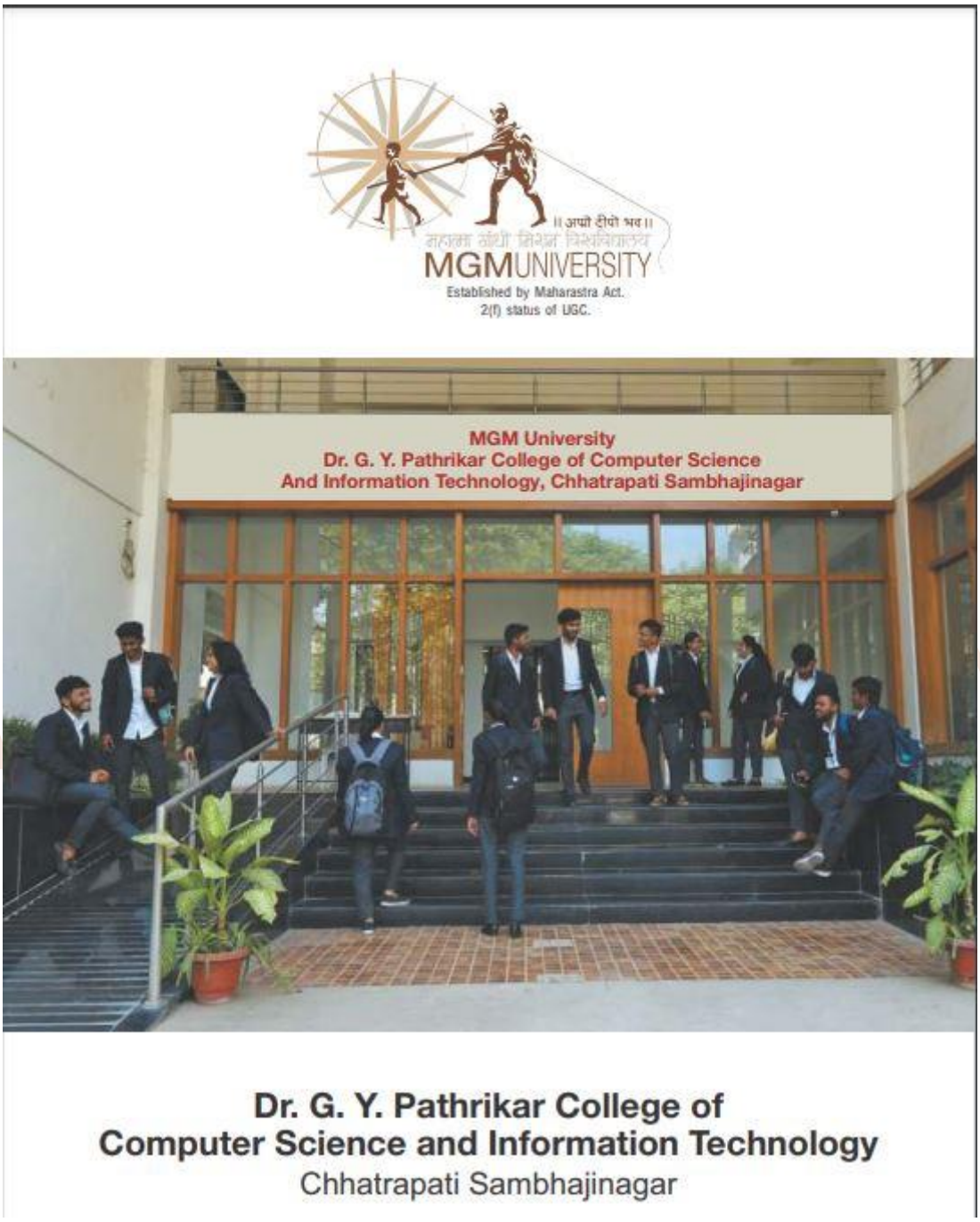

B.Sc. (Hons. / Hons. with Research)
Artificial Intelligence & Machine Learning
(Syllabus)

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 Sambhajinagar.

