Least squares regression-Line of best fit, Illustration, Direct regression method, Maximum likelihood estimation, Matrix approach, Regression assumptions and model properties, Coefficient of determination (R-squared), Example, Testing for	9

	significance, Testing hypothesis in simple linear regression, Illustration, Checking model adequacy, Over-fitting, Detecting over-fit models: Cross validation, Cross validation: The ideal procedure, Logistic regression.	
3	<p>Multiple regression and model building: Introduction, Ordinary least squares estimation for multiple linear regression, Multiple linear regression model building, Partial correlation and regression model building, Multiple linear regression model, Interpretation of multiple linear regression coefficients-Partial regression coefficients, Standardized regression coefficients, Missing data, Validation of multiple regression model, Coefficient of multiple determination (R-Squared), Adjusted R-squared, Statistical significance of individual variables in multiple linear regression: t-Test.</p> <p>Introduction to Classification & Classification Algorithms: Preamble: Machine learning, To classify faces and expressions, Introduction, ML classifier, Classification and general approach, Classification algorithms, Instance based learning, K-Nearest neighbour, Decision trees, Attribute selection measure: Information gain, ID3 algorithm, Decision tree: weekend example, Converting a tree to rules, Bayesian algorithms, Ensemble, Stories of success, Why ensemble works? Ensemble of classifiers, Bagging, Boosting, Random forests, Neural networks, Activation functions, Feedforward neural network, Multi-layer perceptron, Backprop algorithm, Recurrent or feedback architecture, Perceptron rule, Gradient-descent (training examples, η), Multilayer networks and back propagation algorithm, Support vector machine, Classification model evaluation and selection, ROC curves, Cost Benefit Analysis (CBA).</p>	9
4	<p>Clustering Techniques: Clustering, Clustering algorithms, More common clustering situation, Statistics associated with cluster analysis, General applications of clustering, Clustering as a pre-processing tool, Hard vs. soft clustering, Similarity and dissimilarity between objects, Type of data in clustering analysis, Binary variables, Nominal variables, Ordinal variables, Major clustering approaches, Types of clusters, Cluster centroid and distances, Hierarchical clustering, Hierarchical Agglomerative Clustering (HAC), Hierarchical Agglomerative Clustering: Linkage method, Hierarchical Agglomerative Clustering: Variance and Centroid method, Cluster distance measures, Single link agglomerative clustering, Complete-link clustering, Average-link clustering, Other agglomerative clustering methods, Distance between two clusters, Hierarchical clustering: Time and Space requirements, K - means clustering, Importance of choosing initial centroids, The K-medoids clustering method, PAM (Partitioning Around Medoids), CLARA (Clustering Large Applications), CLARANS (Randomized CLARA), Density based clustering methods, DBSCAN: Density Based Spatial Clustering of Applications with Noise, When DBSCAN Does NOT Work Well, External criteria for clustering quality,</p>	9

	Different aspects of cluster validation, Measures of cluster validity, Measuring cluster validity via correlation, Using similarity matrix for cluster validation, Internal measures: SSE, Framework for cluster validity, Internal measures: Cohesion and Separation, Internal measures: Silhouette coefficient.	
5	Information Retrieval: Information retrieval: introduction, Information retrieval process, Information retrieval architecture, how do we represent documents? Information retrieval models, Similarity metric, Term weighting, Retrieval in vector space model, Constructing inverted index (word counting), Stop words removal, Stemming, Text document clustering, Agglomerative vs. divisive, Impact of cluster distance measure, Buckshot clustering, Issues related to cosine similarity, Validity of document clusters, Text datasets, Experimental evaluation.	9

Textbooks:

- Reference Books:**
1. Pattern Recognition and Machine Learning by Christopher M. Bishop
 2. Machine Learning by Tom M. Mitchell
 3. Python Machine Learning: Machine Learning in Python by Sebastian Raschka and Vahid Mirjalili

Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus

Semester-IV

Course Code: GAM41MML204	Course Name: Data Mining in AI
Course Category: Major Mandatory	
Credits: 3	Teaching Scheme: L-3 P-0
Evaluation Scheme: CA-60, ESE-40	
Pre-requisites: foundational understanding of the Probability & Statistics, Programming Fundamentals, Data Structures	
Course Objectives: To introduce the concept of data mining, its origins, and the necessity of mining data from both commercial and scientific perspectives. And to clean, preprocess and transform raw data into a quality format suitable for analysis.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Identify and Define the core tasks of data mining (Clustering, Classification, Association) and the challenges associated with large-scale data.	
CO2: Apply Data Preprocessing techniques such as sampling, dimensionality reduction, and attribute transformation to improve data quality.	
CO3: Analyze and Visualize datasets using statistical measures (mean, variance) and graphical tools (Box plots, Scatter plots, Parallel coordinates).	
CO4: Construct and Evaluate classification models using various algorithms and measure their performance using ROC curves and confidence intervals.	
CO5: Assess AI Paradigms by understanding the roles of Heuristics, Expert Systems, and Deep Learning in the broader landscape of intelligent data analysis.	

