MGMUNIVERSITY

MGM UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

ACADEMIC SECTION

NOTIFICATION

No. 95/2023 17th August 2023

Enclosed Format of Curriculum Booklet

Registrar 17/8/23

Registrar
MGM University
Aurangabad

To,

All Deans and Principals / Directors / HoD's

Copy to :

1. PS of Hon'ble Chancellor - For kind information please,
2. PS of Hon'ble Vice-Chancellor
3. The Controller of Examinations
4. The ERP section
5. The Website Team
6. The Deputy Registrar (Academics)

MGM University

Chhatrapati Sambhajinagar

Name of Faculty – Engineering & Technology

Name of Institute – Institute of Information and Communication Technology

Name of Programme – B. Tech. DS with Multidisciplinary Minor

CURRICULUM BOOKLET

(With effect from Academic year 2023-24)

MGM University

Chhatrapati Sambhajinagar

Published by –

Academic Section,

Registrar Office,

MGM University

Contents

MGM University

Vision

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

Mission

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

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

विद्यापीठ गीत

अत्त दिप भव भव प्रदिप भव,
स्वरूप रूप भव हो
ज्ञान सब्ब 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 :

Institute of Information and Communication Technology (IICT) at a Glance

The Institute of Information and Communication Technology (IICT) offers emerging courses in Information Technology, with a focus on Internet of Things (IoT), Blockchain, and Big Data Analytics (BDA). Additionally, it provides undergraduate degrees in Artificial Intelligence & Machine Learning (B.Tech. AI and ML) and Data Science (B.Tech. Data Science). IICT also offers B. Tech CSE(AI) in collaboration with IBM. Furthermore, the department offers Master of Technology Degrees in Data Science (M.Tech. Data Science) and AI & ML (M.Tech. AI and ML) and UG Diploma in Cyber Security and Digital Forensics. Moreover, IICT offers a PhD program in IT.

Vision

IICT shall be a center of excellence fostering innovation, entrepreneurship, and technological advancement with social and global perspectives. It will develop skilled professionals and contribute to industry, research, and interdisciplinary growth.

Mission

- Empower students with human values, ethical conduct, and environmental responsibility.
- Foster interdisciplinary technocrats contributing to sustainable industrial growth.
- Promote expertise in emergent technologies through research, innovation, and industry collaboration to solve real-world challenges.
- Encourage entrepreneurship and leadership, preparing students for future challenges.

Programs offered at IICT

Undergraduate Programmes	Postgraduate Programmes	UG Diploma	PhD Programmes
B.Tech. in Information Technology	M.Tech. Data Science	Cyber Security and Digital Forensics	PhD in IT
B.Tech. in Artificial Intelligence and Machine Learning	M.Tech. AI and ML		
B.Tech. in Data Science			
B. Tech CSE(AI)			

Name of Program – B. Tech. Data Science

Duration – Four Years

Eligibility –Passed HSC or its equivalent examination from science stream and obtained at least 45% marks (at least 40% marks, in case of Backward class categories belonging to Maharashtra State only) and the candidate should have appeared and secured non zero score in MGMU-CET 2024/MHT-CET 2024/PERA-CET 2024/JEE Mains 2024.

1. Maharashtra State Candidate

(i) The Candidate should be an Indian National and having domicile of Maharashtra state and/or born in Maharashtra state.

(ii) Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies, and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together and the candidate should have appeared in MGMU-CET 2024/ MHT-CET 2024/ PERA CET 2024/ JEE (Main) Paper-I 2024 and should obtain non zero score in MGMU-CET 2024/ MHT-CET 2024/ PERA CET 2024/ JEE (Main) Paper-I 2024.. However, preference shall be given to the candidate obtaining non-zero positive score in MGMU-CET 2024 over the candidates who obtained non-zero score in MHT-CET 2024/ PERA CET 2024.

OR

(ii)Passed Diploma in Engineering and Technology and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only).

2. All India Candidates

(i) The Candidate should be an Indian National.

(ii) Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies , and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together and candidate should have appeared in MGMU-CET 2024/ MHT-CET 2024/ PERA CET 2024/ JEE (Main) Paper-I 2024 and should obtain non-zero score in MGMU-CET 2024/ MHT-CET 2024/ PERA CET 2024/ JEE (Main) Paper-I 2024. However, preference shall be given to the candidate obtaining non-zero positive score in JEE Mains Paper-I over the candidates who obtained non-zero score in MGMU-CET 2024/ MHT-CET 2024/ PERA CET 2024.

OR

(ii) Passed Diploma in Engineering and Technology and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only)

Name of Faculty: Faculty of Engineering and Technology
Name of the Department : University Department of Information and Communication Technology (UDICT)
Name of the Programme: **B.Tech. in Data Science with Multidisciplinary Minor**
Programme Type (UG/PG): UG
Duration: 4 Years

First Year - Semester I (Group A)												
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
BSC	APS21BSL101	Single and Multivariable Calculus	Lecture	4	4	-	60	40	100	-	16	40
BSC	APS21BSL102	Engineering Physics	Lecture	3	3	-	60	40	100	-	16	40
ESC	APS21ESL101	Python Programming	Lecture	2	2	-	60	40	100	-	16	40
ESC	APS21ESL102	Engineering Graphics	Lecture	2	2	-	60	40	100	-	16	40
AEC	MGM54AEL101	Communicative English	Lecture	1	1	-	30	20	50	-	8	20
VSEC	APS21VSP101	Engineering Exploration	Practical	2	-	4	60	40	100	-	16	40
BSC	APS21BSP101	Engineering Physics Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP101	Python Programming Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP102	Engineering Graphics Studio	Practical	2	-	4	30	20	50	-	8	20
ESC	APS21ESP103	Recent Trends in Integrated Technology	Practical	1	-	2	30	20	50	-	8	20
AEC	MGM54AEP101	Communicative English Lab	Practical	1	-	2	30	20	50	-	8	20
CCA	MGM82CCP101 MGM82CCP102 MGM82CCP103	NCC /Yoga / Sports	Practical	2	-	4	50	-	50	20	-	20
TOTAL				22	12	20	530	320	850	-	-	-

First Year - Semester II (Group A)													
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
BSC	APS21BSL103	Linear Algebra and Differential Equations	Theory	4	4	-	60	40	100	-	16	40
BSC	APS21BSL104	Engineering Chemistry	Theory	3	3	-	60	40	100	-	16	40
ESC	APS21ESL103	Engineering Mechanics	Theory	2	2	-	60	40	100	-	16	40
ESC	APS21ESL104	Building Programming logic in C	Theory	1	1	-	30	20	50	-	8	20
PCC	APS21PCL 101	Basics of Electrical and Electronics Engineering	Theory	2	2	-	60	40	100	-	16	40
IKS	APS21IKL101	Indian Knowledge System	Theory	2	2	-	60	40	100	-	16	40
VSEC	APS21VSP102	Workshop Practices	Practical	2	-	4	60	40	100	-	16	40
BSC	APS21BSP102	Engineering Chemistry Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP104	Engineering Mechanics Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP105	Building Programming logic in C Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	APS21PCP101	Electrical and Electronics Technology Lab	Practical	1	-	2	30	20	50	-	8	20
CCA	MGM82CCP104 MGM73CCP105 MGM73CCP106 MGM85CCP107 MGM82CCP201	NSS/ Fine Art/ Visual Art Cultural Activities Health and Wellness	Practical	2	-	4	50	-	50	20	-	20
TOTAL				22	14	16	560	340	900	-	-	-

First Year - Semester I (Group B)												
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
BSC	APS21BSL101	Single and Multivariable Calculus	Theory	4	4	-	60	40	100	-	16	40
BSC	APS21BSL104	Engineering Chemistry	Theory	3	3	-	60	40	100	-	16	40
ESC	APS21ESL101	Python Programming	Theory	2	2	-	60	40	100	-	16	40
ESC	APS21ESL103	Engineering Mechanics	Theory	2	2	-	60	40	100	-	16	40
AEC	MGM54AEL101	Communicative English	Theory	1	1	-	30	20	50	-	8	20
PCC	APS21PCL101	Basics of Electrical and Electronics Engineering	Theory	2	2	-	60	40	100	-	16	40
VSEC	APS21VSP102	Workshop Practices	Practical	2	-	4	60	40	100	-	16	40
BSC	APS21BSP102	Engineering Chemistry Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP101	Python Programming Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP104	Engineering Mechanics Lab	Practical	1	-	2	30	20	50	-	8	20
AEC	MGM54AEP101	Communicative English Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	APS21PCP101	Electrical and Electronics Technology Lab	Practical	1	-	2	30	20	50	-	8	20
CCA	MGM82CCP101 MGM82CCP102 MGM82CCP103	NCC / Yoga / Sports	Practical	2	-	4	50	-	50	20	-	20
TOTAL				23	14	18	590	360	950	-	-	-

First Year - Semester II (Group B)												
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
BSC	APS21BSL103	Linear Algebra and Differential Equations	Theory	4	4	-	60	40	100	-	16	40
BSC	APS21BSL102	Engineering Physics	Theory	3	3	-	60	40	100	-	16	40
ESC	APS21ESL102	Engineering Graphics	Theory	2	2	-	60	40	100	-	16	40
IKS	APS21IKL101	Indian Knowledge System	Theory	2	2	-	60	40	100	-	16	40
ESC	APS21ESL104	Building Programming logic in C	Theory	1	1	-	30	20	50	-	8	20
VSEC	APS21VSP101	Engineering Exploration	Practical	2	-	4	60	40	100	-	16	40
BSC	APS21BSP101	Engineering Physics Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP102	Engineering Graphics Studio	Practical	2	-	4	30	20	50	-	8	20
ESC	APS21ESP105	Building Programming logic in C Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP103	Recent Trends in Integrated Technology	Practical	1	-	2	30	20	50	-	8	20
CCA	MGM82CCP104 MGM73CCP105 MGM73CCP106 MGM85CCP107 MGM82CCP201	NSS/ Fine Art/ Visual Art Cultural Activities Health and Wellness	Practical	2	-	4	50	-	50	20	-	20
TOTAL				21	12	18	500	300	800	-	-	-

Program Name: B.Tech. (Information Technology/Data Science/AIML) Structure (Semester III)												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching Contacts Hrs/week		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ITY23PCL201	Discrete Structures and Applications	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCL202	Data structures	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCL203	Object Oriented Programming	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCL204	Network Communications and Computing	Lecture	2	2		60	40	100	-	16	40
PCC	ITY23PCP202	Data structures Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ITY23PCP203	Object Oriented Programming Lab	Practical	1	-	2	30	20	50	-	8	20
MDM		Refer Course no.1 of selected MDM from Appendix A	Lecture	2	2	-	60	40	100	-	16	40
OE1		Refer MGMU Basket	Lecture	2	2	-	30	20	50	-	8	20
OE2		Refer MGMU Basket	Lecture	2	2		30	20	50		8	20
FP	ITY23FPJ201	Web Technology	Project	2		4	50	-	50	20	-	20
EEMC	ITY23HSL201	Business Management and Financial Accounting	Lecture	2	2	-	60	40	100	-	16	40
VEC	MGM56VEL102	Constitution of India	Lecture	2	2	-	30	20	50	-	8	20
		TOTAL		**22**	**18**	**8**	**560**	**340**	**900**			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PC-Program Core, PE-Program Elective, MDM-Minor, OE- 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.

Program Name: B.Tech. (Information Technology/Data Science/AIML) Structure
(Semester IV)

Course Category	Course Code	Course Title	Nature of Course	Credit	Teaching Scheme		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ITY23PCL251	Statistics	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCL252	Programming in JAVA	Lecture	2	2		60	40	100	-	16	40
PCC	ITY23PCL253	Digital Logic Design	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCL254	Digital Image Processing	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCP252	Programming in JAVA– Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ITY23PCP254	Digital Image Processing - Lab	Practical	1	-	2	30	20	50	-	8	20
MDM		Refer Course no.2 of selected MDM	Lecture	2	2	-	60	40	100	-	16	40
OE3		Refer MGMU Basket	Lecture	2	2	-	30	20	50	-	8	20
VSEC	ITY23VSP251	Advanced Python	Practical	2	-	4	30	20	50	-	8	20
EEMC	ITY23HSL252	Entrepreneurship Development	Lecture	2	2	-	60	40	100	-	16	40
VEC	MGM21VEL101	Environmental Studies	Lecture	2	2	-	30	20	50	-	8	20
AEC		Refer MGMU Basket	Lecture	2	2	-	30	20	50	-	8	20
		TOTAL		**22**	**18**	**8**	**540**	**360**	**900**			

Note:
Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PC-Program Core, PE-Program Elective, MDM-Minor, OE- 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.

Program Name: B.Tech. Data Science Structure
Semester V

Course Category	Course Code	Course Title	Nature of Course	Credit	Teaching Scheme		Evaluation Scheme(Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ITY23PCL301	Design and Analysis of Algorithms	Lecture	3	3	-	60	40	100	-	16	40
PCC	ITY23PCL302	Machine Learning	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCL303	Database Management Systems	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCL304	Geographical Information Systems	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCP301	Design and Analysis of Algorithms – Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ITY23PCP302	Machine Learning - Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ITY23PCP303	Database Management Systems – Lab	Practical	1	-	2	30	20	50	-	8	20
Program Elective - I												
PEC	DSC23PEL301	Remote Sensing	Lecture	3	3	-	60	40	100	-	16	40
PEC	ITY23PEL303	Introduction to Big Data	Lecture									
PEC	AIM23PEL302	Mathematical Foundation for Cyber Security	Lecture									
PEC	DSC23PEP301	Remote Sensing Lab	Practical	1	-	2	30	20	50	-	8	20
PEC	ITY23PEP303	Introduction to Big Data Lab	Practical									
PEC	AIM23PEP302	Mathematical Foundation for Cyber Security Lab	Practical									
MDM		Refer Course no.3 of selected MDM	Lecture	4	4	-	60	40	100	-	16	40
OE4		Refer MGMU Basket	Lecture	2	2	-	30	20	50	-	8	20
		TOTAL		**22**	**18**	**8**	**510**	**340**	**850**			

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PC-Program Core, PE-Program Elective, MDM-Minor, OE- Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project.

Semester VI

Course Category	Course Code	Course Title	Nature of Course	Credit	Teaching Scheme		Evaluation Scheme(Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	DSC23PCL351	Deep Learning	Lecture	3	3	-	60	40	100	-	16	40
PCC	DSC23PCL352	Computer Vision and Pattern Recognition	Lecture	3	3	-	60	40	100	-	16	40
PCC	DSC23PCL353	Data Analytics	Lecture	2	2	-	60	40	100	-	16	40
PCC	DSC23PCP351	Deep Learning - Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	DSC23PCP353	Data Analytics Lab	Practical	1	-	2	30	20	50	-	8	20
Program Elective - II												
PEC	DSC23PEL351	Spatial Statistics	Lecture									
PEC	ITY23PEL353	Big Data Modelling and Management	Lecture									
PEC	AIM23PEL352	Cryptography and Data Compression	Lecture	3	3	-	60	40	100	-	16	40
PEC	DSC23PEP351	Spatial Statistics Lab	Practical									
PEC	ITY23PEP353	Big Data Modelling and Management Lab	Practical									
PEC	AIM23PEP352	Cryptography and Data Compression Lab	Practical	1	-	2	30	20	50	-	8	20
Program Elective - III												
PEC	DSC23PEL352	Spatial Econometrics	Lecture									
PEC	ITY23PEL356	Big Data Integration and Processing	Lecture									
PEC	AIM23PEL354	Steganography and Digital Watermarking	Lecture	3	3	-	60	40	100	-	16	40
PEC	DSC23PEP352	Spatial Econometrics - Lab	Practical									
PEC	ITY23PEP356	Big Data Integration and Processing - Lab	Practical									
PEC	AIM23PEP354	Steganography and Digital Watermarking - Lab	Practical	1	-	2	30	20	50	-	8	20
MDM		Course no.4 of selected MDM	Lecture	2	2	-	60	40	100	-	16	40
VSEC	ITY23VSP301	Mobile Application Development	Practical	2		4	30	20	50	-	8	20
		TOTAL		22	16	12	510	340	850			

Semester VII													
Course Category	Course Code	Course Title	Nature of Course	Credit	Teaching Scheme		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	DSC23PCL401	Generative Adversarial Networks	Lecture	3	3	-	60	40	100	-	16	40
PCC	ITY23PCL402	Cloud Computing	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCP402	Cloud Computing Lab	Practical	1	-	2	30	20	50	-	8	20
MDM		Course no.5 of selected MDM	Lecture	2	2	-	60	40	100	-	16	40
PCC	DSC23PCL402	Cognitive Computing	Lecture	2	2	-	60	40	100	-	16	40
PCC	ITY23PCL404	Adv. Web Programming	Lecture	2	2	-	60	40	100	-	16	40
PCC	DSC23PCP402	Cognitive Computing Lab	Practical	1	-	2	30	20	50		8	20
PCC	ITY23PCP404	Adv. Web programming Lab	Practical	1	-	2	30	20	50		8	20
MDM		Course no.6 of selected MDM	Practical	2		4	30	20	50	-	8	20
RM	ITY23RML401	Research Methodology	Lecture	4	4	-	60	40	100	-	16	40
RP	ITY23RPJ401	Project	Project	4	-	8	60	40	100	-	16	40
Total				**24**	**15**	**18**	**540**	**360**	**900**			

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PC-Program Core, PE-Program Elective, MDM-Minor, OE- Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project.

Semester VIII													
Course Category	Course Code	Course Title	Nature of Course	Credit	Teaching Scheme		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
Program Elective - IV												
PEC	DSC23PEL451	Time Series Analysis	Lecture	4	4	-	60	40	100	-	16	40
PEC	ITY23PEL453	Machine Learning with Big Data										
PEC	AIM23PEL452	Cyber Security and Digital Forensics										
Program Elective - V												
PEC	DSC23PEL452	Predictive Analytics and Basic Simulation	Lecture	4	4		60	40	100	-	16	40
PEC	ITY23PEL456	Graph Analytics for Big Data										
PEC	AIM23PEL453	Intellectual Property Rights										
OJT /RP	ITY23JTI451 / ITY23RPJ451	Internship/ Major Project	Internship	12	-	24	100	50	150	-	20	60
Total				20	8	24	220	130	350			

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

Semester I

Course code: APS21BSL101 **Course name:** Single Variable Calculus **Course category:** Basic Science
Credits: 4 **Teaching scheme:** L-4 hrs/week **Evaluation scheme:** CA–60, ESE–40
Duration of External Examination-2 Hrs
Pre-requisites: Pre-university mathematics.
Course Objectives:
1. To develop mathematical models using standard functions.
2. To determine derivatives of function.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Represent function verbally, numerically, visually, algebraically and formulate a mathematical model using standard functions.
CO2: Find Limit of functions and use limit to find tangents and velocities which gives rise to derivative.
CO3: Trace the Cartesian curve, Parametric curve and Polar curve. Find arc length, area, volume and surface area using integrals.
CO4: Solve ordinary differential equations analytically and numerically and apply these methods to solve engineering problems.

Contents –

Unit	Contents	Teaching Hours
1	**Differentiation and its Applications** Limit ,Continuity and Differentiation, Rate of Change in sciences and Engineering, Chain Rule and implicit differentiation, Related rates, Extreme value theorem, Rolle's Theorem, Lagrange's Mean value theorems, Nth derivatives, Taylor and Maclaurin series Expansions, Linear approximations and Differentials.	10
2	**Integration and its Applications** Integration, Reduction formulae, Beta and gamma function, Properties, Evaluation of integrals using Beta and gamma functions, Application of Definite integrals to volume, arc length, surface of revolution, Work and Fluid Forces..	10
3	**Partial Differentiation and its Applications** Limit and Continuity, Partial derivatives of first and higher orders, Total differentials, Errors and Approximations, Total derivative, Extreme values and saddle points, Method of Lagrange multipliers, Jacobians, Vector differentiation, Gradient, Curl and Divergence, directional derivatives.	10
4	**Multiple Integrals and its Applications** Double integrals ,Evaluation of Double integrals**,** Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Area and Volume, Root mean square value, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian),Volume by triple integration.	10

5	**Vector Integration and its Applications** Line integrals, Surface integrals, Green's Theorem, Stokes Theorems, Divergence theorems	10

Text Books: 1. James Stewart, Calculus Early Transcendental, 7th edition, Cengage.
2. George B. Thomas, Ross L. Finney, Calculus and Analytical Geometry, 9th edition, Pearson
3. Howard Anton, Irl Bivens, Stephens Davis, Calculus, 10th Edition, Wiley

Reference Books: 1. Shanti Narayan, Differential Calculus, S. Chand & Co. 2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New York.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.
4. P. N. Wartikar, J. N. Wartikar, Applied Mathematics (Vol I & II) , Pune Vidyarthi Griha Prakashan, Pune
5. H. K. Das and Rajnish Verma, Higher Engineering Mathematics , S. Chand & CO. Pvt. Ltd., New Delhi
6. K. D Joshi, Calculus for Scientists and Engineers, CRC Press.
7 Prasad and Reena Garg, Advanced Engineering Mathematics, Khanna Publishing Company Private Limited, New Delhi.
Online Resources: 1. NPTEL / SWAYAM lectures.

Semester-I

Course code: APS21BSL102 **Course name:** Engineering Physics **Course category:** Basic Science
Credits: 3 **Teaching scheme:** L-3 hrs/week **Evaluation scheme:** CA–60, ESE–40
Duration of External Examination-2 Hrs
Pre-requisites: Students should know Basic Physics and basic Mathematics.