Vision

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

Mission

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

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

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

Name of Program – B.Sc. (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.

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					

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	GAM41MML101	Operating System	Lecture	2	2		30	20	50		8	20
MM	GAM41MML102	Design Thinking and Innovation	Lecture	2	2		30	20	50		8	20
MM	GAM41MMP101	Practical based on Operating System	Practical	1		2	30	20	50		8	20
MM	GAM41MMP102	Practical based on Design Thinking and Innovation	Practical	1		2	30	20	50		8	20
IKS	GAM41IKL101	Indian Psychology and yoga	Lecture	2	2	-	30	20	50		8	20
AEC	MGM54AEL104	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	GAM41VSP101	Programming Logic and Design	Practical	2		4	30	20	50		8	20
SEC	GAM41SEL101	Mathematical Foundation	Lecture	2	2	-	30	20	50		8	20
VEC	MGM21VEL101	Environmental Studies	Lecture	2	2	-	30	20	50		8	20
CC	MGM85CCP107	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: M**M-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

First Year- Semester II												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	GAM41MML103	Data Structure	Lecture	2	2		30	20	50		8	20
MM	GAM41MML104	Python	Lecture	2	2		30	20	50		8	20
MM	GAM41MMP103	Practical based on Data Structure	Practical	1		2	30	20	50		8	20
MM	GAM41MMP104	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	MGM54AEL102	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	GAM41VSP102	Advance Excel	Practical	2		4	30	20	50		8	20
SEC	GAM41SEL102	Statistical Methods	Lecture	2	2	-	30	20	50		8	20
VEC	MGM56VEL102	Constitution of India	Lecture	2	2	-	30	20	50		8	20
CC	MGM82CCP103	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: M**M-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Second Year - Semester 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	GAM41MML201	AI and ML Essentials	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MML202	Regression Analysis & Optimization Technique	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MMP201	Practical Based on AI and ML Essentials	Practical	1	-	2	30	20	50	-	08	20
MM	GAM41MMP202	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	MGM54AEL103	Functional Hindi	Lecture	2	2	-	30	20	50	-	08	20
VSC	GAM41VSP201	Exploratory Data Analysis	Practical	2	-	4	30	20	50	-	08	20
FP	GAM41FPJ201	Field Project - I	Practical	2	-	4	50	-	50	20	-	20
CC	MGM82CCP201 / 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: M**M-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Second Year - Semester IV												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	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	GAM41CEP P201	Community Engagement Program	Practical	2	-	4	50	-	50	20	-	20
CC	MGM82CC P104/ MGM73CC P105/ 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: M**M-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

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	GAM41MML301	Deep Learning	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MML302	Computer Network for AI and ML	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MMP301	Practical Based on Deep Learning	Practical	1	-	2	30	20	50		08	20
MM	GAM41MMP302	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
	GAM41MEL302	Predictive Analytics										
ME	GAM41MEP301	Practical Based on Big Data	Practical	1	-	2	30	20	50		08	20
	GAM41MEP302	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	GAM41VSP301	R Programming	Practical	2	-	4	30	20	50		08	20
FP	GAM41FPJ301	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: M**M-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