Course Contents –

Unit	Content	Teaching hours
1	UNIT-I: Introduction to Data Mining: Why Mine 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, 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.	9
2	UNIT II: 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,	9
3	UNIT III: Data Mining Classification: Basic Concepts, Decision Trees, and Model Evaluation: Classification: Definition, Classification Techniques, Tree Induction, Measures of Node Impurity, Practical Issues of Classification, ROC	9

	curve, Confidence Interval for Accuracy, Comparing Performance of Two Models, Comparing Performance of Two Algorithms.	
4	UNIT IV: Data Mining Classification: 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.	9
5	UNIT-V: Introduction to AI for Data Mining: What is Artificial Intelligence, Strong AI versus Weak AI, The Turing Test, Heuristics, Knowledge Representation, AI and Games, Expert Systems, Neural Computing, Evolutionary Computation, Natural Language Processing, Bioinformatics, Major Parts of AI, Machine Learning, Deep Learning, Reinforcement Learning, Robotics	9

Text Books: 1. Introduction to Data Mining by Tan, Steinbach, Kumar ISBN-9332571406
2. Artificial intelligence Machine learning And deep learning by Oswald Campesato ISBN: 978-1-68392-467-8

Reference Books: Artificial Intelligence in Data Mining Theories and Applications Edited by: D. Binu and B.R. Rajakumar ISBN: 978-0-12-820601-0

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus

Semester-IV

Course Code: GAM41MMP203	Course Name: Practical based on Machine Learning Engineering	
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: An introductory concepts of Artificial Intelligence and Machine Learning		
Course Objectives:		
<ul style="list-style-type: none"> ● To understand the fundamental concepts of machine learning. ● To learn about various machine learning algorithms and techniques. ● To apply machine learning techniques to solve real-world problems. ● To evaluate the performance of machine learning models. ● To understand the ethical and societal implications of machine learning. 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Identify suitable machine learning techniques for a given problem.		
CO2: Prepare and preprocess data for machine learning.		
CO3: Implement machine learning algorithms using appropriate tools and libraries.		
CO4: Evaluate the performance and interpret the results of machine learning models.		
CO5: Understand the ethical and societal implications of machine learning.		

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Develop a machine learning pipeline to preprocess a dataset and evaluate the performance of a suitable classification algorithm.	2
2	Implement Simple Linear Regression to predict a continuous variable and evaluate the model using R^2 .	2
3	Build a Multiple Linear Regression model to analyze the effect of multiple independent variables on a dependent variable.	2
4	Implement Logistic Regression to classify data into binary classes and evaluate using ROC curve and confusion matrix.	2
5	Apply K-Nearest Neighbour (KNN) algorithm to classify a dataset and analyze the impact of different K values.	2
6	Construct a Decision Tree classifier and compare its performance with a Random Forest ensemble model.	2
7	Implement Support Vector Machine (SVM) for classification and compare linear and kernel-based models.	2

8	Perform K-Means and DBSCAN clustering on a dataset and validate clusters using Silhouette score.	2
9	Apply Hierarchical Agglomerative Clustering and analyze cluster formation using dendrograms.	2
10	Design a basic Information Retrieval system using TF-IDF and cosine similarity to retrieve relevant documents for a query.	2
11	Project	10

Textbooks:

Reference Books: 1. Pattern Recognition and Machine Learning by Christopher M. Bishop
2. Machine Learning by Tom M. Mitchell
3. Python Machine Learning: Machine Learning in Python by Sebastian Raschka and Vahid Mirjalili

Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus

Semester-IV

Course Code: GAM41MMP204	Course Name: Practical Based on Data Mining in AI
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L- P-2 Evaluation Scheme: CA-30, ESE-20
Pre-requisites: foundational understanding of the Probability & Statistics, Programming Fundamentals, Data Structures	
Course Objectives: To provide a deep dive into exploratory data analysis (EDA), visualization, and statistical summaries. And to bridge the gap between traditional data mining and modern Artificial Intelligence, including Neural Networks and Machine Learning.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Identify and Define the core tasks of data mining (Clustering, Classification, Association) and the challenges associated with large-scale data.	
CO2: Apply Data Preprocessing techniques such as sampling, dimensionality reduction, and attribute transformation to improve data quality.	
CO3: Analyze and Visualize datasets using statistical measures (mean, variance) and graphical tools (Box plots, Scatter plots, Parallel coordinates).	
CO4: Construct and Evaluate classification models using various algorithms and measure their performance using ROC curves and confidence intervals.	
CO5: Assess AI Paradigms by understanding the roles of Heuristics, Expert Systems, and Deep Learning in the broader landscape of intelligent data analysis.	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Create any dataset using Python	2
2	Data Preprocessing (Cleaning): Demonstration of preprocessing on a dataset (e.g., student.arff or weather.nominal). Handling missing values and noisy data.	2
3	Data Preprocessing (Transformation): Performing data transformation techniques like Normalization (Min-Max, Z-score) and Discretization (Binning).	2
4	Association Rule Mining: Implementation/Demonstration of the Data Mining Algorithm to find frequent itemsets and generate association rules (often on supermarket or contact-lenses data).	2
5	Association Rule Mining (FP-Growth): Implementation of the FP-Growth Algorithm for efficient frequent pattern mining	2
6	Classify a dataset (e.g., iris.csv) using k-NN and observe how the prediction changes when a new "unknown" instance is introduced.	2
7	Classification (Naive Bayes): Implementation of the Naive Bayes Classifier to predict class labels.	2
8	Classification (Rule Based): Implementation of the Rule based to predict class labels.	2

9	Run k-NN with different values of k (e.g., k=1,3,5) and different distance measures (Euclidean vs. Manhattan) to observe changes in accuracy.	2
10	To develop a simple rule-based Chatbot (e.g., ELIZA clone) to simulate human conversation.	2
11	Create a "Family Tree" or "Medical Diagnosis" system using Prolog predicates	10

Reference Book / Hand Books/ Lab Manual

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

2. Deep Learning with Python by François Chollet — practical implementation using Keras/TensorFlow

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

Syllabus

Semester-IV

Course Code: GAM41SEP201	Course Name: Intelligent Database Management System		
Course Category: Skill Enhancement Course			
Credits: 2	Teaching Scheme: L-0,P-4	Evaluation Scheme:	CA-30, ESE-20
Pre-requisites: Basic knowledge of databases, database management systems and query languages			
Course Objectives: Apply basic knowledge of databases and data management systems, also to analyze data-related problems and identify appropriate intelligent data handling techniques for interpreting structured data to generate insights and support decision-making.			
Course Outcomes: At the end of the course, the students will be able to -			
CO1: Understand the fundamentals, scope, and importance of Intelligent Data Management Systems.			
CO2: Design and implement structured databases for efficient data storage and management.			
CO3: Apply intelligent SQL queries to retrieve, filter, and analyze data effectively.			
CO4: Perform data cleaning, preprocessing, and indexing to improve data quality and performance.			
CO5: Develop simple rule-based intelligence for data analysis and decision support.			

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	To understand the concept and components of an Intelligent Data Management System.	4
2	To design and create a structured database: Define tables with appropriate data types and Insert sample data sets for intelligent data processing.	4
3	To retrieve meaningful information using advanced SQL queries: Use SELECT with WHERE, ORDER BY, GROUP BY and perform aggregate operations. And Write nested queries.	4
4	To prepare data for intelligent analysis: Identify missing, duplicate, and inconsistent data.and apply data cleaning techniques.Also Normalize and standardize data.	4
5	To improve query performance using indexing techniques: Create indexes on tables,and compare query execution time with and without indexing.	4
6	To understand intelligent data storage using data warehouses: Design star or snowflake schema and Identify fact and dimension tables.	4
7	To generate intelligent insights through reports and visualizations: Generate summary reports using SQL.Create bar and line charts and interpret trends and patterns.	4
8	To generate intelligent insights through reports and visualizations: Generate summary reports using SQL.Create pie charts and interpret trends and patterns	4
9	To apply simple rule-based intelligence on data: Define business rules (IF-THEN) and apply rules to classify data.	4
10	To understand intelligent data protection mechanisms: Create users and assign roles.Grant and revoke permissions and demonstrate data access control.	4
11	To integrate all IDMS concepts into a small application of Library	20

	management with intelligent search : Design database. Clean and preprocess data.. Apply intelligent queries or rules and generate reports.	
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Reference Book / Hand Books/ Lab Manual

- 1.Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan
2. Data Science and Big Data Analytics by EMC Education Services (Paul Zikopoulos et al.)
3. Data Visualization: A Practical Introduction by Kieran Healy