Course Objectives: The Objective of this course is

1. To impart knowledge in basic concepts of physics relevant to engineering applications.
3. To introduce advances in technology for engineering applications.
2. To introduce advances in technology for engineering applications
Course Outcomes:
CO1: Summarize fundamentals of electron optics, modern physics and ultrasonic waves related to the engineering fields.
CO2: Identify the importance of the optical phenomenon i.e interference, diffraction and polarization in
relevance with its engineering applications.
CO3: Classify the material on the basis of electric conductivity as semiconductor and superconductors and dielectric materials this leads to their fascinating applications
CO4 Recognize the use of laser and optical fibers in various fields.

Contents –

Unit	Contents	Teaching Hours
1	**Modern Physics Electron Optics:** e/m by Thomson's method , Positive ray, Bainbridge mass spectrograph **Quantum Mechanics:** Role and concepts, De-Broglie's hypothesis, Uncertainty Principle, Fundamentals of quantum computing, Quantum Fundamentals of quantum computing, Quantum features **Ultrasonic Waves:** Production of ultrasonic waves (Magnetostriction & Piezoelectric method), Applications **Numericals.**.	10
2	**Wave Optics Interference-** Interference in thin films (reflected light), Newton's Rings, Engineering applications of Interference. **Diffraction-** Fresnel's and Fraunhofer Diffraction, Theory of plane transmission Grating **Polarization-** Polarization by reflection and double refraction, Optical activity, Specific rotation, Construction and working of Laurent's half shade polarimeter, Engineering applications of Polarization. **Numerical**.	10
3	**Materials of Technological Importance Dielectric Materials:** Introduction, Types of polarizations: Electronic and Ionic, Orientation Polarizations - Applications of Dielectrics **Semiconducting Materials:** Introduction, Fermi energy in Intrinsic semiconductors and extrinsic semiconductors, Hall effect, Applications of Semiconductors. **Numericals Superconducting Materials:** Introduction, Type I and Type – II superconductors, Meissner effect, BCS Theory, Application..	10

4	**Optoelectronic Materials and Devices LASER** : Absorption, spontaneous and stimulated emission, population inversion pumping mechanism, Construction and working of Ruby laser, Construction and working of He-Ne laser. Lasers in various technological applications. **Introduction to Optical Fibers**-Introduction Acceptance Angle-Numerical Aperture Applications of optical fibbers. **Numerical**	10
5	**Physics of Materials** Crystal **structure:** Unit cell, Coordination number, atomic radius, packing density of cubic system. **X-rays:** Bragg's law, X-Ray Diffraction (XRD), Industrial Applications of X-Rays. **Numerical.** **Particle detector**: G.M. Counter **Nano-Materials:** Basic principles of nano- science and technology, properties, applications of nanotechnology.	10

Text Books: 1.Engineering Physics- H.K. Malik & A.K. Singh, McGraw Hill publication.

2.Engineering Physics - R.K. Gaur and S. L. Gupta. Dhanpat Rai Publications Pvt. Ltd.-New Delhi.

3 M. N. Avadhanulu, P.G. Kshirsagar "A Text book of Engineering Physics"- S. Chand Publications.

4.B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012

Reference Books: **1. Fundamental** of Physics - Halliday and Resnik. Willey Eastern Limited.

2. Introduction to Electrodynamics –David R. Griffiths.

3 Concepts of Modern Physics – Arthur Beizer. Tata McGraw-Hill Publishing Company Limited.

4. Optics – Ajoy Ghatak .Mac Graw Hill Education (India) Pvt. Ltd.

Online Resources: 1. NPTEL / SWAYAM lectures.

https://nptel.ac.in/courses/122107035/ Engineering Physics
https://youtu.be/98xoZknQjl8 Polarization https://youtu.be/yINtzw63KncMaxwell's Equations and EM theory https://youtu.be/bwreHReBH2AMaxwell's Equations and EM theory
https://www.youtube.com/playlist?list=PLuv3GM6-gsE3-hVNaw-YEb7EeY5XVPZdz Maxwell's Equations and EM theory(nptel)
https://nptel.ac.in/courses/115105120/ Experimental Physics
https://youtu.be/2CsMpEBl5QY Crystal Structure and X- rays
https://youtu.be/z_8aJPLr21E Crystal Structure and X- rays
https://youtu.be/_Ckh-60B6LY Condensed matter Physics
https://youtu.be/QQZ6EGf0Ju8 Magnetic Properties
https://youtu.be/DDLljK1ODeg Magnetic Materials
https://youtu.be/etjZmdmrjSU Dielectrics
https://youtu.be/k6ZxP9Yr02E Semiconductor
https://youtu.be/D-9M3GWoBrw Superconductivity
https://youtu.be/GglT1RoBPzg Superconductivity
https://youtu.be/VHp2Ff5N_bs Superconductivity
https://youtu.be/FNp81kkxj5c LASER
https://youtu.be/YvrwVK9ZqQY LASER
https://nptel.ac.in/courses/115107095/ Optic Fiber
https://youtu.be/cjBPnIXK60U Quantum Mechanics (Prof.H.C. Verma)
https://youtu.be/BDuqChhUhM0 Divergence and Curl (Prof.H.C. Verma)
https://youtu.be/sCviGSMaYfI Divergence and Curl (Prof.H.C. Verma)
https://youtu.be/SZCsFS9izfQ Divergence and Curl

And other related videos from following resources
www.nptel.ac.in ;www.swayam.gov.in;https://inflibnet.ac.in/

www.sciencedirect.com
http://vlabs.iitb.ac.in/vlab/ www.youtube.com

Semester-I

Course code: APS21ESL101	**Course name: Python Programming**	**Course category:** ESC
Credits: 2 **Teaching scheme:** L-2hrs/week **Evaluation scheme:** CA–60, ESE–40		
Duration of External Examination-2 Hrs		
Pre-requisites: Basic Computer Knowledge		
Knowledge of any programming language (optional)		
Course Objectives:		
1. To understand fundamental concepts in Python Programming		
2. To learn the different Conditional Loops and Iteration.		
3. To understand various data structures and packages		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Describe programming fundamentals of python.		
CO2: Interpret the python syntax and semantics of control flow statements.		
CO3: Identify the methods to create and manipulate programs with python data structures		
CO4: Use modular approach for problem solving.		
CO5: Apply advanced features and packages of python programming required for data science.		

Contents –

Unit	Content	Teaching hours
1	**Python for everybody** Why Program, Hardware Overview, Python as a Language, Why Python Installation Python Jupyter notebook, Using the Python Playground, how to write program and compile in Jupyter notebook. Writing input and output statements in Python, output formatting, Writing comments keywords in Python .variables and variable assignments, Operators, writing expressions.	6
2	**Conditional Loops and Iteration** Conditional Statements, in Python, Loops and Iteration, Definite Loops, Finding the Largest Value, Loop Indioms.	6
3	**Data Structures in Python** Strings, Manipulating Strings, Files, Processing Files, Dictionaries, and sets, Tuples, Lists Manipulating Lists, Lists and Strings, Strings, Manipulating Strings.	6
4	**Functions, Modules and Packages** Functions, Lambda functions, Recursive function, Types of functions, modules and packages.	6
5	**Packages in Python for Data Science** Numpy introduction, Numerical operations on Numpy, Introduction of Matplotlib, getting started with Pandas, Data frames basics in Pandas, key operations on data frames. Introduction to Data Science, Binary search, finding elements in common in lists using Hash, Finding largest elements, Introduction of SQL	6

Text Books:	1. D. Lee, “Python Programming Fundamentals”, Second Edition, Springer Publication..
	2. Wes McKinney, “Python for Data Analysis” O’Reilly Publication.

Reference Books: Reference Books:

1. The Python Language Reference: http://docs.python.org/2/reference/index.html
2. The Python Standard Library: http://docs.python.org/2/library/
3. https://docs.scipy.org/doc/scipy/reference/tutorial/stats.html
4. http://matplotlib.org/api/mlab_api.html#module-matplotlib.mlab
5. http://conference.scipy.org/proceedings/scipy2010/pdfs/seabold.pdf
6. http://seaborn.pydata.org
7. https://www.datacamp.com/community/data-science-cheatsheets
8. PEP 20 -- The Zen of Python: https://www.python.org/dev/peps/pep-0020/
9. https://docs.scipy.org/doc/numpy-dev/user/numpy-for-matlab-users.html

Semester-I

Course code: MGM54AEL101**Course name:** Communicative English **Course category:** AEC
Credits: 1 **Teaching scheme:** L-1hr/week **Evaluation scheme:** CA–30, ESE–20
Pre-requisites: Basic knowledge of English.
Duration of External Examination-2 Hrs
Course Objectives:
1. The course aims at grooming the professional ethics of the students through variouspersonality traits and behavioral patterns focusing on communication skills.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Communicate formally with enhanced communication Competency.
CO2: Adapt professional nonverbal communication.
CO3: Construct English formal syntax and apply corporate vocabulary in written and verbal communication
CO4: Acquire listening and drafting skills with professional competency.

Contents –

Unit	Content	Teaching hours
1	**Communication and Communication Process:** Introduction to Communication, Forms and functions of Communication, Barriers to Communication and overcoming them, Ways of Effective Communication.	5
2	**Non-verbal Communication And its types:** Kinesiccs Occulesics Appearance roxemics Chronemics Paralanguage Qualities of effective speech.	3
3	**English Grammar** Overview of basic Mid-level grammar Tenses& concept of time, Sentence construction, Corporate vocabulary Difference between formal and informal sentences, phrases and words.	3
4	**Listening Skills and Writing Skills** Listening : Active and Passive Listening writing styles –layouts Business Letters- job application, resignation, resume .	4

Text Books: 1. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill.

2. Sanjay Kumar, Pushp Lata, Communication Skills, Oxford University Press, 2016..

3. Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017

4.Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education,2010.

5. Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken Englishfor Academic Purposes. Cambridge: CUP, 2004.

6. Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press,1998

7. Bhasker, W. W. S & Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan,1975

8.Bovee Courtland, L and Thrill, John V. Business Communication, Today McGraw Hill, NewYork Taxman Publication (1989).
9. Murphy, Raymond. Essential English Grammar, Cambridge: University Press (2000)
10.Hewings Martin Advanced English Grammar Cambridge: University press(2003)
11. Bansal Harrison. Spoken English

Semester-I

Course code: APS21ESL102 **Course name:** Engineering Graphics **Course category:** ESC
Credits: 2 **Teaching scheme:** L-2 hrs/week **Evaluation scheme:** CA–60, ESE–40
Duration of External Examination-2 Hrs
Pre-requisites: NIL
Course Objectives:
1.Understand the basic principles of engineering graphics and improve the visualization skills.
2. To gain knowledge on projection of points, straight lines, planes, solids.
3. To understand the real life objects through Drawings
4. To know the principles of orthographic and isometric projections.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Identify basic concepts in drawing and its application
CO2: Plan and prepare neat orthographic drawings of points, straight lines, planes and solids.
CO3: To visualize and draw orthographic and isometric projection of solids.
CO4 Acquire skill to draw real life engineering objects by using the engineering drawing.

Contents –

Unit	Content	Teaching hours
1	**Projections of Straight Lines** Introduction to Engineering Graphics, Need of Engineering Drawing, Drawing Instruments, BIS code of practice for general engineering drawing, Projections of Points in Four Quadrants, Projections of Points in Reference Plane, Line Parallel to both the Plane, Line Parallel to One Plane and Perpendicular to the other, Line Inclined to One Plane and Parallel to The Other, Line Inclined to Both the Reference Planes, Traces of Line (Only first quadrant to be considered).	10
2	**Engineering Curves** Curves used in Engineering Practice, Conic sections, Construction of conics by different methods, Rectangular-hyperbola, Cycloidal curves, Epi and hypo-cycloids, Involutes and Archimedean spiral.	10
3	**Projections of Planes** Plane with Surface Parallel to One Plane and Perpendicular to other, Plane Inclined to One Plane and Perpendicular to other, Projections of Planes Inclined to both the Planes .	10
4	**Projections of Solids** Introduction to Solids: Prisms, Pyramid, Cylinder, Cone, Cube, Tetrahedron, Sphere, Projections of above Solids with Axis inclined to one plane, Projections of above solids with Axis inclined to both the Planes, Projection of composite solids (different arrangement of Spheres with above Solids).	10
5	**Orthographic Projections** Orthographic projections of different Machine Parts (First Angle Projection method only) .	10

6	**Isometric Projections ,Introduction to CAD** Introduction to Pictorial views, Converting Orthographic Projections into Isometric Projections and Isometric views. Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.	10

Text Books: 1. N. D. Bhatt and Panchal V. M., "Engineering Drawing", Charotar Publishing House, Anand
2 . P. J. Shah , " A Text Book of Engineering Drawing", S.Chand, New Delhi
3. Shah M.B. & Rana B.C, "Engineering Drawing & Computer Graphics", Pearson Publications,
4. Agrawal B.& Agrawal C.M, "Engineering Graphics", TMH Publications
5. Narayana K.L. & P. Kannaiah, "Engineering Drawing", Scitech Publications
6. P.I Vargese, "Engineering Graphics", Mcgraw Hill Publications
7. D.A.Hindoliya," Engineering Graphics", B. S. Publications
Reference Books: 1 Dabhade M. L., "Engineering Graphics", Vol.-I and Vol.-II, Vision Publications, Pune
2. K.Venugopal, "Engineering Drawing and Graphics" ,New Age International Publishers.

Semester-I

Course code: APS21BSP101 **Course name:** Engineering Exploration **Course category:** VSEC
Credits: 2 **Teaching scheme:** P-4 hrs/week **Evaluation scheme:** TW–60, PR–40
Pre-requisites: NIL.
Lab Objectives:
1. Understand the principles of Engineering Design and apply them to identify product requirements, objectives, and constraints through interactions with clients, users, and relevant stakeholders.
2. Develop critical thinking and problem-solving skills to analyze existing technologies, conduct surveys, study literature, and generate creative design concepts using various means and combinations
3. Acquire proficiency in using appropriate tools and techniques to generate electronic and mechanical simulations, schematic diagrams, and product concept sketches or CAD models for effective communication of design ideas.
4. Demonstrate competency in categorizing inputs and outputs of systems in terms of materials, information, and energy, enabling a holistic understanding of engineering projects.
5. Cultivate effective teamwork and communication skills to collaborate with peers, mentors, and team members during the development and presentation of engineering prototypes.
6. Develop the ability to evaluate, defend, and communicate design decisions, progress, and project outcomes, showcasing awareness of course concepts and their application in real-world scenarios.
Lab Outcomes: On completion of the course, the student should be able to:
LO1: Effectively interact with clients, users, and stakeholders to gather relevant information and derive product requirements, thereby demonstrating proficiency in Requirement Analysis and Client Interaction.
LO2: Analyze and compare existing technologies, conduct surveys, and study literature to identify potential solutions, and develop objective trees and function trees, reflecting their competency in C conceptual Design and Analysis.
LO3: Create product concept diagrams, combining different means, and prepare sketches or CAD models to present their design ideas aesthetically and coherently, indicating proficiency in Product Concept Development.
LO4: Categorize system inputs and outputs in terms of materials, information, and energy, illustrating their understanding of System Categorization and Analysis.
LO5: Exhibit hands-on skills in physical assembly, connection, and demonstration of engineering prototypes, showcasing Proficiency in Prototyping and Implementation
LO6: Explain and defend their design choices, project progress, and outcomes during presentations, demonstrating Communication Skills, Project Evaluation, and Awareness of Engineering Concepts

Course Contents

The course is conducted in the following modules:

1. Introduction to Engineering Exploration
2. Engineering Design
3. Platform Based Development
4. Mechanisms
5. Data acquisition and analysis
6. Engineering Ethics
7. Project Management

The following practical contents are delivered in an integrated mode along with theory:

1. Conceptualizing a product
2. Designing a product with constraints
3. Simulation of electronic circuits (at least 10 sets)
4. Implementation of electronic circuits (at least 5 sets)
5. Implementation of four bar chain mechanism
6. Conversion of problem statement to need statement
7. Identification of objectives, constraints and functions
8. Generation of black box, glass box and expanded class box
9. Generation of morphological chart
10. Generation of concepts
11. Comparison of concepts
12. Selection of concept
13. Implementation and testing of prototype

Text Books: 1. James Stewart, Calculus Early Transcendental, 7th edition, Cengage.

2.Shanti Narayan, Differential Calculus, S. Chand & Co.

- **Reference Books:** George E. Dieter and Linda C. Schmidt (2009), Engineering Design, 4ed, Mc Graw Hill Higher Education
- Clive L. Dym, Patrick Little, and Elizabeth J. Orwin (2014), Engineering Design: A project- based introduction, 4ed, John Wiley and Sons

G. Pahl, W. Beitz, J. Feldhusen and K.-H. Grote (2007), Engineering Design: A systematic approach, 3ed, Springer, New York.

Semester-I

Course code: APS21BSP101 **Course name:** Engineering Physics Lab **Course category:** Basic Science
Credits: 1 **Teaching scheme:** P-2 hrs/week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Student should know the basic aspects of measurements like least count and range of instrument, scale identification, accuracy, error etc..
Lab Objectives: The Objectives of this course is
1. To make the students gain practical knowledge to co-relate with the theoretical studies
2. To achieve perfectness in experimental skills.
3. To study practical applications will bring more confidence
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Plot the I-V characteristics of pn junction diode and determine the value of band gap energy which can be used for core engineering Courses..
LO2: Perform optical experiments; using light properties like interference, polarization, diffraction and their applications
LO3: Interpret the results and analyze the data and use the experimental data to plot the graph for a best fit.
LO4: Discuss the characteristics of plateau region and determine operating voltage of G.M counter.
LO4: Determine the numerical aperture and bending loss of optical fiber cable.

List of Practicals –

Unit	Content
1	Thomson's Bar Magnetic method -Determination of e/m of electron **.**
2	Newton's rings -Determination of radius of curvature of Plano convex lens.
3	Polarization - Half shade Polarimeter -Determination of specific rotation of optically active material.
4	Diffraction - Determination of wavelength of light by plane transmission grating.
5	Wedge Shaped film -Determination of thickness of thin wire.
6	Semiconductors – To study of forward and reverse bias characteristic of Semiconductors diode.
7	Fibre Optics – Determination of Bending losses in optical fibre
8	Fibre Optics – Determination of Numerical Aperture of given optical fibre
9	Determination of operating voltage of G.M tube and characteristics of plateau region
10	Determination of wavelength of laser source.