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	GAM41MML303	Applied Large Language Model Development and Deployment	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MML304	Cloud Computing for AI & ML	Lecture	3	3	-	60	40	100	-	16	40
MM	GAM41MMP303	Practical Based on Applied Large Language Model Development and Deployment	Practical	1	-	2	30	20	50		08	20
MM	GAM41MMP304	Practical based on Cloud Computing for AI & ML	Practical	1	-	2	30	20	50		08	20
ME	GAM41MEL303	Big Data Analytics	Lecture	3	3	-	60	40	100		16	40
	GAM41MEL304	AI in Business Intelligence										
ME	GAM41MEP303	Practical Based on Big Data Analytics	Practical	1	-	2	30	20	50		08	20
	GAM41MEP304	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	GAM41JTP301	**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: M**M-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Fourth Year - Semester VII												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	GAM41MML401	Computer Vision	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MML402	Natural Language Processing	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MML403	Edge AI	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MMP401	Practical Based on Computer Vision	Practical	2	-	2	30	20	50		08	20
MM	GAM41MMP402	Practical Based on Natural Language Processing	Practical	2	-	2	30	20	50		08	20
MM	GAM41MMP403	Practical Based on Edge AI	Practical	2	-	2	30	20	50		08	20
ME	GAM41MEL401	AI in Healthcare	Lecture	3	3	-	60	40	100		16	40
	GAM41MEL402	AI in Social Media										
ME	GAM41MEP401	Practical Based on AI in Healthcare	Practical	2	-	2	30	20	50		08	20
	GAM41MEP402	Practical Based on AI in Social Media										
RM	GAM41RML401	Research Methodology	Lecture	3	3	-	60	40	100		16	40
RM	GAM41RMP401	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 Cred-its**	**Teach-ing (Con-tact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Inter-nal**	**Exter-nal**	**Total**	**Inter-nal**	**Exter-nal**	**Total**
MM	GAM41MML404	Explainable AI	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MML405	Sentiment Analysis	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MML406	Generative AI	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MMP404	Practical Based on Explainable AI	Practical	1	-	2	30	20	50		08	20
MM	GAM41MMP405	Practical Based on Sentiment Analysis	Practical	1	-	2	30	20	50		08	20
MM	GAM41MMP406	Practical Based on Generative AI	Practical	1	-	2	30	20	50		08	20
ME	GAM41MEL403	AI With Cloud Services	Lecture	3	3	-	60	40	100		16	40
	GAM41MEL404	Recommenda-tion System										
ME	GAM41MEP403	Practical Based on AI with Cloud Services	Practical	1	-	2	30	20	50		08	20
	GAM41MEP404	Practical Based on Recommen-dation System										
OJT	GAM41JTP401	**On Job Train-ing – 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	GAM41MML407	Computer Vision	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MML408	Geospatial AI and GIS	Lecture	3	3	-	60	40	100		16	40
MM	GAM41MMP407	Practical Based on Computer Vision	Practical	1	-	2	30	20	50		08	20
MM	GAM41MMP408	Practical Based on Geospatial AI and GIS	Practical	1	-	2	30	20	50		08	20
ME	GAM41MEL405	Human Computer Interaction	Lecture	3	3	-	60	40	100		16	40
	GAM41MEL406	AI in Blockchain	Lecture									
ME	GAM41MEP405	Practical Based on Human Computer Interaction	Practical	1	-	2	30	20	50		08	20
	GAM41MEP406	Practical Based on AI in Blockchain	Practical									
RM	GAM41RML401	Research Methodology	Lecture	3	3	-	60	40	100		16	40
RM	GAM41RMP401	Practical based on Research Methodology	Practical	1	-	2	30	20	50		08	20
RP	GAM41RPJ401	Research Project	Practical	4	-	8	60	40	100		16	40
Total				**20**	**12**	**16**	**420**	**280**	**700**			

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

Fourth Year - Semester VIII (Honours with Research)												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	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: M**M-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Syllabus
Semester-I

Course Code: GAM41MML101 **Course Category:** Major Mandatory		**Course Name:** Operating System
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: 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 Category:** Major Mandatory		**Course Name:** Design Thinking and Innovation
Credits: 2	**Teaching Scheme:** L-2, P-0	**Evaluation Scheme:** CA-30, ESE-20
Pre-requisites: Introduction to Computer Fundamentals		
Course Objectives: • 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 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.	
2	**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.	
3	**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.	
4	**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 - 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.	**Model creation and Idea pitching** 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.	