Semester-I

Course code: APS21ESP101	**Course name:** Python Programming Lab	**Course category:** ESC
Credits: 1 **Teaching scheme:** P-2 hrs/week **Evaluation scheme:** TW–30, PR–20		
Pre-requisites: Nil.		
Lab Objectives:		
1.To develop mathematical models using standard functions.		
2.To determine derivatives of function.		
Lab Outcomes: At the end of the course, the students will be able to -		
LO1: Demonstrate python program using development environment		
LO2: Find Develop logical thinking to solve the problems using programming fundamental concepts..		
LO3: Construct python program using various data structures.		
LO4: Apply modularization approach for solving complex problem.		
LO5: Make use of various packages in Python for data science		
LO6: Implement different SQL commands in python		

Contents –

Unit	Content	Teaching hours
1	Program to perform input/output operations Write a program to take input (integer, float, string) and print it**.**	**10**
2	Program based on operators 1. Write a program to simulate a simple calculator (+ - / * %) that takes two operands as input and displays the result 2. Write a program to find area and perimeter of geometric objects. 3. The distance between two cities (in km.) is input through the keyboard. 4. Write a program to convert and print this distance in meters, feet, inches and centimeters 5. Write a Program to interchange two numbers. 6. Write a program to compute Fahrenheit from centigrade	10
3	Programs based on Decision making. ● Write a program to read marks from keyboard and your program should display equivalent grade according to following table(else-if) (ladder) Marks Grade 100 - 80 Distinction 79 - 60 First Class 59 - 40 Second Class < 40 Fail ● Write a program to input basic salary of an employee and calculate gross salary according to given conditions. Basic Salary <= 10000 : HRA = 20%, DA = 80%	10

	Basic Salary is between 10001 to 20000 : HRA = 25%, DA = 90% Basic Salary >= 20001 : HRA = 30%, DA = 95% ● If the ages of three brothers are input through the keyboard, write a C Program to determine the youngest and oldest of the three. ● Write a program to calculate overtime pay of employee. Overtime is paid at the rate of Rs. 12.00 per hour for every hour worked above 40 hours. Assume that employee do not work for fractional part of an hour.	
	Write a program for checking the speed of drivers: If speed is less than 70, it should print "Ok". Otherwise, for every 5km above the speed limit (70), it should give the driver one demerit point and print the total number of demerit points. For example, if the speed is 80, it should print: "Points: 2". If the driver gets more than 12 points, the function should print: "License suspended"	**10**
	Programs using while and for loops ● WAP to find factorial of given number ● WAP to check whether given number is Palindrome or not ● WAP to check whether given number is Armstrong or not ● WAP to print Fibonacci series 5.Write a Python program which iterates the integers from 1 to 50. For multiples of three print "Fizz" instead of the number and for the multiples of five prints "Buzz". For numbers which are multiples of both three and five print "FizzBuzz". 6. WAP to check whether given number is Perfect number or not 7. WAP to check whether given number is Prime number or not 8. Write C program to print given star and number patterns and reverse it. 1. * 1 2. ** 12 3. *** 123 **** 1234.	**10**
	Programs on string 1. Write Python Program to find length of string without using len() function. 2. Count all letters, digits, and special symbols from a given string. 3. Python Program to Count the Number of Vowels in a String. 4. Python Program to Calculate the Number of Upper Case Letters and Lower Case Letters in a String. 5. Python Program to Check whether given string is palindrome or not 6. Write a Python program to merge two Python dictionaries 7. Write a Python program to get the maximum and minimum value in a dictionary 8. Write a Python program to create set difference, Union and intersection 9. Write a Python program to check if two given sets have no elements in common	**10**
	Programs using function 1. Write Functions to calculate your trip's costs: 2. Define a function called hotel cost with one argument nights as input 3. Define a function called plane_ride_cost that takes a string, city, as input. 4. Define a function called rental_car_cost with an argument called days.	**10**

	5. Define a function called trip_cost that takes two arguments, city and days. Like the example above, have your function return the sum of calling the rental_car_cost (days), hotel_cost (days), and plane_ride_cost (city) functions. 6. Write a program in to check a given number is even or odd using the function. 7. Write a function Exchange to interchange the values of two variables, say x and y. illustrate the use of this function in a calling function. 8. Write a program to find Sum of natural number using recursion 9. Write a program to print Fibonacci series number using recursion	
	Program using NumPy, Matplotlib and Pandas library 1. Write a program to perform matrix addition, substraction, multiplication. 2. Plot all types of graph using Matplotlib. 3. Write a program which perform basic operation of Pandas	**10**
	Program on SQL Commands ● Write a program of binary search ● Write a program which perform basic SQL commands ● Programs based on real life problems/GUI based programs	**10**

Semester-I

Course code: APS21ESP102 **Course name:** Engineering Graphics Studio **Course category: ESC**
Credits: 2 **Teaching scheme:** P-4 hrs/week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Nil
Course Objectives: The Objectives of this course is to develop the skills required for
Engineering drawing.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Develop competence in correct expression of the visualized objects
CO2: Dimension and annotate two-dimensional engineering drawings
CO3: .Plan and prepare neat orthographic drawings of points, straight lines, planes and solids
CO4:Develop the ability to visualize and draw orthographic and isometric projection of solids

Lab Contents

Lab	Content
1	Drawing three problems based on projections of lines on half imperial size drawing sheet.
2	Drawing three problems based on engineering curves on half imperial size drawing sheet.
3	Drawing three problems based on projections of planes on a half imperial size drawing sheet.
4	Drawing three problems based on projections of solids on a half imperial size drawing sheet.
5	Drawing three problems based on orthographic projection on a half imperial size drawing sheet.
6	Drawing three problems based on isometric projections on half imperial size drawing sheet
7	Demonstration of CAD software in CAD lab, drawing simple objects using various commands

Semester-I

Course code: APS21ESP103 **Course name:** Recent Trends In Integrated Technologies **Course category:** ESC
Credits: 1 **Teaching scheme:** P-2 hrs/week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Pre-university mathematics.
Lab Objectives:
1. To introduce students the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques.
2.To recognize industrial control problems suitable for Industrial Robotics.
3. To acquire basic skills in exploring the potential of the drone technology in professional activities
4. Ability to recognize industrial automation problems suitable for PLC control
Lab Outcomes:, the students will be able to -
LO1: Prepare 3D Model (slice & print) in either Stratasys or Zortrax & generate scan data through Hexagon portable scanning arm
LO2: Describe basic industrial robotics & it's applications.
LO3: Operate a small drone in a controlled environment.
LO4: Explain principles of sensor, PLC & applications.

Contents –

Unit	Content	Teaching hours
1	Scan to CAD, CAD to STL conversion& patching, machine setup & processes for printing	7
2	Programming the TATA Robot(pendant) for pick & place, programming the Yaskawa Robot(pendant) for motion planning, Demonstrate welding exercise by the instructor.	8
3	Introduction to components of drone, Demonstration of assembly of drone, Demonstration of mission planning & flying the drone.	7
4	Controller & sensor & their interfacing, basic ladder logic instructions, pneumatic& hydraulic actuator	8

Text Books:
1. A Step-by-Step Guide For Beginners: Aircraft Design & Construction Design Guide by :Merlin Debrie
2. Industrial Automation & Robotics By A.K. Gupta & S.K.Arora
3. Additive Manufacturing Principles, Technologies & Applications By C.P.Paul (TMH)
4. Basics of unmanned aerial vehicle By Garvit Pandya (Motion press)

Semester-I

Course code: MGM54AEP101 **Course name:** Communicative English Lab **Course category:** AEC
Credits: 1 **Teaching scheme:** P-2 hrs/week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic knowledge of English.
Lab Objectives:
The course aims at grooming the professional ethics of the students through various personality traits and behavioral patterns focusing on communication skills
Lab Outcomes: the students will be able to -
LO1: Introduce themselves formally and informally through practice.
LO2: Pronounce English vowel and Consonant sounds effectively.
LO3: Participate effectively in G.Ds, Presentations, & Interviews.
LO4: Face Interviews competently.
LO5: Draft resume, business letters, reports formally.
LO6: Comprehend the meaning of English text by comprehension techniques.

Contents –

Unit	Content
1	Self Introduction.
2	Pronunciation of Vowel sounds in English
3	Pronunciation of consonant sounds in English.
4	Group discussion.
5	Presentation techniques.
6	Interview techniques.
7	Letter writing.
8	Email writing, Agenda of the meeting and notices.
9	Resume Writing.
10	Report writing.
11	Skimming & Scanning.

Semester-I

Course code: MGM82CCP101	**Course name:** National Cadet Corps **Course category:** CCA
Credits: 2 **Teaching scheme:** P-4 hrs/week **Evaluation scheme:** TW–30, PR–20	
Pre-requisites: Nil	

Contents –

Unit	Content	Teaching hours
1	**NCC General, National Integration and Awareness, Social Service and Community Development, Drill:** Aims, Objectives and Organization of NCC, Duties of NCC Cadet, National Integration Importance and Necessity, Factors Affecting National Integration, Foot Drill, Drill With Arms, Ceremonial Drill with Arms, Social Service and Community Development Activities- Pollution, Mission Indradhanush, Beti Bachao Beti Padhao, Tree Plantation, Digital Awareness.	12
2	**Personality Development, Disaster Management, Weapon Training, Map Reading :** Critical and Creative Thinking, Decision Making, Self Awareness, Public Speaking, Interview Skills, Types, Org, Capability and Role of NCC cadets, Initiative Trg, Organizing Skills, Do's & Don't, Introduction and Characteristics of .22 rifles, Handling of .22 rifle, Introduction to Map Reading, Conduct of MR-Google and Tourist Maps and Apps.	10
3	**Health and Hygiene, Environmental Awareness and Conservation, Adventure, Obstacle Training:** Hygiene & Sanitation (Personal & Camp Hygiene) Soch Vichar, First Aid in Common Medical Emergencies, Treatment & Care of Wounds, Introduction Yoga & Exercises, Water Conservation, Energy Conservation, Introduction Adventure Activities. Obstacle Course	10
4	**Leadership, Introduction to Infantry Weapons and Equipments:** Traits, Indicators, Motivation, Ethics, Case Studies- Chhatrapati Shivaji Maharaj, Maharana Pratap, Jhasi ki Rani, Ratan Tata, Narayan Murty, Rabindra Nath Tagor, Organization of Infantry Battalion and its weapons.	8
5	**Armed Forces, Field Craft and Battle Craft, :** Armed Forces, Army, CAPF, Police, Modes of Entry to Army, CAPF, Police, Introduction to Field Craft, Indication of Landmark, Observation, Camouflage and Concealment, Fire and Move Capsule.	8

Text Books: 1. James Stewart, Calculus Early Transcendental, 7th edition, Cengage.
2.George B. Thomas, Ross L. Finney, Calculus and Analytical Geometry, 9th edition, Pearson
3. Howard Anton, Irl Bivens, Stephens Davis, Calculus, 10th Edition, Wiley
References:

1. Cadet's Handbook- Common Subject, all wings by DG NCC, New Delhi.
2. Cadet's Handbook- Common Subject by NCC Directorate- Bhubaneshwar.
3. Cadet's Handbook- Specialised Subjects, Army, Navy, Air-Force by DG NCC, New Delhi.
4. NCC OTA Precise by DG NCC, New Delhi.
5. Chanakya's 7 Secrets of Leadership by Radhakrishanan Pillai and D. Shivnandhan. 6. National Cadets Corps (India) by Lambert M. Suvarkar. **E-Resources:** 1. National Cadet Corps, Youth in Action (Google eBook). 2. https://indiancc.nic.in/dg-ncc-lt-gen-gurbirpal-singh/ www.youtube.com

Semester-I

Course code: APS21BSL102	**Course name:** Yoga	**Course category:** CCA
Credits: 2	**Teaching scheme:** P-4 hrs/week	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Students should know Basic.		

Unit	Content	Teaching hours
1	**Yoga** **History of Yoga** Yoga is a mind and body practice with a 5,000-year history in ancient Indian philosophy. The word "yoga" comes from the Sanskrit word "yuj," which means "to yoke" or "to unite." Yoga is a system of physical postures, breathing exercises, and meditation designed to help practitioners achieve physical, mental, and spiritual well-being The earliest written records of yoga date back to the 2nd century BCE, and the practice has been evolving ever since. Yoga has spread to all corners of the world, and there are now many different styles of yoga practiced today. **Fundamental Skills of Yoga** Postures: The postures, or asanas, are the physical component of yoga. There are many different postures, and they can be practiced in a variety of ways. Breathing: Breathing, or pranayama, is an important part of yoga. There are many different breathing techniques, and they can be used to help relax the body and mind. Meditation: Meditation is the mental component of yoga. There are many different meditation techniques, and they can be used to help focus the mind and achieve a state of peace.	20
2	**Swimming** **History of Swimming** Swimming is one of the oldest sports in the world, with evidence of swimming dating back to 2500 BC. The earliest recorded swimming competitions were held in ancient Greece and Rome. Swimming became an Olympic sport in 1896, and it has been a part of every Game since then. Swimming is now a popular sport all over the world, and there are many different types of swimming, including freestyle, backstroke, breaststroke, butterfly, and individual medley. **Fundamental Skills of Swimming** Breathing: Breathing is one of the most important skills in swimming. It is important to be able to breathe efficiently while swimming in order to avoid getting tired. Body Position: Body position is another important skill in swimming. It is important to maintain a good body position in order to be hydrodynamic and to swim efficiently.	20

	Stroke Technique: Stroke technique is the way that the arms and legs are used to propel the body through the water. There are many different stroke techniques, and it is important to develop a good stroke technique in order to swim efficiently. Drills: Drills are exercises that can be used to improve swimming skills. There are many different drills, and they can be used to improve different aspects of swimming, such as breathing, body position, and stroke technique. Mental Toughness: Mental toughness is also an important skill in swimming. It is important to be able to stay focused and motivated during long swims, especially in competitions.	

Semester-I

Course code: MGM82CCP103 **Course name:** Sports **Course category:** CCA
Credits: 02 Teaching scheme: P-4hrs/week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Student should know Basic Physics and basic Mathematics.

Course Objectives: The Objective of this course is

1. To understand the importance of sports in physical and mental development.
2. To learn about the different types of sports
3. To learn about the different types of indoor games .
4. To participate in indoor games.
5. To learn about the different types of outdoor games.
6. To participate in outdoor games
Course Outcomes:
Upon completion of this course, students will be able to
1. Demonstrate knowledge of the history, benefits, types, equipment, and safety of sports.
2. Demonstrate proficiency in the basic skills of indoor and outdoor games
3. Understand the rules and regulations of selected sports
4. Participate in sports competitions.

Contents –

Unit	Content	Teaching hours
	Football The earliest forms of football can be traced back to ancient China, Greece, and Rome. In England, the game of football developed in the 19th century, with different rules being used by different schools and organizations. In 1863, the Football Association (FA) was founded, and it standardized the rules of the game. The first international match was played between England and Scotland in 1872. Football became an Olympic sport in 1900, and the first World Cup was held in 1930. Today, football is the most popular sport in the world, with billions of fans around the globe. **Fundamental Skills of Football** Dribbling: Dribbling is the ability to move the ball with your feet while keeping control of it. It is an essential skill for all footballers, as it allows you to move past defenders and create scoring opportunities. Passing: Passing is the ability to accurately and effectively throw the ball to your teammates. It is another essential skill, as it allows you to move the ball up the field and create scoring opportunities. Shooting: Shooting is the ability to kick the ball with power and accuracy. It is the most important skill for scoring goals, and it is essential for all footballers to develop a good shot. Heading: Heading is the ability to use your head to control and direct the ball. It is a	**10**

	valuable skill for both attacking and defending, and it is important for all footballers to learn how to head the ball effectively. Tackling: Tackling is the ability to take the ball away from an opponent. It is an important skill for defenders, but it is also valuable for midfielders and attackers.	
1	**Basket Ball** Basketball was invented by James Naismith in 1891 at the International YMCA Training School in Springfield, Massachusetts. Naismith was a physical education instructor who was looking for a game that would be less injury-prone than football. He nailed two peach baskets to the lower rail of a balcony and used a soccer ball to play the game. The first game of basketball was played on December 21, 1891, with nine players on each team. The rules of basketball have evolved over time, but the basic premise of the game has remained the same. Today, basketball is one of the most popular sports in the world, with millions of players and fans around the globe. **Fundamental Skills of Basketball** Dribble: Dribbling is the ability to move the ball with your hands while keeping control of it. It is an essential skill for all basketball players, as it allows you to move past defenders and create scoring opportunities. Passing: Passing is the ability to accurately and effectively throw the ball to your teammates. It is another essential skill, as it allows you to move the ball up the court and create scoring opportunities. Shooting: Shooting is the ability to throw the ball through the hoop with power and accuracy. It is the most important skill for scoring points, and it is essential for all basketball players to develop a good shot. Rebounding: Rebounding is the ability to catch the ball after it has been missed by a shooter. It is an important skill for both offense and defense, as it allows teams to get second chances at scoring. Defense: Defense is the ability to prevent the other team from scoring points. It is an essential skill for all basketball players, as it is impossible to win a game without playing good defense.	10

	Volleyball 1. Volleyball was invented in 1895 by William G. Morgan, a physical education instructor at the Young Men's Christian Association (YMCA) in Holyoke, Massachusetts. 2. Morgan was looking for a game that would be less vigorous than basketball and he created volleyball as a way to keep his students active during the winter months. 3. The original name of the game was "mintonette," but it was renamed "volleyball" in 1896. 1. Volleyball quickly spread throughout the United States and around the world, and it became an official Olympic sport in 1964. **Fundamental Skills of Volleyball** Passing: Passing is the ability to receive the ball from the opponent and direct it to a teammate. It is an essential skill for all volleyball players, as it allows the team to keep possession of the ball and start an attack. Setting: Setting is the ability to control the height and direction of the ball so that a teammate can spike it. It is a critical skill for setters, as they are responsible for setting up the team's offense. Spiking: Spiking is the ability to hit the ball over the net with power and accuracy. It is the most important skill for scoring points in volleyball, and it is essential for all attackers to develop a good spike. Blocking: Blocking is the ability to prevent the opponent from spiking the ball over the net. It is an important skill for blockers, as they can prevent the other team from scoring points. Digging: Digging is the ability to prevent the opponent from scoring a point by returning the ball over the net. It is an important skill for all defenders, as they are responsible for preventing the other team from scoring points	10

2	**4 Kabaddi History of Kabaddi** Kabaddi is a contact team sport that originated in India. It is believed to have originated in the Indian subcontinent over 4,000 years ago. The game is mentioned in the Sangam literature of Tamil Nadu, which dates back to the 3rd century BC. Kabaddi was first played as a competitive sport in the Indian Olympic Games in 1938. It was included as a demonstration sport at the 1982 Asian Games in Delhi, and it became a full medal sport in the 1990 Asian Games in Beijing. Kabaddi is now played in over 100 countries around the world. **Fundamental Skills of Kabaddi** Dabki: Dabki is the act of entering the opponent's half of the court while chanting "kabaddi, kabaddi." It is a fundamental skill for all raiders, as it allows them to enter the opponent's half of the court without being tackled. Touch: Touching an opponent is the most important skill in kabaddi. It is how raiders score points for their team. There are many different ways to touch an opponent, such as touching their arm, leg, or torso. Tackling: Tackling is the act of preventing a raider from touching an opponent. It is a fundamental skill for all defenders, as it allows them to prevent the other team from scoring points. There are many different ways to tackle a raider, such as grabbing them, pushing them, or tripping them. Stamina: Stamina is essential for all kabaddi players, as the game is very physically demanding. Players need to be able to run, jump, and tackle for long periods of time. Agility: Agility is also important for kabaddi players, as they need to be able to change direction quickly and avoid being tackled.	10
4	**Unit-2** **Badminton** **History of Badminton** The game of badminton originated in ancient Greece, China, and India. It was brought to England in the 1870s by British army officers stationed in India. The first badminton club was founded in 1873 at Badminton House, the country estate of the Duke of Beaufort. The first official all-England badminton championships for men were held in 1899, and the first badminton tournament for women was arranged the next year. Badminton became an Olympic sport in 1992. Today, badminton is a popular sport played by millions of people around the world. **Fundamental Skills of Badminton**	10

Grip: The grip is the most important fundamental skill in badminton. It allows you to control the racket and hit the shuttlecock with power and accuracy. There are many different grips, but the most common are the forehand grip and the backhand grip.

Footwork: Footwork is essential for moving around the court and positioning yourself to hit the shuttlecock. There are many different footwork drills that you can practice to improve your footwork.

Racket control: Racket control is the ability to hit the shuttlecock with power and accuracy. It is important to practice hitting the shuttlecock in different directions and with different levels of power.

Timing: Timing is the ability to hit the shuttlecock at the right time. It is important to practice hitting the shuttlecock at the peak of its flight.

Stamina: Stamina is essential for badminton, as it is a physically demanding sport. You need to be able to run, jump, and hit the shuttlecock for long periods of time.

Soft Tennis

History of Soft Tennis

Soft tennis is a racquet sport that originated in Japan in the early 20th century. It was created as a less dangerous alternative to lawn tennis, as the ball used in soft tennis is made of foam rubber and does not travel as fast as a regular tennis ball.

The first soft tennis tournament was held in Japan in 1921, and the sport quickly spread to other countries in Asia.

Soft tennis was first introduced to the United States in the 1950s, and it has since become a popular recreational sport in the country.

Fundamental Skills of Soft Tennis

Grip: The grip is the most important fundamental skill in soft tennis. It allows you to control the racquet and hit the ball with power and accuracy. There are many different grips, but the most common are the forehand grip and the backhand grip.

Footwork: Footwork is essential for moving around the court and positioning yourself to hit the ball. There are many different footwork drills that you can practice to improve your footwork.

Racket control: Racket control is the ability to hit the ball with power and accuracy. It is important to practice hitting the ball in different directions and with different levels of power.

Timing: Timing is the ability to hit the ball at the right time. It is important to practice hitting the ball at the peak of its flight.

Stamina: Stamina is essential for soft tennis, as it is a physically demanding sport. You need to be able to run, jump, and hit the ball for long periods of time.

Here are some additional fundamental skills of soft tennis:

Ball control: The ability to control the direction and speed of the ball.

Serve: The ability to serve the ball accurately and with power.

Volley: The ability to hit the ball before it bounces.

Overhead smash: The ability to hit the ball forcefully and accurately overhand.

Drop shot: The ability to hit the ball softly and precisely so that it bounces low and close to the net.

Tennis

History of Tennis

The origins of tennis can be traced back to a 12th–13th-century French handball game called jeu de paume (“game of the palm”), from which was derived a complex indoor racket-and-ball game: real tennis.

The modern game of lawn tennis was invented in England in the 1870s by Major Walter Winfield.

Wing field created a set of rules and equipment for the game, and he called it "Sphairistike". The game quickly became popular, and it was renamed "lawn tennis" in 1874.

The first lawn tennis tournament was held in 1877 at the All England Club in Wimbledon, England.

Tennis became an Olympic sport in 1896.

Today, tennis is a popular sport played by millions of people around the world.

Fundamental Skills of Tennis Grip: The grip is the most important fundamental skill in tennis. It allows you to control the racket and hit the ball with power and accuracy. There are many different grips, but the most common are the forehand grip and the

	backhand grip.	
5	Footwork: Footwork is essential for moving around the court and positioning yourself to hit the ball. There are many different footwork drills that you can practice to improve your footwork. Racket control: Racket control is the ability to hit the ball with power and accuracy. It is important to practice hitting the ball in different directions and with different levels of power. Timing: Timing is the ability to hit the ball at the right time. It is important to practice hitting the ball at the peak of its flight. Stamina: Stamina is essential for tennis, as it is a physically demanding sport. You need to be able to run, jump, and hit the ball for long periods of time.	10
	Fencing **History of Fencing** The earliest evidence of fencing dates back to ancient Egypt, Greece, and Rome. Fencing was used as a form of training for warfare and as a way to settle disputes. The modern sport of fencing developed in Italy in the 15th century. The first fencing competition was held in 1550 in Paris. Fencing became an Olympic sport in 1896, and it has been a part of every Games since then. Fencing is now a popular sport all over the world, and there are three main disciplines: foil, épée, and sabre. **Fundamental Skills of Fencing** Footwork: Footwork is essential in fencing, as it allows you to move quickly and efficiently around the piste. There are many different footwork drills that you can practice to improve your footwork. Blade work: Blade work is the ability to use the sword effectively. There are many different blade work techniques, and you need to practice them in order to become proficient. Parrying: Parrying is the ability to deflect an opponent's attack. There are many different parrying techniques, and you need to practice them in order to become proficient. Riposte: The riposte is the counterattack that follows a parry. It is an important skill in fencing, as it allows you to score points. Mental Focus: Mental focus is also an important skill in fencing, as it allows you to stay focused on the opponent and to avoid making mistakes**5 Athletics** **History of Athletics** The history of athletics can be traced back to the ancient Olympic Games, which were held in Greece from 776 BC to 393 AD. The original events included running, jumping, throwing, and wrestling.	**10**

	The modern Olympic Games were revived in 1896, and athletics has been a part of every Game since then. Athletics is now a global sport, with competitions held at all levels, from local to international. **Fundamental Skills of Athletics** Running: Running is the most basic skill in athletics. It is the ability to move forward quickly and efficiently. There are many different types of running, including sprinting, distance running, and middle- distance running.	
	Jumping: Jumping is the ability to move upwards from the ground. There are many different types of jumping, including high jump, long jump, and triple jump. Throwing: Throwing is the ability to propel an object through the air. There are many different types of throwing, including shot put, discus throw, javelin throw, and hammer throw. Sprinting: Sprinting is a type of running that involves short bursts of speed. Sprinters need to be able to accelerate quickly and maintain their speed for a short period of time. Distance Running: Distance running is a type of running that involves running for long distances. Distance runners need to be able to pace themselves and maintain their energy levels for long periods of time. Middle-Distance Running: Middle-distance running is a type of running that involves running for distances between 800 meters and 1500 meters. Middle- distance runners need to be able to combine speed and endurance. High Jump: High jumping is a type of jumping that involves clearing a bar that is raised progressively higher. High jumpers need to be able to generate a lot of power in their legs and have good timing. Long Jump: Long jumping is a type of jumping that involves jumping as far as possible. Long jumpers need to have good speed and coordination. Triple Jump: Triple jumping is a type of jumping that involves jumping three times in a row. Triple jumpers need to have good speed, coordination, and power. Shot Put: Shot put is a type of throwing that involves throwing a heavy ball as far as possible. Shot putters need to have good upper body strength and technique. Discus Throw: Discus throw is a type of throwing that involves throwing a disc as far as possible. Discus throwers need to have good upper body strength and technique. Javelin Throw: Javelin throw is a type of throwing that involves throwing a spear as far as possible. Javelin throwers need to have good upper body strength and technique. Hammer Throw: Hammer throw is a type of throwing that involves throwing a heavy ball on a chain as far as possible. Hammer throwers need to have good upper body strength and technique.	**10**

	Kho-Kho **History of Kho-Kho**Kho-Kho is a tag game that originated in India. It is believed to have originated in the Indian subcontinent over 4,000 years ago. The game is mentioned in the Sangam literature of Tamil Nadu, which dates back to the 3rd century BC. Kho-Kho was first played as a competitive sport in the Indian Olympic Games in 1938. It was included as a demonstration sport at the 1982 Asian Games in Delhi, and it became a full medal sport in the 1990 Asian Games in Beijing. Kho-Kho is now played in over 100 countries around the world. **Fundamental Skills of Kho-Kho** Touch: Touching an opponent is the most important skill in Kho-Kho. It is how raiders score points for their team. There are many different ways to touch an opponent, such as touching their arm, leg, or torso. Dive: Diving is a fundamental skill for all Kho-Kho players. It allows players to avoid being touched by the opponents. There are many different types of dives, such as front dive, side dive, and back dive. Stamina: Stamina is essential for all Kho-Kho players, as the game is very physically demanding. Players need to be able to run, jump, and dive for long periods of time. Agility: Agility is also important for Kho-Kho players, as they need to be able to change direction quickly and avoid being touched by the opponents. Teamwork: Teamwork is essential for Kho-Kho, as it is a team sport. Players need to be able to work together to score points and defend their territory	**10**
	Cricket **History of Cricket** The history of cricket can be traced back to the 16th century in England. The game is believed to have originated from a game called "stoolball", which was played by children in the 15th century. The first recorded cricket match was played in 1611 between two teams of Kentish cricketers. Cricket became a popular sport in England during the 18th century, and it was first played in Australia in 1826. Cricket became an international sport in the 19th century, and the first Test match was played between England and Australia in 1877. Cricket is now played in over 100 countries around the world. **Fundamental Skills of Cricket** Batting: Batting is the act of hitting the ball with a bat. It is the most important skill in cricket, as it is how runs are scored. There are many different batting techniques, such as the defensive technique and the attacking	**10**

	technique. Bowling: Bowling is the act of delivering the ball to the batsman. There are many different bowling techniques, such as the fast bowling technique and the spin bowling technique. Fielding: Fielding is the act of catching the ball and preventing the batsman from scoring runs. It is an important skill for all cricketers, as it helps to prevent the other team from scoring runs. Running: Running is essential for scoring runs in cricket. Players need to be able to run quickly between the wickets to score runs. Stamina: Stamina is essential for all cricketers, as the game is very physically demanding. Players need to be able to run, jump, and field for long periods of time. Agility: Agility is also important for cricketers, as they need to be able to change direction quickly and avoid being run out. Teamwork: Teamwork is essential for cricket, as it is a team sport. Players need to be able to work together to score runs and prevent the other team from scoring runs.	
	Rifle Shooting **History of Rifle Shooting** The history of rifle shooting can be traced back to the 16th century in Europe. The first recorded rifle shooting competition was held in 1533 in Zurich, Switzerland. Rifle shooting became a popular sport in Europe during the 18th century, and it was first introduced to the United States in the 1770s. Rifle shooting became an Olympic sport in 1896, and it has been a part of every Games since then. Rifle shooting is now a popular sport all over the world. **Fundamental Skills of Rifle Shooting** Accuracy: Accuracy is the most important skill in rifle shooting. It is the ability to hit the target with the bullet. There are many different factors that affect accuracy, such as the stance, the grip, the breathing, and the trigger control. Consistency: Consistency is also important in rifle shooting. It is the ability to hit the target with the same accuracy shot after shot. There are many different factors that affect consistency, such as the mental focus and the physical preparation. Stance: The stance is the position of the body when shooting. It is important to have a stable stance in order to be accurate. There are many different stances that can be used, such as the standing stance, the kneeling stance, and the prone stance. Grip: The grip is the way that the rifle is held. It is important to have a firm grip in s order to be accurate. There are many different grips that can be used, such as the weaver grip and the isosceles grip. Breathing: Breathing is important in rifle shooting because it can affect the accuracy	**10**

	of the shot. It is important to breathe slowly and evenly before and after the shot. Trigger Control: Trigger control is the ability to pull the trigger smoothly and evenly. It is important to avoid jerking the trigger, as this can cause the shot to go off target.	

Semester-II

Course code: APS21BSL103 **Course name:** Linear Algebra and Differential Equations **Course category:** Basic Science
Credits: 4 **Teaching scheme:** L-4 hrs/week **Evaluation scheme:** CA–60, ESE–40
Duration of External Examination-2 Hrs
Pre-requisites: Pre-university mathematics.
Course Type: Basic Science Course
Course Objectives:
1. This course aims to make the students become familiar with the basic concepts of linear algebra with a thorough understanding of vector spaces, linear transformations and matrix operations enhancing the students' ability to reason mathematically and able to apply this knowledge to many fields in engineering, statistics and computer science.
2. To create and analyze mathematical models using differential equations
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand basic concepts such as vector spaces, linear dependence / independence of vectors, basis and linear maps.
CO2: Analyze and calculate eigen values, eigen vectors, rank nullity of a matrix / linear map.
CO3: Prove theorems; apply Gram-Schmidt process on inner product spaces, diagonalizable special matrices.
CO4: Solve ordinary differential equations analytically and numerically and apply these methods to solve engineering problems.
CO5: Find the solution of linear differential equations having their applications in mechanical and electrical systems.

Contents –

Unit	Content	Teaching hours
1	**Matrices and Vector Spaces** - Basic property of matrices, row operations and Gauss elimination, Inverse of a matrix. Basic concepts in linear algebra: vector spaces, subspaces, linear independence and dependence of vectors, bases, dimensions. Row and Column spaces, rank. Applications to systems of linear equations, Inverse transformation..	10
2	**Linear mappings and Diagonalization** Linear mappings, representation by matrices, rank-nullity theorem, Diagonaliazation, Eigen values, Eigen vectors and their basic properties, Cayley Hamilton Theorem.	10
3	**Inner Product Spaces and Quadratic** Inner Product Spaces , Orthogonality, Gram-Schmidt process, Geometric Applications of Linear Transformation, Quadratic Forms: Positive Definiteness and applications	10
4	**First order ordinary differential equations and Applications** Exact , Linear ,Bernoulli and separable differential equations, Applications to Population growth/decay, Mixing problems, Draining tank/Torricelli's Law problems, Newton's Law of Cooling, Electric circuits, Falling bodies	10
5	**Ordinary differential equations of higher orders and Applications** Linear differential equations with constant and variable coefficients, method of variation of parameters, Applications to mass spring systems and electrical circuits and	10

	Bending of beam and columns	

Text Books: 1. Introduction to Linear Algebra (2nd edition) by Serge Lang, Springer.
2. Elementary Linear Algebra (10th edition) by Howard Anton and Chris Rorres, John Wiley and sons.
3. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005
4. S. L. Ross, Differential Equations, 3rd Edition, Wiley India, 1984

Reference Books: 1. Shanti Narayan, Differential Calculus, S. Chand & Co
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New York.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.
4. P. N. Wartikar, J. N. Wartikar, Applied Mathematics (Vol I & II), Pune Vidyarthi Griha Prakashan, Pune.
5. Differential Equations with Applications and Historical notes by George Simmons, Tata McGraw Hill publishing company Ltd, New Delhi
6. K.D Joshi, Calculus for Scientists and Engineers, CRC Press
7. Prasad and Reena Garg, Advanced Engineering Mathematics, Khanna Publishing Company Private Limited, New Delhi
8. Schaum's outlines of Linear Algebra (5th edition) by Seymour Lipschutz, Marc Lipson, McGraw-Hill Education (India) Private Limited, New Delhi

Semester-II

Course code: APS21BSL104 **Course name:** Engineering Chemistry **Course category:** Basic Science
Credits: 3 **Teaching scheme:** L-3hrs/week **Evaluation scheme:** CA–60, ESE–40
Duration of External Examination-2 Hrs
Pre-requisites: Fundamentals of basic chemistry.
Course Type: - Basic Science Course
Course Objectives:
1. To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
2. To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
3. The objectives of the laboratory sessions are to enable the learners to get hands-on experience on the principles discussed in theory sessions and to recognize the applications of these concepts in engineering.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Illustrate the water quality parameters, water softening processes and causes of hard water in industries.
CO2: Analyze Demonstrate a comprehensive understanding of advanced concepts in polymer chemistry
CO3: Apply fundamental concepts of corrosion science to solve problems arising in engineering applications
CO4: Interpret physical, chemical properties and applications of fuels and lubricants.
CO5: Describe the functions of batteries and applications of modern instrumental techniques like conductometry, pH metry, TLC, gas chromatography, UV-Visible and IR spectroscopy.

Contents –

Unit	Content	Teaching hours
1	**Water Treatment** - Natural sources of water, Impurities in water, Water quality parameters and its BIS standards, Hardness- Definition, Types, Estimation of hardness by EDTA method, Numerical based on hardness calculation, Disadvantages of hard water, Boiler troubles (causes, effect on boiler operation and methods of prevention), Internal and external treatments, Alkalinity and its determination, Water softening: Ion exchange process, Sewage water analysis- Dissolved oxygen (DO) and its determination, Biological oxygen demand (BOD), Chemical oxygen demand (COD) and their significance, Sewage water treatment.	9
2	**Polymer Chemistry** Introduction, Classification of polymers, Use and disposal of polymers, Polymerization and its types, Plastics and its types- Thermoplastic and thermosetting plastics, Preparation, properties and engineering applications of: PVC, PMMA, Bakelite and Epoxy resin, Molding constituents of plastics, Methods for molding of plastics into articles, Conducting polymers and Biopolymers (Introduction, types, examples and its applications.	8

3	**Corrosion and its Control** Introduction, Types of corrosion, Mechanism of dry & wet corrosion, Factors influencing on corrosion – Nature of metal &Nature of environment. Methods of corrosion control, Catholic and anodic protection, Use of Inhibitors, Protective Coatings: a) Metallic coatings: Types of coatings methods of applications, (hot dipping, cladding and electroplating), b) Nonmetallic coatings: Chemical conversion coatings, Powder coatings.	8
4	**Fuels and Lubricants Fuels:** Introduction, Classification of fuel, Calorific value of a fuel, Characteristics of a good fuel, Solid fuel- Coal, Various types of Coal, Analysis of coal- Proximate and Ultimate analysis, Numerical based on analysis of coals, Liquid fuel- Refining of Petroleum, Gaseous fuels- LPG and CNG. **Lubricants**: Introduction, Mechanism of lubrication, Classification of lubricants, Solid, Semi-solid and Liquid Lubricants, Properties of lubricants, Physical properties – Viscosity & Viscosity index, Surface tension, Flash and Fire point, Cloud and pour point. Chemical properties – Acid value, Saponification value, Aniline point.	10
5	**Electrochemistry and Instrumental Methods of Chemical Analysis Electrochemistry**: Introduction - Basic concepts: Conductance, Specific Conductance, Equivalent conductance, Molecular conductance, Effect of dilution on conductance, Cell constant. Battery: Primary & secondary batteries, Ni-Cd cell, Lithium-air battery, Fuel cell- H2-O2 Cell. **Instrumental Methods of Chemical Analysis**: Basic principle, instrumentation and applications of pH metry, Conductometry, Thin layer chromatography, Gas Chromatography, Ultraviolet-Visible spectroscopy and Infra-Red Spectroscopy.	**10**

Text Books: 1. Jain P.C & Jain Monica, Engineering Chemistry, Dhanpat Rai & Sons, Delhi
2.O. G.Palanna , Engineering Chemistry, Tata McGraw-Hill Publication, New Delhi.
3. S. S. Dara, A textbook of Engineering Chemistry, McGraw-Hill Publication, New Delhi.
4. Shashi Chawla, Engineering Chemistry, Dhanpat Rai and Co Education and Technical Publishers.
5. Shikha Agrawal, Engineering Chemistry- Fundamentals and Applications, Cambridge Publishers
Reference Books: 1. Barrow G.M., Physical Chemistry, McGraw-Hill Publication, New Delhi
2. Atkins, Physical Chemistry, OUP Oxford
3. Bhal & Tuli, Text book of Physical Chemistry, S. Chand & Company, New Delhi..
4. V. R Gowarikar, Polymer Science, New Age International Ltd
5. B. K. Sharma, Instrumental Methods of Chemical Analysis, Krishna Prakashan Medi
E-Resources: Name of the website/ E-Journals/ Online Videos 1. NPTEL Basic Courses Engineering Chemistry (https://nptel.ac.in/courses/122/101/122101001/) 2. https://www.ncertbooks.guru/engineering-chemistry/ 3. Coursera Chemistry Courses (https://www.coursera.org/browse/physical-science-and-engineering/chemistry?languages=en&page=2)

4. "Introduction to Polymer Physics" NPTEL Course (https://www.youtube.com/playlist?list=PLwdnzlV3ogoXe67WsgE8f1fOIWcc5GKKS)
5. "Introduction to Corrosion" NPTEL Course (https://www.youtube.com/playlist?list=PL8lylDWRkaW8BXestE4baRnN0699S11Lq)
6. "Tribology & Lubrication" NPTEL Course (https://www.youtube.com/playlist?list=PLLwnvFq-JAltJvWAfEVU4gcUK27hEA7FD)
7. "Electrochemistry" NPTEL Course (https://www.youtube.com/playlist?list=PLVFqK_9GOGXnnriQpsn0z1Rss96Rh0vsm)
8. "Modern Instrumental Methods of Analysis" NPTEL Course (https://www.youtube.com/playlist?list=PL400CAFBA72E94CF8)

Semester-II

Course code: APS21ESL103 **Course name:** Engineering Mechanics **Course category:** ESC
Credits: 2 **Teaching scheme:** L-2 hrs/week **Evaluation scheme:** CA–60, ESE–40
Duration of External Examination-2 Hrs
Pre-requisites:
Coordinate Geometry, Trigonometry, Sine & Cosine Rule, Unit Conversions.
Fundamentals of Physics
Course Type:- Basic Science Course
Course Objectives:
1.This course aims to make the students become familiar with the basic concepts of linear algebra with a thorough understanding of vector spaces, linear transformations and matrix operations enhancing the students' ability to reason mathematically and able to apply this knowledge to many fields in engineering, statistics and computer science.
2. To create and analyze mathematical models using differential equations
Course Outcomes: At the end of the course, the students will be able to -
CO1: Identify the force system for given conditions by applying the basics of mechanics.
CO2: Determine the unknown forces of different engineering systems by applying equilibrium conditions.
CO3: Apply the principles of friction and to locate Center of Gravity and find Moment of Inertia of plane lamina
CO4: Establish the relations between kinematic parameters for different types of motion.
CO5: Formulate the relevant equations for types of motion in kinetics.

Contents –

Unit	Content	Teaching hours
1	**Force System** Introduction to Mechanics, Laws of mechanics, Newton's Laws, Law of Parallelogram, Law of transmissibility, Characteristics of force, System of Forces, Method of resolution and composition moment of a force, Law of Moments, Varignon's Theorem, Problems on moment, Resultant, Equivalent force& couple, properties of couple.	8
2	**Equilibrium** Introduction to Equilibrium and its types, Equilibrant, Concept of FBD, Analytical conditions of equilibrium, Equilibrium of different force system, Lami's Theorem, Types of loads, beams and supports..	7
3	**Friction, Centre of Gravity and Moment of Inertia** Friction: Introduction to friction, types and application, Laws of friction, Angle of friction, Angle of repose, Cone of friction, Problems on horizontal & inclined plane, block, and ladder. CG & MI: Centroid of regular and composite plane lamina, MI and its application, Perpendicular axis Theorem, Parallel Axis Theorem, Radius of Gyration, Problems on plane and composite lamina.	8

4	**Kinematics** Introduction and classification of dynamics motion and its classification, Rectilinear Motion Equation of Motion, Motion curves, Curvilinear Motion, rectangular and tangential components of acceleration, Projectile Motion: General Equation of Projectile Motion.	4
5	**Kinetics Applications** Basic concepts and laws of motion, D'Alemberts Principle, Problems on rectilinear motion Curvilinear motion, Work, Energy Principle, Work Done by force, Work Done by weight force, Work Done by frictional force, Work Done by spring force, Kinetic and Potential energy of the particle Problems on all cases of Work Done, Principle of Impulse and Momentum, Principle of Conservation Momentum, Impact and its types, Coefficient of restitution, Problems on impact Problems on impulse and momentum, Kinetics of rigid body problems	3

Text Books: 1 Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).

2 Vela Murali, "Engineering Mechanics", Oxford University Press (2010).

3. S. Timoshenko, D. H. Young, "Engineering Mechanics", McGraw Hill, 1995.

4. Tayal A. K., "Engineering Mechanics", Umesh Publications, 2010

5. Singer F. L., "Engineering Mechanics - Statics & Dynamics", Harper and Row Pub. York.

6. Khurmi R. S., "Engineering Mechanics", S. Chand Publications, N. Delhi.

Reference Books:

6. McLean, Nelson,"Engineering Mechanics",Schaum's outline Series,McGraw Hill Book Company, N. Delhi,Publication.
7. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11thEdition,Pearson Education (2010).
8. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, (1998).
9. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education (2006).
10. RajasekaranSandSankarasubramanianG.,"EngineeringMechanicsStaticsandDynamics",3rdEdition ,VikasPublishingHousePvt. Ltd., (2005).
11. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2",Third Edition, John Wiley & Sons,(1993).
12. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing Company, New Delhi (2008).

E-Resources :

- www.nptel.ac.in (Learning platform from IIT professors)
- http://www.asnu.com.au (For Engineering applications)
- www.discoveryforengineers.com (Investigating Discoveries)

Semester-II

Course code: APS21ESL104 **Course name:** Building Programming logic in C **Course category:** ESC
Credits: 1 **Teaching scheme:** L-1 hr/week **Evaluation scheme:** CA–30, ESE–20
Duration of Theory Exam: 1 Hr
Pre-requisites: Basic Knowledge of computers.
Course Objectives:
1. To introduce the basic concepts of programming and the C language, including algorithms, program structure, data types, variables, constants, and tokens.
2. To learn various operators, expressions, type casting, and input/output functions in C
3. To understand decision-making statements, loops, and jump statements for controlling program flow.
4. To learn arrays, strings, and functions, including user-defined and library functions, recursion, and variable scope.
5. To understand structures, unions, and enums for creating user-defined data types in C
Course Outcomes:
After the completion of this course, students will be able to:
CO1: Write a simple C program.
CO2: Apply operators, expressions, and I/O functions to develop simple C programs.
CO3: Design and implement programs using control structures and loops for decision-making and iteration
CO4: Write C programs using arrays, strings, and functions to solve problems efficiently.
CO5: Write C programs using structures, unions, and enums to organize and manage complex data efficiently.