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 Category:** Major Mandatory	**Course Name:** Practical based on Operating System	
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: • 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. •**Expected Outcome:** A foundational understanding of Design Thinking principles, its advantages, and its contrast with other approaches. **Lab 2: Divergent vs. Convergent Thinking Exercise** •**Objective:** Practice divergent and convergent thinking techniques within a problem-solving context. •**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). •**Expected Outcome:** Practical experience in applying both thinking styles and initial promising ideas for a given problem. **Lab 3: Initial Problem Statement Generation** •**Objective:** Formulate insightful initial questions to clarify a given ambiguous problem. •**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. •**Expected Outcome:** A comprehensive list of clarifying questions for a complex problem. **Lab 4: Empathy Map Creation** •**Objective:** Develop a deep understanding and empathy for a target user by creating an Empathy Map. •**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. •**Expected Outcome:** A completed Empathy Map that visually represents user insights and pain points. **Lab 5: Point-Of-View (POV) Statement Definition** •**Objective:** Learn to synthesize user insights into a clear, actionable, and user-centric Point-Of-View (POV) statement**.** •**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]". •**Expected Outcome:** A well-articulated POV statement that focuses the problem-solving efforts. **Lab 6: User Persona Development** •**Objective:** Create a detailed user persona to represent a segment of the target user base. •**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. •**Expected Outcome:** A comprehensive user persona that aids in user-centric design decisions. **Lab 7: Stakeholder Mapping** •**Objective:** Identify and map all key stakeholders relevant to a problem and understand their relationships. •**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. •**Expected Outcome:** A visual stakeholder map providing a holistic view of the ecosystem surrounding a problem. **Lab 8: Root Cause Analysis (5 Whys)** •**Objective:** Practice identifying the fundamental root cause of a recurring problem using the 5 Whys technique. •**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.	

	•**Expected Outcome:** Identification of a core root cause and a deeper understanding of problem origins. **Lab 9: Problem Reformulation** •**Objective:** Learn to reframe an initial problem statement into a more precise, actionable, and inspiring challenge. •**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...?" cite_start question that encourages innovative solutions (e.g., "How might we make our product more appealing to young professionals?"). •**Expected Outcome:** A refined and impactful "How Might We" problem statement. **Lab 10: Observation Practice** •**Objective:** Develop keen observation skills to gather insights from user behavior in real-world contexts. •**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). •**Expected Outcome:** Sharpened observation skills and documented behavioral insights for a given scenario. **Lab 11: "As-Is" State Analysis and Mapping** •**Objective:** Understand and visually document the current "as-is" state of a specific process or user journey. •**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. •**Expected Outcome:** A visual representation of the current user journey or process flow, highlighting areas for improvement. **Lab 12: Brainstorming Session using SCAMPER** •**Objective:** Generate a wide range of innovative ideas using the structured SCAMPER brainstorming technique. •**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. •**Expected Outcome**: A diverse set of ideas, demonstrating the application of the SCAMPER technique. **Lab 13: Mind Mapping for Idea Generation** •**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. **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.	

	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. **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** **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. **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. **Lab 19: Storytelling for Idea Pitching** •**Objective:** Practice presenting an innovative idea persuasively and memorably using storytelling techniques. •**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. •**Expected Outcome:** Improved public speaking and storytelling skills for effectively communicating ideas to stakeholders.	

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: • 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 Wiely 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 Category:** Major Mandatory		**Course Name:** Data Structure
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

Text Books:	1. Seymour Lipschutz, Data Structures, Tata McGraw Hill Publication.
	2.Thomas H. Cormen, Charles E. Leiserson, Ronaild 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 Category:** Major Mandatory		**Course Name:** Python
Credits: 2	**Teaching Scheme:** L-2, P-0	**Evaluation Scheme:** CA-30, ESE-20
Pre-requisites: Fundamental Knowledge of computer programming language.		
Course Objectives: • 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, Arithmetic Operators, Comparison Operators, Logical Operators, Input and Output Operations, Using input() for User Input, Printing Output with print(). **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	6

	(Lists, Strings), Using range() for Controlled Iteration, Loop Control Statements (break, continue), Breaking Out of a Loop, Skipping Iterations with continue	
2	**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. **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	8
3	**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) **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	8
4	**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, 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	8

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: GAM41MMP103 **Course Category:** Major Mandatory		**Course Name:** Practical based on Data Structure
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, Ronaild 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 Category:** Major Mandatory		**Course Name:** Practical based on Python
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 using objects of this class.	2
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 Category:** Vocational skill course		**Course Name:** Advance Excel
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' Garde 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 DatVisualization	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