Contents –

Unit	Contents	Teaching Hours
1	**Introduction To C Programming:** **Overview of C**: History of C, Algorithm and Structure of C program. Keywords, Tokens, Data types, Constants, Literals and Variables. **Operators and Expressions:** Arithmetic operators, Relational operators, Logical operators, Expressions. Operator precedence and associativity, Type casting **Console I/O Formatting:**Formatted I/O, Unformatted I/O functions: getch(), getchar(), getche(), getc(), putc(), putchar()	**3**
2	**Control Statements and Loops:** **Control statements:** if , if-else, Nested if–else, conditional operators, switch and break, nested conditional branching statements, **Looping Statements** : while, do while, for, Nested loops, **Jump Statements**: break and continue, goto and label, exit function.	**3**
3	**Array and String:** **Array:** Array declaration, One and Two dimensional numeric and character arrays, Multidimensional arrays, operations on array. **String:** String declaration, initialization, string manipulation with library function, Without library functions.	**3**

4	**Functions:** **Functions:** Definition, function components: Function arguments, return value, function prototype, function call statement, **Types of function:** Library Functions(math and character),User-defined Functions, Scope and lifetime of variable, Call by value and call by reference. Function using arrays, function with command line argument. **Recursive function.**	**3**
5	**Structure and Union:** **Structure:** Basics, declaring structure and structure variable, typedef statement, array of structure, array within structure, Nested structure; passing structure to function, function returning structure. **Union:** basics, declaring union and union variable, Difference between Structure and Union **Enum:** declaring enum and enum variable.	**3**

Text Books:

1. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill, Third Edition.
2. Let Us C, Yashwant Kanetkar, Infinity Science Press, Eighth Edition.
3. Mastering C, K. R. Venugopal, Tata McGraw-Hill.

Reference Books

- The C Programming Language, Brian W. Kernighan & Dennis M. Ritchie, Prentice Hall, 2nd Edition.
- Applications Programming in ANSI C, R. Johnsonbaugh & Martin Kalin, Macmillan, 2nd Edition.
- The Spirit of C, Mullish Cooper, Jaico Publishing House.
- How to Solve It by Computer, R. G. Dromey, Pearson Education

Semester-II

Course code: APS21PCL101 **Course name:** Basics of Electrical and Electronics Engineering **Course category:** PCC
Credits: 2 **Teaching scheme:** L-2 hrs/week **Evaluation scheme:** CA–60, ESE–40
Duration of External Examination-2 Hrs
Pre-requisites: Pre-university mathematics
Course Type:- **Professional Core Course**
Course Objectives:
1. To understand Electrical circuits and classify circuits asper laws.
2. To understand Magnetic circuits and apply them in transformer devices.
3. To understand the working principle of semiconductor devices.
4. To understand the basics and applications of digital electronics.
Course Outcomes: After completion of this course, students will be able to:
CO1: Solve simple DC and single-phase AC circuits using KCL, KVL and network theorems.
CO2: Explain fundamentals of magnetic circuit and transformers.
CO3: Explain the working of diodes and transistors.
CO4: Explain the importance of number systems and logic gates.

Contents –

Unit	Content	Teaching Hours
1	**Electrical Circuits** Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, inductor, mutual inductor and capacitor; Kirchhoff's laws, mesh and nodal analysis, superposition,Thevenin's, maximum power transfer theorems. Alternating voltages andcurrents, RMS, average, maximum values,Single Phase RL, RC, RLC series circuits,Power in AC circuits, Power Factor,Three phase balanced systems	**7**
2	**Magnetic Circuits & Transformer** Concepts of m.m.f, flux, flux density, reluctance, permeability and field strength, their units and relationship, right hand thumb rule and cork screw rule, Faraday's law of electromagnetic induction, Fleming's right-hand rule statically and dynamically induced EMF's self and mutual inductance coefficient of coupling, energy stored in magnetic circuit, Single phase transformers: Construction, principle of working, e.m.f equations.	**8**
3	**Semiconductor Devices** Introduction to Semiconductors, P-type and N-type Semiconductors, P- N Junction Diode: Construction and working, V-I characteristics of Diode, Reverse breakdown mechanism. Special purpose diodes: Zener Diode, Light Emitting Diode (LED) and PhotoDiode - Construction, working and applications. Bipolar Junction Transistor (BJT): types, construction and regions of operation.	**7**
4	**Digital Electronics:** Binary, Decimal, Octal, Hexadecimal, number systems and thei inter-conversion, Binary Addition, Binary Subtraction, One's complement, Two's complement, Logic Gates: Basic, Universal and Special. Boolean Laws (AND, OR, NOT) and Demerger's theorems, Realization of basic logic gates using universal gates.	**8**

Text Books: 1 V. N. Mittal and Arvind Mittal, "Basic Electrical Engineering" McGraw Hill
2. Edward Hughes, "Electrical Technology,", Pearson Education
3. Electrical Technology Vol.1 & Vol.4 by B. L. Theraja & A. K. Theraja, S. Chand Publications.
4. "Electronics Devices and Circuits", S Salivahanan, McGraw Hill Publications
5. "Modern Digital Electronics", R.P. Jain, McGraw Hill Publications
Reference Books: **1.** Vincent Del Toro, "Electrical engineering Fundamentals", PHI second edition 2011 1. Robert Boylestad, "Electronics Devices and Circuits Theory", Pearson Education India 2. "Electronics Devices and Circuits Theory", Robert Boylestad, Pearson Education India. **E-Resources:** a. Online course on NPTEL "Basic Electrical Engineering" b. NPTEL Course on "Introduction to Basic Electronics", Prof. T.S. Natarajan, IIT Madras. c. NPTEL Course on "Digital Electronic Circuits", Prof. Goutam Saha, IIT Kharagpur.

Semester-II

Course code: APS21IKL101 **Course name:** Indian Knowledge Systems **Course category:** IKS
Credits: 2 **Teaching scheme:** L-2 hrs/week **Evaluation scheme:** CA–60, ESE–40
Duration of External Examination-2 Hrs
Pre-requisites: NIL
Course Objectives:
The objective of this course is
1. To make students understand foundational concepts in IKS for science, engineering and technology.
2. To explore ancient Indian pursuits and accomplishments in the various domains of engineering
Course Outcomes: At the end of the course, the students will be able to -
CO1: Familiarise with key components of the IKS & develop appreciation for Indian philosophical systems
CO2: Understand key features of the Indian Numeral System, units of measurement and the framework for establishing the right knowledge.
CO3: Appreciate the unique & specific contributions of ancient Indian mathematicians in Arithmetic, Geometry & Trigonometry.
CO4: Develop awareness about engineering & technology heritage of India and understand ancient Indian contributions in various engineering domains.

Unit	Content	Teaching Hours
1	**Introduction to IKS:** Importance of ancient knowledge, defining IKS, Classification framework for IKS, Historicity of IKS, Indian philosophical systems, Vedic schools of philosophy(Sankhy and yoga, Nyaya and Vaisesika, Purva- Mimamsa and Vedanta), Non- Vedic philosophical systems (Jain, Bauddha and Carvaka) , Wisdom through the ages: Issues of interest in the Puranas, Itihasa as a source of wisdom (Uniqueness of the two epics), Nitisastras.	08
2	**Foundational Concepts for Science and Technology:** Number system in India, salient features of the Indian numeral system. Measurements for Time, Distance and weight. The knowledge triangle, Prameya- a Vaisesikan approach to Physical Reality, Pramana - The means of valid knowledge, Framework for establishing valid knowledge.	07
3	**Science in IKS:** Mathematics: Great mathematicians and their contributions. Arithmetic (square of a number, square root, series and progressions). Geometry (Property of right angled triangle in Sulba- sutras, value of tt). Trigonometry, Algebra, Binary Mathematics and combinatorial problems in Chandah- Sastra of Pingala.	08

4	**Engineering and Technology in IKS:** The Indian Science and Technology Heritage, Mining and ore extraction. Metals and metal working technology. Iron and Steel in India, Lost wax casting of idols and artefacts, apparatuses used for extraction of metallic components. Literary sources for Science and Technology, Physical Structures in India, Irrigation & Water Management, Dyes and Painting Technology, Shipbuilding.	08

Text Books:

1. Mahadevan B.,Bhat Vinayak Rajat & Nagendra Pavana R.N. "Introduction to Indian Knowledge System Concepts and Applications"PHI,2023.
2. Jha Amit "Traditional Knowledge System in India" Atlantic Publishers and Distributors (P) Ltd,2023
3. Chauhan Bhag Chand "IKS: The Knowledge system of Bharata" Garuda Prakashan,2023
4. Bag A.K., "Mathematics in Ancient and Medieval India" Chaukhambha Orientalia, 1979
5. Sengupta Nirmal,"Traditional Knowledge in Modern India"Springer,2019

Reference Books:

1. Bag A.K., "History of Technology in India,Vol.I" Indian National Science Academy,1997
2. Kumar Alok, "Ancient Hindu Science" Jaico Publishing House,2019
3. Datta B and Singh A.N."History of Hindu Mathematics:Parts I and II" Asia Publishing House,1962
4. Kapoor Kapil, Singh Awdhesh Kumar "Indian Knowledge Systems Vol.-I & II" D.K. Print World Ltd,2005

E-Resources:

https://www.youtube.com/watch?v=-cBd6JYPWtY&list=PLRfu94TCePTtWtu0xl45H_63Wgoe¥ickE
https://www.youtube.com/watch?v=yvj5ROYbP2E&list=PLRfu94TCePTtLuEYSzmJXNYK EnDSvY3N
https://iksindia.org/book-list.php

Semester-II

Course code: APS21VSP102	**Course name:** Workshop Practices **Course category:** VSEC
Credits: 2	**Teaching scheme:** P-4 hrs/week Evaluation **scheme:** TW–60, PR–40
Pre-requisites: Pre-university English.	
Course Type: Vocational Skill Enhancement Course.	
Course Objectives:	
1. To know about the different carpentry tools and perform various carpentry operations to complete the job	
2. To understand different welding tools, joints, defects and perform welding operation to complete useful article/job.	
3. To learn various types of pipes, plumbing tools, operations and perform thread cutting on GI pipes.	
4. To know different sheet metal tools, operations, applications and perform various operations to complete job.	
Course Outcomes: On completion of the course, the student should be able to:	
CO1: Perform basic carpentry operation on wood and prepare carpentry article.	
CO2: Perform welding processes and prepare welding article by performing various welding operations.	
CO3: Use plumbing tools, processes and perform threading on GI pipe.	
CO4: Use sheet metal tools, processes and prepare sheet metal article .	

Contents –

Unit	Contents
1	**Carpentry Shop** Carpentry shop: Types of woods, tools, joints, operations, applications, safety measures etc. Job: Exercises on wood involving operations marking, sawing, chiselling, planning, grooving etc to make useful wooden article/ job e.g. Wooden Trophies, Showpiece articles, Stools etc
2	**Welding Shop** Welding Shop: Types of welding, welding joints, tools, welding defects, applications, safety measures etc. Job: Exercise in Arc welding to make useful articles like Grills, Stools, Tree Guards, Flower pot stand, Shoe rack, Bag Stand, Showpiece Articles from Scrap etc.
3	**Plumbing Shop** Plumbing shop: Study of types of pipe, pipe joints, operations, applications, safety measures etc. Job: Prepare threading on GI pipe to make useful items like Nipple, Pipe joints etc.
4	**Sheet Metal Shop:** Sheet Metal Shop: Sheet metal tools, operations, applications, safety measures etc. Job: Making an utility item using G I sheet involving development, marking, cutting , bending, spot welding/riveting Parts like i) Tray, ii) Funnel etc..

Text Books: 1 Hazra and Chaudhary, Workshop Technology-I, Media promoters & Publisher private limited.

2. Hazra and Chaudhary, Workshop Technology-II, Media promoters & Publisher private limited.

Reference Books: 1.K. C. John, Mechanical Workshop Practice, Prentice Hall Publication, New Delhi, 2010.

Semester-II

Course code: APS21BSP102 **Course name:** Engineering Chemistry Lab **Course category:** Basic Science
Credits: 1 **Teaching scheme:** P-2 hrs/week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Pre-university English.
Course Type: Vocational Skill Enhancement Course.
Lab Objectives:
1. To know about the different carpentry tools and perform various carpentry operations to complete the job
2. To understand different welding tools, joints, defects and perform welding operation to complete useful article/job.
3. To learn various types of pipes, plumbing tools, operations and perform thread cutting on GI pipes.
4. To know different sheet metal tools, operations, applications and perform various operations to complete job.
Lab Outcomes: Upon completion of the Lab Experiments, the students should able to,
LO1: Perform the experiments as well as accurately record the readings and analyze the results of such experiments
LO2: Estimate the impurities present in water using titrimetric and instrumental methods**.**
LO3: Employ the basic techniques used in chemistry laboratory for analysis such as volumetric titrations, complexometric titrations, Conductometry, pH metry, viscometer, Stalagmometer and TLC.

Unit	Content
1	Determination of hardness of water sample by EDTA method.
2	Determination of chloride content in water sample by precipitation titration method
3	Determination of dissolved oxygen in water by Iodometric method
4	Determination of percentage purity of bleaching powder
5	Determination of strength of acid / base using pH metric titration
6	Determination of strength of acid / base using conductometric titration.
7	To determine the cell constant of the given conductivity cell.
8	To determine relative surface tension of unknown liquids by using stalagmometer.
9	To determine the viscosity of unknown liquids by using Ostwald / Redwood viscometer.
10	To determine acidity of given water sample.
11	Determination of acid value of an oil sample.
12	Determination of saponification number of an oil sample
13	To determine alkalinity of given water sample.

14	Preparation of phenol- formaldehyde / urea-formaldehyde resin.
15	To find out the Rf value of given sample by thin layer chromatography.
16	To separate the given mixture using thin layer chromatography.
17	Proximate analysis of coal (moisture content, volatile matter, ash content).
18	To study factors influencing on rate of electrochemical corrosion.
19	To determine flash and fire point of given oil by Pensky-Marten flash point apparatus.
20	To determine cloud and pour point of lubricating oil.

Reference Books:

1. A Text book on Experiments and Calculations in Engineering Chemistry by Dr. S. S. Dara, S Chand Publication**.**
2. Laboratory manual on Engineering Chemistry by S. K. Bhasin & Sudha Rani, Dhanpat Rai Publishing Company.
3. Engineering Chemistry with Laboratory Experiments by M. S. Kaurav, Asia-Pacific the holdings Private Ltd.

Semester-II

Course code: APS21ESP104 **Course name:** Engineering Mechanics Lab **Course category:** ESC
Credits: 1 **Teaching scheme:** P-2hrs/week **Evaluation scheme:** TW–30, PR–20
Lab Outcomes:
LO1: Describe the working principle of mechanics and correlate them with day to day engineering applications
LO2: Formulate and solve mechanics problems based on law of moments, conditions of equilibrium.
LO3: Verify theoretical concepts through analytical, experimental and graphical methods.

List of Experiments –

Unit	Content
1	Verification of law of the Machine using Screw jack.
2	Polygon law of coplanar forces.
3	Bell crank lever.
4	Lami's theorem.
5	Support reactions for beam.
6	Problems on beam reaction by graphics statics method.
7	Inclined plane (to determine coefficient of friction).
8	Centroid of irregular shaped bodies.
9	Determine center of gravity for composite sections.
10	Determine moment of inertia for composite sections.
11	Moment of Inertia of fly wheel.
12	Simple / compound pendulum.

Semester-II

Course code: APS21ESP105 **Course name:** Building Programming logic in C Lab **Course category:** ESC
Credits: 1 **Teaching scheme:** P-2 Hrs/week **Evaluation scheme:** TW–30, PR–20
Lab Objectives:
1.To introduce the basic concepts of programming and the C language, including algorithms, program structure, data types, variables, constants, and tokens.
2.To learn various operators, expressions, type casting, and input/output functions in C.
3.To understand decision-making statements, loops, and jump statements for controlling program flow.
4.To learn arrays, strings, and functions, including user-defined and library functions, recursion, and variable scope.
5.To understand structures, unions, and enums for creating user-defined data types in C
Lab Outcomes: After the completion of this course, students will be able to:
LO1: Write a simple C program.
LO2: Apply operators, expressions, and I/O functions to develop simple C programs.
LO3: Design and implement programs using control structures and loops for decision-making and iteration.
LO4: Write C programs using arrays, strings, and functions to solve problems efficiently
LO5: Write C programs using structures, unions, and enums to organize and manage complex data efficiently

List of Practicals

Unit	List of Practicals	Teaching hours
1	1. Write a C program to find sum and average of three numbers. 2. Write a C program to find the sum of individual digits of a given positive integer.	02
2	1. Write a C program to check whether the given number is perfect or not. 2. Write a C program to check whether the given number is strong or not.	02
3	1. Write a C program to generate the first n terms of the Fibonacci sequence. 2. Write a C program to generate prime numbers between 1 to n.	02
4	1. Write a C program to find the roots of a quadratic equation. 2. Write a C program to perform arithmetic operations using switch statement.	02
5	1. Write a C program to find the largest and smallest number in a list of integers. 2. Write a C program to sort the array in ascending order.	02
6	1. Write a C program to find whether the given matrix is symmetric or not. 2. Write a C program to perform addition of two matrices.	02
7	● Write a C program that displays the position or index in the main string S where the sub-string T begins, or -1 if S doesn't contain T. ● Write a C program to count the number of lines, words, and characters in a given text.	02

8	1. Write a C program to swap the values of two variables using: i) call by value ii) call by reference 2. Write a C program using user-defined functions to determine whether the given string is palindrome or not. 3. Write a C program using function to perform multiplication of two matrices.	02
9	● Write a C program to use function to insert a sub-string into a given main string from a given position. ● Write a C program to find factorial of a given integer using recursive function. ● Write C program to find GCD of two integers by using recursive function	02
10	1. Write a C program to calculate total and percentage marks of a student using structure.	02

References:

- "College of Engineering, Pune"
- "University of Mumbai"

Semester-II

Course code: APS21PCP101 **Course name:** Basics of Electrical and Electronics Engineering Lab **Course category:** PCC	
Credits: 1 **Teaching scheme:** P-2 hrs/week **Evaluation scheme**TW–30, PR–20	
Lab Objectives	
1. Understand the DC circuit as per KCL & KVL and AC circuits as per theorems.	
2. Understand the working of a single-phase transformer.	
3. Understand the working of electronic instruments, components and logic gates .	
4. Understand the working of a PN junction diode.	
Course Outcomes: After completion of this lab, students will be able to:	
CO1: Use of KCL & KVL to solve DC circuits as well as use of AC theorems to solveAC circuits	
CO2: Demonstrate a single-phase transformer & it's working.	
CO3: Use electronic instruments, working of electronic components and logics gates	
Contents –	
Unit	**Content**
1	Verification of Loop Analysis and Nodal Analysis for DC Circuits
2	Verification of Thevenin's Theorem for DC Circuits
3	Verification of Maximum Power Transfer Theorem for DC Circuits.
4	Determination of Voltage, Current and Power Flow in Single Phase AC Circuit including R, L and C with Combination
5	Determination of Magnetic Material Terms and EMF Induction.
6	Demonstration and Determination of Single-Phase Transformer Terms likeVoltage Ratio and Turns Ratio.
7	Study of Electronic Instruments
8	Study of Electronic Components.
9	Study of Logic Gates.
10	Study of V-I characteristics of a PN Junction Diode using V-Lab.
11	Study of Rectifier Circuits using Every Circuit simulation application.
12	Study of working and troubleshooting of Smartphone, Computer & TV (CaseStudy Approach).

Semester-II

Course code: MGM82CCP104 **Course name:** National Service Scheme **(NSS) Course category:** CCA		
Credits: 2 **Teaching scheme:** P-4 hrs/week **Evaluation scheme:** TW–30, PR–20		
Pre-requisites: Pre-university English.		
Course Type:- CCA		
Course Objectives:		
Contents –		
Unit	**Content**	**Teaching hours**
1	**Introduction to National Service Scheme (NSS)** Emergence of NSS in India (Historical Background) and its development. Organizational Structure of National Service Scheme from National Level to College Level.Objectives of National Service Scheme (NSS) National Service Scheme (NSS) – Symbol and its meaning Symbol of NSS and its meaning Motto of National Service Scheme (NSS) Various prayers, inspirational songs to be used in NSS Programme.	8
2	**National Service Scheme (NSS) Regular Activities** Guidelines of Distribution of working hours or academic year. Classification of Regular Activities in the Society 1. Rural 2. Urban 3. Campus Need base with association Associations in NSS Activities 4. Govt. Organization 5. NGO Scope for Innovation (Self-Generated)	8
3	**Social Issues in India** **Concept of Society, Community (Steps involved in evaluation of society)** ● Features of Indian Society ● Communities in India **Basic Social Issues in India** Family System, Division of labor, Cast System in India, Gender Issues, Regional Imbalance.	7

4	**Indian Constitution and Social Justice** **Indian Constitution** 1. Preamble 2. Structure 3. Features 4. Fundamental Rights & Duties **Social Justice** 5. Social Justice – the Concept and its features Contribution for Social Justice – Mahatma Jyotiba Phule, Dr. Babasaheb Ambedkar,Shahu Maharaj.	7

References:

3. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
4. University of Mumbai National Service Scheme Manual 2009.
5. Avhan Chancellor's Brigade-NSS Wing, Training camp on Disaster Preparedness Guidelines, March 2012.
6. Rashtriya Seva YojanaSankalpana- Prof. Dr. SankayChakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
7. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya,
8. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
9. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.

Semester-II

Course code: MGM73CCP204 **Course name:** Fine Art **Course category:** CCA		
Credits: 2	**Teaching scheme:** P-4 hrs/week	**Evaluation scheme:** CA–30, ESE–20
Prerequisites: Nil		
Course Objectives:		
1. Students will be able to draw clean lines. 2. Students will be able to explore shading from light to dark. 3. Students will be able to draw perspective drawing. 4. Students will be able to sketch landscape and portrait drawing.		
Course Outcomes: After completion of this course, students will be able to:		
CO1: Pay attention to core details in visualization. CO2: Represent on paper what they have observed in terms of 3 and 2 dimensional objects and light and dark play of perspective. CO3: Draw clean lines and neat figures which will gradually help the in fashion illustrations.		

List of Practicals:

Sr. No.	Contents	**Lab Hours**
1	Explore pencil as medium for drawing and exploration of different types of grades of pencils. Lines - Freeing hand movement by practicing various ways to draw lines (wavy/zigzag/diagonal/vertical/horizontal)	**8**
2	**3D objects with Shading:** • Exploring and sketching 3D objects with Shading/Hatching - Light to Dark (HB/2B/3B/4B/5B/6B) • Space Division - Studying proportion. Perspectives- Coin / Box / Landscape.	**7**
3	**Sill Drawing:** • Introduction to landscape and portrait drawing. • Still drawing (perspective drawing of man- made object)	**7**
4	**Exploration of color mediums:** • Exploration of color mediums (chalk/ink/poster/pastels/water) • Landscape perspective of natural and man- made, charcoal rendering. • Still drawing of man- made and natural object by rendering and defining perspective. Ambedkar, Shahu Maharaj.	**8**

Reference Books:

1. Mellem, Jeff; Sketching people & Live drawing basics.
2. Belleville- Van Stone, France; Sketch: The Non-Artist's guide to inspiration technique drawing life

Semester-II

Course code: MGM73CCP204 **Course name:** Visual Art **Course category:** CCA		
Credits: 2	**Teaching scheme:** P-4 hrs/week	**Evaluation scheme:** CA–30, ESE–20
Course Type:- **Professional Core Course**		
Course Objectives:		
1.To understand the actual work process in the advertising market. 2. To understand the growth and necessity of advertising in the market.		
Course Outcomes: After completion of this course, students will be able to:		
CO1 :Able to choose a topic for campaign design. CO2: Understand that how campaign design is necessary CO3: Understand the actual work process in advertising market. CO4: Understand the process of designing.		

List of Practicals:

Sr. No	Name of Practical	Lab Hours
1	**Topic for campaign design** • It should be either product, service or social topic. • Mind mapping	8
2	**Different types of media** • New digital medias • Use of elective subject in campaign • Software use in designing	11
3	**Sill Drawing** Final layout • Printing in actual size media • Presentation on ppt of the topic includes artwork with rough work	11

Suggested Tutorial / Practical:

Assignment I: Students will be required to submit a mind map.

Assignment II: Students will be required to submit a list of media selection.

Assignment III: Students will be required to submit different medias in digital form

Assignment IV: Students will be required to submit different medias in print form. Teaching Methods and learning activities-

- Lecture with power point projections
- Demonstration with practical
- Documentaries and Presentation
- Use of different medium and art form to make a new concept of work

Assessment Strategics

Classroom lecture

Power point presentations

Group discussion
digital form

Reference Books:

- Advertising Campaign Design Just the Essentials - By Robyn Blakeman
- Campaign Strategies and Message Design: A Practitioner's Guide from Start to Finish - by Mary Moffitt (Author)
- Student should refer the previous knowledge about medias and refer the internet for help.

Semester –III

Course Code: ITY23PCL201 **Course Name:** Discrete Structures and Applications **Course Category:** PCC
Credits:2 Teaching Scheme: L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Basic Mathematics
Course Objectives: This course will enable students to
This course will enable students to 1. Use standard notations to Write English sentences for logical expressions and vice-versa.
2. develop a foundation of set theory concepts, notation and applications.
3. Understand logic, basic counting principles, function and relation.
Course Outcomes: At the end of the course, the students will be able to -
CO1 Verify the correctness of an argument using symbolic logic and truth tables.
CO2 Construct mathematical arguments using logical connectives and quantifiers.
CO3 Construct proofs using mathematical induction And Solve problems involving recurrence relations and generating functions
CO4 Perform operations on discrete structures such as sets, functions, relation.

Contents–

Unit	Content	Teaching Hours
1	**Mathematical Thinking Variables -** Logical Form and Logical Equivalence, Conditional Statements, Valid and Invalid Arguments, Application: Digital Logic Circuits	6
2	**Logic of Quantified Statements -**Predicates and Quantified Statements, Statements with Multiple Quantifiers, Arguments with Quantified Statements.	6
3	**Sequences, Mathematical Induction-** Sequences, Mathematical Induction I, Mathematical Induction II, Strong Mathematical Induction and the Well-Ordering Principle for the Integers, Application: Correctness of Algorithms: Assertions, Loop Variants.	6
4	**Set Theory & Function -** Set Theory, Definitions and the Element Method of Proof, Properties of Sets, Disproofs: Disproving an Alleged Set Property. Functions: Functions Defined on General Sets, One-to-One and Onto, Inverse Functions, Composition of Functions.	6

5	**Relations-** Relations on Sets, Reflexivity, Symmetry, and Transitivity, Equivalence Relations: The Relation Induced by a Partition, Definition of an Equivalence Relation. Modular Arithmetic with Applications to Cryptography: Properties of Congruence Modulo n, Modular Arithmetic. Partial Order Relations: Antisymmetry, Partial Order Relations, Lexicographic Order, Hasse Diagrams, Partially and Totally Order Sets.	**6**

Text Books:

1. Susanna S. Epp, “Discrete Mathematics with Applications” 4th Edition, 2010.
2. K. H. Rosen, “Discrete Mathematics and Its Applications”, Tata McGraw Hill Publication, 7 th Edition, 2012.
3. B. Kolman, R. Busby, S. Ross, “Discrete Mathematical Structures”, Pearson Education, 6th Edition, 2009.
4. R. K. Bisht, H. S. Dhami, “Discrete Mathematics”, Oxford University Press, 2015.

Reference Books:

1. Kenneth H Rosen, “Discrete Mathematics and its Applications”.7th Edition, 2011
2. C L Liu, “Elements of Discrete Mathematics” 4th Edition, July 2017.
3. Norman L Biggs, “Discrete Mathematics”, 2nd Edition, December 2002
4. Kenneth Bogart and Robert L Drysdale, “Discrete Mathematics for Computer Science”, 1st Edition, Sept.2005
5. R Krishna Kumar, “Discrete Mathematics”,1st Edition, 2005.

Online Resources:

1.NPTEL course on Discrete Mathematics.

Semester –III

Course Code: ITY23PCL202 **Course Name:** Data Structures **Course Category:** PCC
Credits:2 Teaching Scheme: L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Fundamentals of programming logic
Course Objectives: This course will enable students to
1.Build foundation in computer programming
2.Develop programming skills
3.Apply programming constructs to implement different data structures.
Course Outcomes: At the end of the course, the students will be able to -
CO1 Apply knowledge of basic programming constructs to design algorithms and programs.
CO2. Demonstrate functioning of linear data structures (stack, queue and linked list) and apply them in required applications.
CO3. Write neat code by selecting appropriate data structure and demonstrate a working solution for a given problem.
CO4 Analyze performance of algorithms by determining time and space complexity.
CO5. Distinguish between linear and non-linear data structures and determine their applicability.
CO6. Analyze possible solutions for solving a given problem and select the most efficient one. (for eg, Sorting and Searching)

Contents–

Unit	Content	Teaching Hours
1	**Introduction to Data Structures** Data, Data Structure, operations on data structures, Types of data structures: linear and non-linear Algorithm, characteristics of an algorithm, Pseudo-Code. Performance measurement of an algorithm, time and space complexity. Asymptotic notations. Iterative and Recursive algorithms.	7
2	**Linear Data Structures: Stack and Queue** Stack, Operations on a stack, Mathematical expressions: Infix, Prefix and Postfix, Conversion of expression from one form to other. Applications of a stack: Evaluation of	7

	postfix expression.Queue, Operations on a queue, Circular queue, Double ended queue Priority queue, Application of queue.	
3	**Linear Data Structures: Linked List** Static and dynamic memory allocation, Linked list, Types of linked-list: Singly, doubly and circular. Operations on linked list: Create, Insert, Search, Delete etc. Stack and queue implementation using linked list. Application of linked list: Addition of polynomials.	**8**
4	**Non-Linear Data Structures** **Trees:**Binary tree, Binary search tree, Binary tree representation, Operations on binary search trees. Tree traversals, Balanced search tree: AVL **Graphs:** Graphs, Graph representation, Graph Traversals, Minimum spanning tree, Minimum spanning tree algorithms: Kruskal, Prim's	**8**

Text Books:

1. E. Horowitz, D. Mehta, S. Sahni, "Fundamentals of Data Structures in C++", Silicon Press, 2nd Edition, 2008.
2. Goodrich, Tamassia, "Data Structures and Algorithms in Java", Wiley publication, 6th Edition, 2014.
3. Seymour Lipschutz, "Data Structures", Schaum's Outlines,McGraw Hill Education,1 February 2014.
4. E. Balagurusamy. "C Programming and Data Structures ",PublisherTata McGraw - Hill Education, Edition: 4th, 2008

Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, "Introduction to Algorithms", MIT Press, 3rd Edition, 2009.
2. Y. Langsam, M. J. Augenstein and A. M. Tanenbaum, "Data structures using Java", Pearson Education, 2003.
3. Thomas Cormen, Introduction to Algorithms, PHI Publication, 2nd Edition,2002.

Semester –III

Course Code: ITY23PCL203 **Course Name:** Object Oriented Programming **Course Category: PCC**
Credits: 2 **Teaching Scheme:** L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Logic Building ability
Course Objectives: This course will enable students to
1.To understand Object oriented concepts like data abstraction, encapsulation, etc.
2.To solve real world scenarios using a top down approach.
3.To understand various c++ programming constructs.
Course Outcomes: At the end of the course, the students will be able to -
CO1. Explain Object-Oriented Programming Paradigm
CO2. Understand the storage concepts in a simple program
CO3. Develop programs using basic concepts of object oriented languages i.e. objects, encapsulation, data hiding etc.
CO4. Construct programs using advanced concepts of object oriented languages i.e. associations, packages, interfaces, exception handling etc.
CO5. Apply knowledge behind exception handling in c++

Contents–

Unit	Content	Teaching Hours
1	**Fundamentals of Object Oriented Programming-** Object-Oriented Programming Paradigm: Benefits, Applications, Object-Oriented Systems Development,Object-Oriented Design: Class design and algorithm. Tokens, Data types, Operators, Expressions, and Control structures, Array,Functions, Structures and Unions, Class and Objects, specifying a class, Defining member functions,Private member functions, Static data and member functions, Arrays of objects, Friend functions.	6

2	**Constructors and Destructors -** Constructor, Parameterized constructors, Multiple constructors in a class,Copy constructors, Dynamic constructors, Destructor. Programming for class diagrams and relationships.	**6**
3	**Inheritance -** Single inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes.	**6**
4	**Polymorphism and Exception handling -** Operator overloading, Function overloading, Virtual functions, pure virtual functions, Types of exceptions, Catching 10 exceptions, Multiple catching, Nested try statements, Uncaught exceptions, Throw and throws, Built-in exceptions, Creating exception subclasses, Using exceptions.	**6**
5	**Files and Streams** - Working with Files: Classes for file stream operations and I/O stream operation, Opening and closing a file, Detecting end-of-file, More about Open(): File Modes, Sequential input and output operations.	**6**

Text Books:

1. Robert Lafore, "Object Oriented Programming in C++", Pearson Education, 4th Edition, 2008.
2. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill Publication,6th Edition, 2013

Reference Books:

1. J. R. Hubbard, "Programming with C++: Schaum's Outlines", Tata McGraw-Hill publication,2005.
2. P. J. Deitel, H.M.Deitel, "C++ How to Program", Pearson Education, 9th Edition, 2016.

Semester –III

Course Code: ITY23PCL204 **Course Name:** Network Communications and Computing **Course Category: PCC**
Credits: 2 **Teaching Scheme:** L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Computer Basics
Course Objectives: This course will enable students
1. To Understand the working of layers in OSI model
2. To Understand internet protocol.
3. To Understand IPV4 addresses.
Course Outcomes: At the end of the course, the students will be able to -
CO1. Compare intermediate devices such as hub,switch,router.
CO2. Compare OSI and TCP/IP models.
CO3. Compare network types.

Contents–

Unit	Content	Teaching Hours
1	**OSI Model and the TCP/IP Protocol Suite -** Introduction: Data Communications, Networks, Network Types, Network Models, Internet Standards and Administrations, Network Models: Protocol layering, TCP/ IP Protocol Suite, OSI Model**,** Layers in the TCP/IP Protocol Suite, Addressing: Physical Addresses, Logical Addresses, Port Addresses, Application-Specific Addresses, Wired Local Area Networks, Addressing, Ethernet Evolution	6
2	**Physical and Data Link Layer -** Transmission media (cables, wireless,Signal representation (digital/analog)Network interfaces (NICs),Standards and protocols (e.g., Ethernet, Wi-Fi) Error detection and correction (CRC, checksum),Media access control (MAC addressing),Flow control and error handling,,Protocols (e.g., Ethernet II, PPP), , Multiple Access Protocols, Wi MAX, Cellular Telephony	6
3	**Network Layer-** Network layer design issues, Network Layer Services, Packet Switching, Network Layer Performance, IPv4 addresses, Address space, classful and classless addressing, Internet protocol, ICMPv4, Routing Algorithms: Distance Vector Routing, Link	6

	State Routing, Path Vector Routing, Routing in Internet: RIP, OSPF, BGP, Congestion control and QoS.SMTP, MIME, POP3, Webmail, FTP, TELNET.	
4	**Transport and Session Layer -** Transport Layer: Services, Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, TCP features, connection, Congestion Control, Real Time Transport protocol (RTP), UDP for wireless, Stream Control Transmission Protocol (SCTP), Differentiated services,Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP) Session Layer: Session establishment and termination, Dialog control (synchronization),Security services (e.g., authentication) Presentation Layer:Data encryption and decryption	**6**
5	**Application and Presentation Layer -** Presentation Layer:Data encryption and decryption , ,Network services (e.g., email, file transfer, web browsing),Application protocols (e.g., HTTP, FTP, SMTP, SNMP, DNS).	**6**

Text Books:

1. Fourauzan B., "Data Communications and Networking", 5thEdition, Tata McGraw-Hill, Publications, ISBN: 0 –07 –058408 ,2006

2. Andrew S. Tenenbaum,"Computer Networks"Ⅱ,PHI, ISBN 81-203-2175-8 2006

3. Kurose, Rose, "Internet Protocol", Pearson, ISBN-10: 0132856204, 2020

4.William Stalling,"Data and Computer Communication" ,Pearson, 8th edition, ISBN: 0-13-243310-9 , 2007

Reference Books:

1. 1. Kurose, Ross "Computer Networking a Top Down Approach Featuring the Internet",6th edition (March 5, 2012), 2.Pearson , ISBN-10: 0132856204. 2. Andrew S. Tenenbaum, "Computer Networks", 5th Edition, PHI, ISBN 81-23- 2175-8.

Semester –III

Course Code: ITY23PCP202 **Course Name: D**ata Structure LAB **Course Category: PCC**
Credits: 1 **Teaching Scheme:** P- 2 Hrs/Week **Evaluation Scheme:** TW: 30, PR: 20
Pre-requisites: Fundamentals of programming logic
Lab Objectives: This course will enable students to
1. Build foundation in computer programming
2. Develop programming skills
3. Apply programming constructs to implement different data structures.
Lab Outcomes: At the end of the course, the students will be able to -
LO1. Apply knowledge of basic programming constructs to design algorithms and programs.
LO2. Demonstrate functioning of linear data structures (stack, queue and linked list) and apply them in required applications.
LO3. Write neat code by selecting appropriate data structure and demonstrate a working solution for a given problem.
LO4. Analyze performance of algorithms by determining time and space complexity.
LO5. Distinguish between linear and non-linear data structures and determine their applicability.
LO6. Analyze possible solutions for solving a given problem and select the most efficient one. (for eg, Sorting and Searching)

List of Experiments:

1. Implementation of Arrays a. Write a program to accept N elements in an array and find the sum of it. b. Write a program to accept N elements in an array and find even/odd numbers from it. c. Write a program to find the given element present in the array or not. d. Write a program to accept N elements in two arrays and store sum of them in the third array. e. Write a program for multiplication of two matrices
2. Implementation of Stack a. Perform operations on stack using array b. Evaluation of postfix expression using stack c. Reverse a string using array
3. Implementation of Simple Queue a. Perform operations using array

4. Implementation of Circular Queue
5. Implementation of Singly Linked List a. Create a singly linked list and perform insert delete operations on it for all conditions b. Reverse a singly linked list c. Implementation of stack using singly linked list
6. Implementation of Singly Linked List a. Create a singly linked list and perform insert delete operations on it for all conditions b. Reverse a singly linked list c. Implementation of stack using singly linked list d. Implementation of queue using singly linked list
7. Implementation of Doubly Linked List a. Create a doubly linked list and perform insert delete operations on it for all conditions b. Reverse a singly linked list c. Implementation of stack using singly linked list d. Implementation of queue using singly linked list
8. Implementation of Circular Singly Linked List
9. Implementation of Circular Doubly Linked List
10. Implementation of Binary Search Tree and Traversing using linked list

Semester –III

Course Code:ITY23PCP203 **Course Name:** Object Oriented Programming Lab **Course Category: PCC**
Credits: 1 **Teaching Scheme:** P-2 Hrs/week **Evaluation Scheme:** TW- 30, PR- 20
Pre-requisites: Basic understanding of C programming language
Lab Objectives: This course will enable students to
1. To understand the concept of inheritance in C++ and its various forms.
1. To explore advanced features of C++ such as inline functions, operator overloading, and function overloading.
2. To master file handling techniques in C++ for reading from and writing to files.
Lab Outcomes: At the end of the course, the students will be able to -
LO1. Implement single, multiple, multilevel, and hierarchical inheritance in C++ programs, demonstrating proficiency in object-oriented programming principles.
LO 2. Utilize inline functions, operator overloading, and function overloading effectively in C++ programs to improve code efficiency, readability, and maintainability.
LO3. Students will be proficient in performing file operations in C++ programs, including naming files, opening files, writing data into files, reading data from files, and closing files, ensuring data integrity and security.

List of Experiments

1. To write a C++ program to find the sum of the given variables using a function with default arguments.
2. Write a C++ program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, roll no., and grade. Create an array of class objects. Read and display the contents of the array.
3. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members
4. Write C++ programs that illustrate how the following forms of inheritance are supported: a)Single inheritance b)Multiple inheritance
5. Write C++ programs that illustrate how the following forms of inheritance are supported: a) Multiple inheritance b)Multilevel inheritance d)Hierarchical inheritance
6. To write C++ program to implement an inline function.
7. Write a Program to Generate Fibonacci Series using Constructor to Initialize the Data Members.

8. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
9. Write a Program to Naming a file, Opening a file, Writing data into the file, Reading data from the file, Closing a file.
10. Write a Program to Demonstrate the Catching of All Exceptions.

Semester –III

Course Code: ITY23FPJ201 **Course Name:** Web Technology **Course Category : FP**
Credits: 2 **Teaching Scheme:** P- 4 Hrs/week **Evaluation Scheme:** TW-50
Pre-requisites: Fundamentals of programming logic
Lab Objectives: This course will enable students to
1. To introduce HTML and CSS for web development
2. To familiarize students with JavaScript fundamentals and its application in web development.
3.To teach responsive web design using Bootstrap framework.
4. To provide an introduction to back-end development using PHP and MySQL.
5. To introduce students to front-end development with ReactJS and state management with Redux.
Lab Outcomes: At the end of the course, the students will be able to -
LO 1. Students will be proficient in creating visually appealing and responsive web interfaces using HTML, CSS, and Bootstrap, enhancing user experience across different devices and screen sizes.
LO.2 Students will demonstrate competency in client-side scripting using JavaScript, enabling them to create dynamic and interactive web pages, handle form submissions, and manage events effectively.
LO3. Students will gain the skills necessary to develop modern, interactive web applications using ReactJS, including understanding component-based architecture, managing application state with Redux, and implementing routing for single-page applications.

Contents–

Unit	Content	Teaching Hours
1	**Introduction To HTML,CSS - Introduction to HTML:** Basic designing elements, components attributes (Structured tags, Block level tags, meta tags, formatting, style, lists, images, tables, frames, audio, video), HTML5 **Introduction to CSS** Fundamentals of CSS, Inline CSS, external CSS and embedded CSS, Overview and Features of CSS3, creating a webpage with CSS, Media Query, Introduction to responsive website.	6
2	**Introduction To JavaScript -** JavaScript: Fundamentals of JS , Functions , Arrays, Array Methods, Object object methods, Errors, Debugging. Working on Forms, Event handling.	6

3	**Front-End UI development with Bootstrap -** Bootstrap Overview: Basics of Bootstrap, setting up a web project using Bootstrap. Responsive design and the Bootstrap grid system, Bootstrap CSS Components(Navigation and Navigation bar, buttons, forms, tables, cards, images and media, tags, alerts and progress bars) , Bootstrap Javascript Components (pills and tabbed navigation, collapse, accordion, scrollspy, affix, tooltips, popovers, modals and the carousel	**6**
4	**Introduction to Back-End Technology- PHP:** Introduction to PHP, Features of PHP, Basics of PHP, Syntax, Variable, Functions, Array, Object oriented PHP with MySQL and Forms	**6**
5	**Introduction to React JS -** ReactJS – Overview, Features, Limitations, ReactJS - Environment Setup, ReactJS – JSX, ReactJS – Components. **React Router and Single Page Applications** ReactJS – State, ReactJS - Props Overview, ReactJS - Props Validation, ReactJS - Component API, ReactJS - Component Lifecycle **React Forms, Flow Architecture and Introduction to Redux** Working with forms, different components in the forms, basics of Redux, installation, core concepts, ecosystem.	**6**

List of Experiments

1. Introduction to HTML: Demonstration of all the necessary rags in HTML, HTML5
2. Introduction to CSS: CSS, Inline, external and embedded CSS, Overview and Features of CSS3, media query.
3. Create a website for an organization/personal portfolio using HTML and CSS
4. Introduction to Javascript: Demonstration of Variables, Operators, Arithmetic, Assignment, Data Types, Functions, Objects, Scope, Events, Strings, String Methods, Numbers, Number Methods, Math, Random, Dates, Date Formats, Date Methods, Arrays, Array Methods, Array Sort, Booleans, Comparisons, Conditions, Switch, Loop For, Loop While, Break
5. Demonstration using javascript
    a. Create a application for temperature conversion degree Celsius to fahrenheit
    b. Create a application for currency conversion rupee to dollar
    c. Dropdown events based on options (UG->UG courses , PG->PG Courses)
6. Introduction to Bootstrap, CDM, grid system, typography , components
7. Create a theme using bootstrap components
8. Introduction to PHP: Installation of XAAMP, WAAMP, APACHE,MySQL Workbench, syntax of PHP
9. Create a web page with form and perform crud operation through PHP using MySQL
10. Introduction to React : Create a static webpage using ReactJS.

Semester –III

Course Code: ITY23HSL201 **Course Name:** Business Management and Financial Accounting **Course Category:** EEMC
Credits: 2 **Teaching Scheme:** L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Basic Management
Course Objectives: This course will enable students to
1. To enable students to describe the estimated cash flows from a project, including operating, net working capital, and capital spending.
2. To provide the students to understand the related information of business Finance. Students can prepare basic financial statements.
3. To enable students to prepare final financial statements.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Analyze the risk and return of alternative sources of financing.
CO2. Estimate cash flows from a project, including operating, net working capital, and capital spending.
CO3. Define basic terminology used in finance and accounts.
CO4. Prepare Financial Statements.

Contents–

Unit	Content	Teaching Hours
1	I**ntroduction to Business Management** - Aims, Objective And Function of Business Management, Principles of Management, Concept of business finance, Goals & objectives of financial management, Sources of financing-Long Term financing and Short Term Financing	7
2	**Business Capital Management-** Concept of business working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, financing approaches for working capital, Methods of forecasting, working capital requirements	8
3	**Basics of Financial Accounting -** Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts,	7

	Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger, Cash book & Trial balance.	
4	**Financial Statement Preparation and analysis-** Preparation of financial statements. Profit & Loss Account, Balance Sheet, Ratio Analysis.	**8**

Text Books:

1.Financial Management by Khan & Jain, Text, Problem & Cases, Tata McGraw Hill Publication 5th Edition.
2. Tulsian Financial Management by Dr.P.C.Tulsian, S Chand Publication 5th Edition.
3. Taxman's Financial Management by Ravi M. Kishore, Taxmann 2017 Edition.

Reference Books:

1.A Textbook of Financial, Cost & Management Accounting by Dr.P.Periasamy, Himalaya Publishing House.
2. Fundamentals of Financial Management by Bhabhtosh Banerjee, PHI publication, 2nd Edition.

Semester –III

Course Code: MGM55VEL103 **Course Name:** Constitution of India **Course Category: VEC**
Credits: 2 **Teaching Scheme:** L- 2 Hrs/week **Evaluation Scheme:** CA-30, ESE-20
Duration of Theory Exam: 1 Hr
Pre-requisites: Bare Act of Indian Constitution.
Course Objectives: This course will enable students to
1. To make students understand the Constitution and its importance.
2.To sensitise the students about Fundamental Rights and duties enshrined under Indian Constitution
3.To familiarise students with the working of the Indian Constitution.
Course Outcomes: At the end of the course, the students will be able to -
CO1**:** Understand and explain the significance of Indian Constitution as the fundamental law of the land
CO2. Will be able to exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.
CO3. To Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail
CO4. To Understand Electoral Process, Emergency provisions and Amendment procedure

Contents–

Unit	Content	Teaching Hours
1	**Historical Background and Philosophy of Indian Constitution -**Societies before and after the Constitution adoption,Introduction to the Indian constitution. Making of the Constitution.,Role of the Constituent Assembly,Preamble and Nature of Indian Constitution,Salient features of Indian Constitution.	6
2	**Fundamental Rights & Duties -** Right to equality ,Right to freedom ,Right against exploitation ,Right to freedom of religion ,Cultural and educational rights ,Right to Constitutional remedies,Fundamental Duties**.**	6

Text Books:

1. D. D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2013.
2. Subhash Kashyap, Our Constitution (An Introduction of Indin constitution and Constitutional Law), National Book Trust, India, 2001
3. M. P. Jain, Outline of Indian Legal and Constitutional History, Lexis Nexis, 2014
4. Constitutional Law of India-J.N.Pandey-

Reference Books:

1. G. Austin, The Constitution of India, Cornerstone of a Nation. Oxford University press 1966.
2. M.V.P ylee- Constitutional Government in India, Bombay Asia publishing House 1975.
3. Chandra, Bipan and Others, India Since Independence, Penguin Books, New Delhi, 20015.
4.H.M.Seervai Constitution of India.
5. Narendra Chapalgaonker, Mahatma Gandhi and the Indian Constitution, Routledge (Manohar) Publications, 2016.

Semester –IV

Course Code: ITY23PCL251 **Course Name:** Statistics **Course Category:** PCC
Credits: 2 **Teaching Scheme:** L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites:
Course Objectives: This course will enable students to
1. To learn Probability Theory and probability distribution
2. To know the significance of Regression and correlation
3. To learn Time series analysis
Course Outcomes: At the end of the course, the students will be able to -
CO1. Understand Probability Theory and distribution
CO2: Understand and apply appropriate regression and correlation methods and interpret results.
CO3: perform Time series analysis

Contents–

Unit	Content	Teaching Hours
1	**Theory of probability-** Axiomatic approach of probability, Random variable, Probability distributions, PMF, PDF, Binomial distribution, Poisson distribution, Normal distribution	6
2	**Correlation-** Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient, Spearman's rank correlation, Properties of Karl Pearson's correlation coefficient, Properties of Spearman's rank correlation coefficient, Probable errors, Examples	6
3	**Regression-** Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression, Properties of regression coefficient, Examples.	6
4	**Introduction to Sampling Theory-** Introduction, Universe or Population, parameters and statistics of sampling Distributions, Principles of Sampling, Limitations of Sampling, Errors in Statistics	6
5	**Time Series Analysis-** Introduction, Components of Time Series, Analysis of Time Series, Mathematical model for Time Series, Measurement of Trend.	6

Text Books:
1. S. C. Gupta, "Fundamentals of Statistics", 46th Edition, Himalaya Publishing House,1 May 2018.
2. G. V. Kumbhojkar, "Probability and Random Processes", 14th Edition, C. Jamnadas

Reference Books:
1. Jay Devore" Probability and Statistics for engineers and sciences" 8th edition ,Cengage Learning

Semester –IV

Course Code:ITY23PCL252 **Course Name:** Programming in JAVA **Course Category: PCC**
Credits:2 Teaching Scheme: L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Fundamentals of programming logic
Course Objectives: This course will enable students to
1. To enable the students to understand the core principles of the Object-Oriented Language
2. To understand the concept of packages and applet programming
3. To understand the concept of Multi-threading
4. To understand the concept of graphic programming
5. Introduce the students to database connectivity
Course Outcomes: At the end of the course, the students will be able to -
CO1. Apply Object Oriented concepts to develop programs in Java.
CO2. Develop programs using packages and applet programming.
CO3.Develop programs using Inheritance, Interfaces. Multithreading.
CO4. Develop programs using graphic programming
CO5. Develop applications using databases.

Contents–

Unit	Content	Teaching Hours
1	**Introduction to JAVA-** Fundamentals of Object Oriented Programming, Overview of JAVA, Data types, Operators and expressions, Control Statements and Loops, Arrays, Strings Collection Framework: Array List class, Linked List class, List Iterator interface, Hash Set classes, Vector	8
2	**Object Oriented Programming -** Classes and Objects, methods, method overloading, method overriding, static methods, visibility controls, Constructors, Inheritance, Interface, Packages	8
3	**Multithreading and Exception Handling Thread - MultiThreading:** Creating threads, Extending Thread Class, Stopping and Blocking a thread, Life cycle of a thread, using	8

	thread method, Thread exceptions, Implementing the Runnable interface, Inter-thread communication. **Managing Errors and Exceptions**: Types of errors, Exceptions, Syntax of exception handling code, Multiple catch statements, throwing your own exception, Using exceptions for debugging	
4	**SWING and JDBC -** Introduction to AWT, Graphics classes, Introduction to swing, difference between awt and swing, Components of swing Introduction to JDBC, connectivity with database (MySQL, SQLServer, etc)	**8**

Text Books:

1. E. Balagurusamy, “Programming with Java – A Primer”, Tata – McGraw-Hill Publication,1998
2. Steven Holzner et al. “Java 2 Programming”, Black Book, Dreamtech Press ,2006
3. Herbert Schildt, "Java 2: The Complete Reference",2002
4. Ken Arnold, James Gosling, David Holmes, "THE Java™ Programming Language", Addison Wesley Professional ,2000

Reference Books:

1. H.M. Deitel, P.J. Deitel, “Java - How to Program”, PHI Publication
2. Bruce Eckel, “Thinking in Java”, PHI Publication.
3. Patric Naughton, Michael Morrison, “The Java Handbook”, McGraw Hill Publication.
4. Tim Lindholm, Frank Yellin, Bill Joy, Kathi Walrath, “The Java Virtual Machine Specification”, Addison Wesley Publication.

Online Resources:

1. https://www.java.com/en/download/help/index_using.xml
2. https://docs.oracle.com/javaee/6/tutorial/doc/

Semester –IV

Course Code:ITY23PCL253 **Course Name:** Digital Logic Design **Course Category: PCC**
Credits: 2 Teaching Scheme: L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: nil
Course Objectives: This course will enable students to
1. To train the students on fundamentals of digital logic design.
2. To train the students for minimization of digital circuits.
3. To study combinational and sequential Logic Design (Multiplexer, De-multiplexers).
Course Outcomes: At the end of the course, the students will be able to -
CO1. Perform binary arithmetic; explain logic gates, universal gates, K-map.
CO2. Design different Combinational and Sequential Logic circuits.
CO3. Demonstrate the working of flip-flops.

Contents–

Unit	Content	Teaching Hours
1	**Number Systems and Codes -** Number systems: Binary, Octal, Hexadecimal number systems, Binary arithmetic, 2's Complement Arithmetic, Codes: Binary code, Excess-3 code, grey code, Error detecting and correcting codes.	6
2	**Combinational Logic Design -** Introduction, Standard Representation of Logic functions, Karnaugh Map Representation of Logic functions, Simplification of Logic functions using K Map, Minimization of logic functions, Don't-care Conditions, Design Examples, Five and Six Variable K Maps, Quine – McCluskey Minimization Technique	6
3	**Combinational Functions -** Introduction, Multiplexers and their use in Combinational Logic Design, Demultiplexers/ Decoders and their use in Combinational Logic Design, Digital Comparators	6
4	**FLIP-FLOPS -**Introduction, A 1 Bit Memory Cell, Clocked S-R FLIP FLOP, J-K FLIP FLOP, D and T FLIP FLOP, Excitation table of FLIP FLOP, Conversion from one type of FLIP FLOP to Another Type	6

5	**Introduction to Sequential Logic Design - I**ntroduction, Registers, Applications of Shift registers, Ripple and synchronous counters	**6**

Text Books:

1. R.P. Jain, “Modern Digital Electronics”, Tata McGraw Hill Publication, 4th Edition, 2010.
2. M. M. Mano, “Digital Logic and Computer Design”, Prentice Hall of India Publication, 4th Edition, 2006.

Reference Books:

1. D. P. Leach, A. P. Malvino, G. Saha, “Digital Principles and Applications”, Tata McGraw Hill Publication, 8th Edition, 1993.
2. Comer, “Digital Logic & State Machine Design”, Oxford Universities Press, 3rd Edition, 2014

Online Resources:

1.NPTEL videos

Semester –IV

Course Code: ITY23PCL254 **Course Name:**Digital Image Processing **Course Category: PCC**
Credits: 2 **Teaching Scheme:** L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: 1.Elements of visual perception. 2.Basic linear algebra and Fourier transform Set theory
Course Objectives: This course will enable students to
1. Understand fundamental digital image processing steps and mathematical models in digital image
2.Apply enhancement restoration segmentation image processing algorithm.
3.Develop time and frequency domain techniques for image enhancement.
Course Outcomes: At the end of the course, the students will be able to -
CO1. Introduce basic image processing techniques.
CO2. Learn image enhancement techniques in spatial and frequency domain.
CO3. Apply different Segmentation techniques on Image
CO4. Explore Morphological Image Processing and Object Representation and description.

Contents–

Unit	Content	Teaching Hours
1	**Fundamentals of Image Processing -** Introduction & Applications, Components of Image Processing System, Fundamentals Steps in Image Processing, Image sensing and acquisition, simple image formation, Image sampling and Quantization, Representing digital pixels, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels Image quality, Introduction to colour image – RGB and HSI Models	7
2	**Image Enhancement -** Image Enhancement in the Spatial and Frequency Domain: Image enhancement by point processing, Image enhancement by neighborhood processing, Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters	8

3	**Segmentation -** segmentation and threshold function, Different algorithms in thresholding, Line detection, Edge detection, Edge linking by graph search method, Hough transform, Region based segmentation, Matching.	**8**
4	**Morphological operations-** Morphological-dilation and erosion, opening and closing, Hit/ miss transforms, Representation Boundary descriptors, Regional descriptors.	**7**

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education,2007
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar “Digital Image Processing”, McGraw Hill Publication,2014
3. Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson 2004

Reference Books:

1. B. ChaB. Chanda, Dutta Majumdar, “Digital Image Processing and Analysis”, PHI,2000.
2. Ze-Nian Li and Mark S. Drew, "Fundamentals of Multimedia", PHI 2011.
3. Murat Tekalp, "Digital Video Processing", Pearson, 2010.
4. John W. Woods, "Multidimensional Signal, Image and Video Processing", Academic Press 2012.
5. Gonzalez, R. C., & Woods, R. E. (2017). Digital Image Processing. 4th edition. Pearson Education

Semester –IV

Course Code: ITY23PCP252 **Course Name:** Programming in JAVA LAB **Course Category: PCC**
Credits: 1 **Teaching Scheme:** P-2 Hrs/week **Evaluation Scheme:** TW-30, PR-20
Pre-requisites: Basic Programming
Lab Objectives: This course will enable students to
1. To enable the students to understand the core principles of the Object-Oriented Language
2. To understand the concept of packages and applet programming
3. To understand the concept of Multi-threading
4. To understand the concept of graphic programming
5. Introduce the students to database connectivity
Lab Outcomes: At the end of the course, the students will be able to -
LO1. Apply Object Oriented concepts to develop programs in Java.
LO2. Develop programs using packages and applet programming.
LO3. Develop programs using Inheritance, Interfaces. Multithreading.
LO4. Develop programs using graphic programming
LO5. Develop applications using databases.

List of Experiments
Unit I:
Introduction to Java
Aim: To study the working environment of java.
1.Wap to print your Biodata?
2.Wap to add,subtract,divide,multiply two numbers using command line arguments? Wap to print your Biodata using command line arguments?
Aim: To study Decision Control structures and loop control structures in java
1. Wap to find out the Factorial of a number using For loop, While loop, Do while loop.
2. Wap to find out the square root of a number without using any library function?
3. Wap to find out whether a number is palindrome or not?
4. Write a program to print the kth digit from last. e.g. input 23617 and k=4 output 3.

5. Write a program to find the sum of all digits. Input 23617 output 2+3+6+1+7=19.
Aim: To study Arrays in java
1. Find the smallest and largest number in an array.
2. Count even numbers in an array.
3. Count occurrence of a given number in an array.

Aim: To study interface in java
1. WAP to find out the factorial of a number using the interface ?
2. WAP to find out the greatest among three numbers using the interface?
3. WAP to find out gcd and lcm using the interface ?
4. WAP to find out area and perimeter of rectangle using interface ?
Aim: To study packages in JAVA
WAP to check whether a number is palindrome or not using a package ?
WAP to find out square root of a number without using sqrt or pow function and use packages
WAP to check whether a number is prime or not using a package ?

Unit II:
Object Oriented Programming
Aim: To study classes and objects in JAVA
1. WAP to find out the area of a triangle having three sides using class?
2. WAP to find out the volume of a box using class ?
3. WAP to find out the area and perimeter of a rectangle ?
4. WAP to insert 10 no into stack using push operation and delete 2 elements using pop and
display rest using class ?
Aim: To study methods, method overloading , constructors in java
1. WAP to find out the area of a triangle,rectangle,square and circle using method overloading and constructor overloading.
2. Write a JAVA program which contains a method square() such that square(3) returns 9, square(0.2) returns 0.04.
3. Write a JAVA program which contains a method cube() such that cube(3) returns 27, cube(0.2) returns 0.008.
4. Write a JAVA program which contains a method fun() such that fun(x) returns x and fun(x,y) returns x2+ y2 (where x and y are integers).
5. Write a JAVA program which contains a method fun() such that fun(x) returns x and fun(x,y) returns x + y and fun(x,y,z) returns x*y*z. (where x, y and z are integers).
6. Write a set of overloaded methods min() that returns the smaller of two numbers passed to them as arguments. Make versions for int and float.
Aim: To study Inheritance and types of inheritance in java
1. WAP to find out the volume of a box using simple inheritance ?

2. WAP to find out volume, cost and weight of a box using multilevel inheritance ?
3. WAP to find out volume, cost and weight of a box using multilevel inheritance and use super keyword at appropriate place?

Unit III. Multithreading and Exception Handling Thread:
Aim: To study exception handling in JAVA
1. WAP to create your own Exception to check whether a number is Prime or not, Palindrome or not, even or odd.
2. WAP to illustrate Arithemtic Exception,ArrayIndexOut Of BoundsEcxeption using nested Try Block with suitable example?
3. WAP to detect and resolve divide by zero error using Exception with suitable example?
Unit- IV: Multithreading
Aim: To study threads and multithreading in java
1) WAP to perform following using Multithreading i) Sort 10 numbers in ascending order
ii) Find Avg. of 10 numbers
Searchanumberinanarray
2) WAP to detect and resolve deadlock using suitable examples?
3) WAP to illustrate the need of synchronization using suitable examples?
Unit- IV: Graphics Programming
Aim: To study java AWT
Program to set the background color of the panel using the color specified in the constants of the class.
Aim: To study swings in java
Create an applet for arithmetic operations.
Aim: Create a application to connect JDBC application to JDBC

Semester –IV

Course Code: ITY23PCP254 **Course Name:** Digital Image Processing - Laboratory **Course Category: PCC**
Credits:1 Teaching Scheme: P-2 Hrs/week **Evaluation Scheme:** TW- 30, PR- 40
Pre-requisites: signals and systems, Basic programming skills
Lab Objectives: This course will enable students to
1. To master image processing programs utilizing point processing methods for operations like obtaining negative images, flipping images, thresholding, and contrast stretching.
2. To develop proficiency in implementing image arithmetic operations, including addition, subtraction, mean value calculation, and brightness adjustment, for image manipulation and enhancement.
3. To understand and apply histogram calculation and equalization techniques to analyze and improve image contrast and visual quality.
Lab Outcomes: At the end of the course, the students will be able to -
LO1 Execute image processing programs effectively, achieving tasks such as obtaining negative images, flipping images, thresholding, and contrast stretching with precision.
LO2 Demonstrate expertise in performing image arithmetic operations, including addition, subtraction, mean value calculation, and brightness adjustment, resulting in enhanced and manipulated images as per specific requirements.
LO3.Acquire the skills necessary to calculate histograms and perform histogram equalization, leading to improved contrast and visual quality in images, thereby enhancing their understanding and application of image enhancement techniques.

List of Experiments

Sr.No	Name of Experiment
1	To write and execute image processing programs using point processing method a. Obtain Negative image b. Obtain Flip image c. Thresholding d. Contrast stretching
2	To write and execute programs for image arithmetic operations a. Addition of two images b. Subtract one image from other image c. Calculate mean value of image d. Different Brightness by changing mean value
3	Write a program for histogram calculation and equalization.
4	Perform noise removal using different spatial filters and compare their performances.
5	To write and execute program for geometric transformation of image a. Translation b. Scaling c. Rotation d. Shrinking e. Zooming
6	Apply Smoothing, Sharpening Spatial domain kernels on Images for Enhancement.

7	Apply low pass and high pass frequency domain filters on Images for Enhancement.
8	Demonstration of Thresholding and Region Based Image Segmentation Methods.
9	Write and execute a program for image morphological operations erosion and dilation.
10	Case study : Group of 2-3 Students should study recent international journal research papers and present case study

Semester –IV

Course Code:ITY23VSP251 **Course Name:** Advanced Python **Course Category:** VSEC
Credits:2 Teaching Scheme: P- 4 Hrs/week **Evaluation Scheme:** TW-30, PR- 20
Pre-requisites: Fundamentals of python programming logic
Lab Objectives: This course will enable students to
1. To give idea about the functions in Python
2. To get acquainted with OOP concepts, modules and packages in Python
3. To familiarize with MySQL and Python connectivity.
4. Creating application using TKinter and Flask
Lab Outcomes: At the end of the course, the students will be able to -
LO1. Student can use the functions in Python
LO2. Student can implement with OOP concepts, modules and packages in Python
LO3. Student can connect MySQL with Python
LO4. Student can create application using TKinter and Flask

Contents–

Unit	Content	Teaching Hours
1	**Functions in Python -** Built-In functions, User Defined functions, scope, Flow of Execution , Arguments and Parameters , Default Arguments, Named Arguments , Scope of Variables , Lambda function. MAP, ZIP, REDUCE, FILTER, ANY, CHR, ORD, SORTED, GLOBALS, LOCALS, (ALL Built in Functions)	6
2	**Object Oriented Programming - I**ntroduction to OOP concepts, Classes and objects, Inheritance and polymorphism, Encapsulation and abstraction, Class methods and static methods, packages	6
3	**Exception Handling in Python** - Understanding exceptions, Handling exceptions using try-except blocks, Multiple except blocks and else clause, Using finally block for cleanup	6
4	**File Handling in Python -** Working with binary files, Reading and writing CSV files, JSON serialization and deserialization, Exception handling in file operations	6

5	**Application Development using TKinter, Flask and MySQL - I**ntroduction to MySQL, CRUD Operations, GUI: Tkinter programming, Tkinter widgets, Frame, Button, Label, Entry. Introduction to Flask framework, Building a simple RESTful API, Handling HTTP methods and request parameters	**6**

Suggestive Practical List

1.Functions :

Built-In Functions: len(), print(), type(), int(), str(), max(), min(), sum(), range(), input(), lambda function, MAP, ZIP, REDUCE, FILTER, ANY, CHR, ORD, SORTED

- User Defined Functions:
- Define a function add_numbers(a, b) to add two numbers.
- Define a function square(num) to calculate the square of a number.
    - Provide practical examples of each built-in function.

2. Introduction to OOP:

2. Create a class Car with attributes and methods.
3. Implement inheritance and demonstrate polymorphism.
4. Show examples of encapsulation and abstraction.
5. Implement __str__ and __add__ methods in a class.
6. Define class methods and static methods.

3. Exception Handling:

- Introduce exceptions and their types.
- Write code using try-except, multiple except blocks, else, and finally

4. File Handling:

- Read and write binary files.
- Use the csv module for file operations.
- Serialize and deserialize data using JSON.
- Implement exception handling in file operations.

5. Database Connectivity:

- Connect to MySQL, create a database, and perform CRUD operations.

6. GUI:

- Build a basic Tkinter GUI application.
- Tkinter Widgets, Frame, Button, Label, Entry
- Create a application using Tkinter and Database (MySQL)
- Create an Application using Flask and Database (MySQL)

Text Books:

1. "Python Crash Course" by Eric Matthes, (Latest edition: 2021)
2. "Fluent Python" by Luciano Ramalho (Latest edition: 2021)
3. "Head First Python" by Paul Barry (Latest edition: 2016)

Reference Books:

1. "Fluent Python" by Luciano Ramalho (Latest edition: 2021)
2. "Python Cookbook" by David Beazley and Brian K. Jones (Latest edition: 2018)

Semester –IV

Course Code:ITY23HSL252 **Course Name:**Entrepreneurship Development **Course Category:** EEMC
Credits:2 Teaching Scheme: L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Knowledge of Planning
Course Objectives: This course will enable students to
1. To provide an overview of entrepreneurship development, covering its evolution, concepts, role in economic development, and factors affecting it.
2. Types of Entrepreneurship: Introduce various types of entrepreneurship such as techno entrepreneurship, women entrepreneurship, social entrepreneurship, and intrapreneurship, along with the decision-making process and entrepreneurial environments.
3. To equip students with essential skills for successful entrepreneurship, including project planning, business laws, communication, creativity, problem-solving, innovation, negotiation, and risk management, while also exploring different business organizations and legal aspects in India.
Course Outcomes: At the end of the course, the students will be able to -
CO1. Develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management etc.)
CO2. To develop skills related to Project Planning and Business Plan development.
CO3. To determine and compare various skills of successful entrepreneurs, business organizations and business laws.
CO4.To examine essentials to avoid failure in Entrepreneurship.

Contents–

Unit	Content	Teaching Hours
1	**Introduction -** Entrepreneurship Development, Evolution of Entrepreneurship, Meaning, Definition, and Concept of Enterprise, Concepts of Entrepreneurship, Role of Entrepreneurship in Economic Development, Factors Affecting Entrepreneurship, Entrepreneurial Development models and Theories, Entrepreneurial Trait Tests; Business Opportunity Identification.	8

2	**Entrepreneur-** Major types of Entrepreneurship – Techno Entrepreneurship, Women Entrepreneurship, Social Entrepreneurship, Intrapreneurship (Corporate entrepreneurship), Rural Entrepreneurship, Family Business etc. The entrepreneurial decision process, Entrepreneurial Environment – Political, Legal, Technological, Natural, Economic, Socio – Cultural etc.	**7**
3	**Project Planning -** Project Planning, Skills for Successful Entrepreneurs & Business Organizations and Business Laws: Project report; Project appraisal; Setting up an Industrial unit – procedure and formalities in setting up an Industrial unit; Business Plan Development, Communication Skills, Creativity and Problem-solving, Innovation, Negotiation Skills, Risk management. Types of Business Organizations –Sole, Proprietorship, Joint Hindu Family Business, Partnership, Limited Liability Partnership (LLP), Corporate Governance, Franchising, Business Laws in India to Start Business.	**8**
4	**Concepts of Entrepreneurship Failure -** Issues of Entrepreneurial failure, Reasons of Entrepreneurial Failure, Essentials to Avoid Failure in Entrepreneurship. Case Study of Failure in Entrepreneurship.	**7**

Text Books:

1. Dynamics of Entrepreneurship Development – Vasant Desai.
2. Entrepreneurship Development and small business management – Poornima M. Charantimath
3. Dynamics of Entrepreneurship Development – Vasant Desai.
1. Innovation and Entrepreneurship – Peter F. Drucker
2. Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning, 2016.
3. Vijay Sathe, Corporate Entrepreneurship, Cambridge, 2009.

Semester –IV

Course Code:MGM21VEL101	**Course Name:**Environmental Studies	**Course Category:** Basic Science
Credits:2 Teaching Scheme: L- 2 Hrs/week **Evaluation Scheme:** CA-60, ESE-40		
Duration of Theory Exam: 2 Hrs		
Pre-requisites: Basic Science		
Course Objectives: This course will enable students to		
1. To study the environment and ecosystems.		
2. To study different types of natural resources		
3. To study concept of biodiversity and its conservation		
4. To study the concept of causes, effects and control of different types of environmental pollution		
5. To study population growth and its impact on environment		
Course Outcomes: At the end of the course, the students will be able to -		
CO1. Describe environment and ecosystem		
CO2. Explain environmental impacts of human activities on natural resource		
CO3. Identify the importance of conservation of biodiversity.		
CO4. Describe the problems of environmental pollution, its impact on human and ecosystem and control measures		
CO5. Identify the impact of increased population on environment		

Contents–

Unit	Content	Teaching Hours
1	**Ecosystem and the Environment -** a. Definition, Scope and importance of Environmental studies, Need for Public awareness. b. Concepts of an Ecosystem, Structure and functions of an Ecosystem. a. Producers, Consumers and Decomposers in an Ecosystem	6
2	**Natural Resources - a.** Renewable and non-renewable resources, Role of individuals in conservation of natural resources for sustainable lifestyles.	6

	a. Use and over exploitation of Forest resources, Deforestation, Timber extraction, Mining, Dams and their effects on forest and tribal people b. Use and over exploitation of surface and ground water resources, Floods, Drought, Conflicts over water, Dams- benefits and problems.	
3	**Biodiversity and its Conservation - a.** Definition, Genetic, Species and Ecosystem diversity, Bio-geographical classification of India. b. Value of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and option values.	**6**
4	**Environmental pollution- a.** Definition, Causes, effects and control measures of Air pollution. Water pollution and Soil pollution. b. Causes, effects and control measures of Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards	**6**
5	**Population issues and the Environment - a.** Population growth, Variation among nations, Population explosion- Family welfare programmes, Environment and Human health, Human rights, Value education, HIV/AIDS. b. Woman and Child welfare, Role of information technology in environment and human health, Case studies	**6**

Text Books:
1 Bharucha Erach (ed) Text Book of Environmental Studies., University Press (India) Pvt. Ltd
2. Bharucha Erach, 2003. The Biodiversity of India, Mapin Publishing Pvt. Ltd, Ahmedabad – 380013
3. Kaushik, Anubha & Kaushik, C.P. 2006. Perspectives in Environmental Studies, New Age International (P) Ltd. Publisher, New Delhi
4. Deswal, S. and Deswal, A. 2005. A Basic Course in Environmental Studies. Dhanpat Rai & Co ltd., Delhi.

Reference Books:
1. IndiaSantra S.C, (ed), Environmental Science, New Central Agency Pvt Ltd. Kolkata, India.
2. Botbin, D., and Keller, E.1995. Environmental Science. John Wiley and Sons, USA.
3. Cunningham, W.P. and Saigo, B.W. 1997. Environment Science. McGraw-Hill, USA.
4. Lal, R. and Stewart, B.A. 1992. Advances in Science: Soil Restoration Springer Verlag, New York.

Semester-V

Course code: ITY23PCL301 **Course name:** Design and Analysis of Algorithms **Course category:** PCC
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites: 1. Knowledge of C programming, Data Structures
Course Objectives:
1. To learn fundamentals of algorithm design techniques.
2. To understand basic knowledge of computational complexity, approximation and randomized algorithms, selection of the best algorithm to solve a problem.
3. To design and analyse the performance of algorithms and to compare algorithms with respect to time and space complexity.
4.To develop proficiency in problem solving and programming.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Gain understanding of concepts of time and space complexity in terms of worst, average and best case using Asymptotic Notations.
CO2: Design standard algorithms such as sorting, searching, problems involving graphs etc. using various design techniques and compute complexity measures of these algorithms.
CO3: Design algorithms for optimization problems.

Contents –

Unit	Content	Teaching hours
1	**Introduction-** Fundamental concepts of algorithm: characteristics,Specifications; Frequency count and its importance in analysis of an algorithm; Asymptotic Notations, Time complexity & Space complexity of an algorithm; Sorting methods: bubble, insertion, heap sort. Analysis of each sorting technique for best, worst and average cases	8
2	**Divide and Conquer -** The general method, Binary Search, finding the maximum and minimum, Merge Sort, Quick Sort, selection and Strassen's matrix multiplication.	8
3	**Greedy Method -** The general method, optimal storage on tapes, Knapsack problem, Job sequencing with deadlines, Optimal merge patterns, Minimum spanning trees, Single source shortest paths.	8
4	**Dynamic Programming and Traversal Techniques -** The general method, Multistage graphs, All pairs shortest paths, 0/1 Knapsack, The Travelling salesman problem. Tree traversal techniques, Graph traversal techniques: DFS, BFS, connected components, Bi-connected components & spanning trees	8
5	**Backtracking - T**he general Method, The 8-Queens Problems, Sum of subsets, Graph coloring. Hamiltonian cycles.	8

Text Books: 1. E. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms", Silicon Press, 2nd Edition, 2008.

2. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, "Introduction to Algorithms" , MIT Press, 3rd Edition, 2009
Reference Books: 1. B. K. Joshi, "Data Structures and Algorithms in C++", Tata McGraw Hill Education, 2010.
2. G. T. Heineman, Gary Pollice, Stanley Selkow, "Algorithms in a Nutshell", Shroff Publication, 1st Edition, 2008.
Online Resources: 1. NPTEL / SWAYAM lectures.

Semester-V

Course code: ITY23PCL302	**Course name:**Machine Learning.	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2 Hrs/Week	**Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs		
Pre-requisites:		
1. Probability and statistics		
2. Linear Algebra		
3. Basics of Programming		
Course Objectives:		
1. To understand human learning aspects and relate it with machine learning concepts.		
2. To understand the nature of the problem and apply machine learning algorithms.		
3. To find optimized solutions for a given problem.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Distinguish different learning based applications		
CO2: Apply different preprocessing methods to prepare training data set for machine learning		
CO3: Design and implement supervised and unsupervised machine learning algorithms.		
CO4: Implement different learning models		
CO5: Learn Meta classifiers and deep learning concepts		

Contents –

Unit	Content	Teaching hours
1	**Introduction to Machine Learning - W**hat Is Machine Learning? Machine Learning Applications, LearningAssociations, Classification, Regression, Unsupervised, Reinforcement,Supervised Learning ,Classic and adaptive machines, Machine learning matters.	6
2	**Feature Selection -** Scikit- learn Dataset, Creating training and test sets, managing categorical data, Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principal Component Analysis(PCA)-non negative matrix factorization, Sparse PCA, Kernel PCA. Atom Extraction and Dictionary Learning	6
3	**Regression- Linear regression**- Linear models, A bi-dimensional example, Linear Regression Robust regression with random sample consensus, Polynomial regression, Isotonic regression **Logistic regression**-Linear classification, Logistic regression, Implementation and Optimizations, Stochastic gradient descendent algorithm.	6
4	**Naïve Bayes and Support Vector Machine -** Naive Bayes Theorem, Naïve Bayes‟ Classifiers, Naïve Bayes in Scikit- learn- Bernoulli Naïve Bayes, Multinomial Naïve Bayes, and Gaussian Naïve Bayes. Support Vector Machine(SVM)- Linear Support Vector Machines, Scikit- learn implementationLinear Classification, Kernel based classification, Non- linear Examples. Controlled Support Vector Machines, Support Vector Regression.	6

5	**Decision Trees and Clustering Techniques - D**ecision Trees- Impurity measures, Feature Importance. Decision Tree Classification with Scikitlearn, Ensemble Learning-Random Forest, Voting Classifier. Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, Hierarchical Clustering, Expectation maximization clustering, AgglomerativeClusteringDendrograms, Agglomerative clustering in Scikit- learn.	6

Text Books: 1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st
3.George B. Thomas, Ross L. Finney, Calculus and Analytic Geometry, 9th edition, Pearson.
Reference Books: 1. Ethem Alpaydin, " Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0- 262-01243-0
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make
Online Resources: 1. NPTEL / SWAYAM lectures.

Semester-V

Course code: ITY23PCL303 **Course name:** Database Management Systems **Course category:** PCC
Credits: 2 **Teaching scheme:** L-2 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites: No prerequisite is required, however having knowledge on Set Theory will help.
Course Objectives:
1.To understand architecture and functioning of database management systems.
2. To learn relational mode.
3. To use structured query language (SQL) and its syntax, transactions, database recovery and techniques for query optimization.
4. To acquaint with various normalization forms and query processing.
5. To learn indexing methods
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand, appreciate and effectively explain the underlying concepts of database technologies
CO2: Design and normalize database schema for a given problem-domain
CO3: Populate, query and enforce integrity constraints on databases using commands.
CO4: Understand basics of transaction management.

Contents –

Unit	Content	Teaching hours
1	**Introduction to DBMS and ER Model** - Introduction, An Example of Database, Characteristics of Database Approach, Actors on the Scene Workers behind the Scene, Data models **ER Model** Entity Types, Entity sets, Attributes, Keys, Relationship Types, S Relationship Sets, Roles, Structural Constraints, Strong and Weak entity types, E-R diagram: Naming Conventions, The Enhanced ER Model: Subclasses, Super classes and Inheritance , Specialization and Generalization, Union Types using Categories, Data Abstraction.	8
2	**Structured Query Language -** SQL Data Definition and Data Types, Specifying Constraints in SQL, INSERT, DELETE, and UPDATE Statements in SQL, DDL, Tables: creating, modifying, deletingViews: creating, dropping, Updation using views, DML, Operators, SQL DML queries, SELECT, Set operations, Predicates and joins, Set membership, Tuple variables, Set comparison, Ordering of tuples, Aggregate functions, Nested queries, Integrity Constraints, Triggers	8
3	**Normalization -** Normalization,Functional Dependencies, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Properties for Relational Decompositions: Relation, Dependency Preservation, Property of a Decomposition, Multi-valued Dependencies and 4NF.	8
4	**Transaction Management and Concurrency control-** Introduction to Transaction Processing ACID Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Concurrency	8

	Control, Concurrency Control Based on Lock Based Protocol, Deadlock Handling, Multiple Granularity, Timestamp Based Protocol, Validation Based Protocol.	

Text Books: 1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, "Database System Concepts", McGraw Hill Education, 6th Edition, 2011.
2. Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 7th Edition, 2015.
Reference Books: 1. Carlos Coronel, Steven Morris "Database systems: Design Implementation andManagement", Cengage Learning Press, 11th Edition, 2014.
2. J. Murach, "Murach's MySQL", Shroff Publication, 2nd Edition, 2016.
Online Resources: 1. NPTEL / SWAYAM lectures.

Semester-V

Course code: ITY23PCL304 **Course name:** Geographical Information Systems **Course category:** PCC
Credits:2 **Teaching scheme:** L-2 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Basic Geographical concepts
Course Objectives:
1. To learn basics of GIS
2. To understand Spatial data modeling and Database
3. To Understand GIS data Analysis
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand basic concepts of GIS
CO2: Model Spatial data and Database
CO3: Apply various Analysis Techniques on GIS data

Contents –

Unit	Content	Teaching hours
1	**GIS – An Overview-** Introduction, Defining GIS, Components of GIS, Spatial Data, Maps & their Influence on the Character of Spatial Data, Thematic Characters, Other Sources of Spatial Data.	6
2	**Spatial Data Modeling and Database Management -** Spatial Data Modeling, Entity Definition, Spatial Data Models, Spatial Data Structures, Modeling Surfaces Modeling, Networks, Building, Computer Worlds, Modeling the Third and Fourth Dimension.	6
3	**Database Management and Data Editing -** Database Approach, Attribute Data in GIS, Relational Model, Attribute Data Entry,Manipulation of Fields and Attribute Data, GIS Database Applications, Web GIS, Developments in Databases, Data Input and Editing, Methods of Data Input, Data Editing, Integrated Database.	6
4	**Data Analysis-** Measurements in GIS-Lengths, Perimeters, Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation, Analysis of Surfaces, Network Analysis.	6
5	**Modeling and Output-** Analytical Modeling in GIS, Modeling Physical and Environmental Processes, Modeling Human processes, Modeling the Decision-Making Process, Output: from New Maps to Enhanced Decisions, Maps as Output, Non-Cartographic Output, Spatial Multimedia, Mechanisms of Delivery, GIS and Spatial Decision Support.	6

Text Books: 1. Ian HeyWood, Sarah Cornelius Steve Carver, “An Introduction to Geographical Information Systems”, Pearson Education, Second Edition
2. Kang-tsung Chang, “Introduction to Geographic Information Systems”, Tata McGrawHill, Fourth Edition.
Reference Books: 1.Peter A. Burrough, Rachael A. McDonnell, “Principles of Geographical Information System”, Oxford University Press.

2. . Keith C. Clarke, Bradley O. Parks, Michael P. Crane, “Geographical Information Systems and Environmental Modeling”, Prentice-Hall India.
Online Resources: 1. NPTEL / SWAYAM lectures.

Semester-V

Course code: ITY23PCP301 **Course name:** Design and Analysis of Algorithms - Lab **Course category:** PCC
Credits: 1 **Teaching scheme:** P-2 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Knowledge of any programming language
Lab Objectives:
1.To familiarize students with different algorithm design paradigms, including divide and conquer, greedy, dynamic programming, backtracking, and branch-and-bound.
2.To enhance problem-solving skills by solving real-world problems through appropriate algorithmic approaches.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Design algorithms using various strategies to solve computational problems effectively.
LO2: Demonstrate the ability to implement algorithms efficiently in a programming language of their choice.
LO3: Apply algorithms to solve real-world problems in domains such as sorting, searching, graph traversal, and optimization.
LO4: Develop critical thinking skills to select the most appropriate algorithm for a given problem based on its constraints and requirements.

List of Experiments

1. Program to implement Heap sort.
2. Program to implement Insertion, bubble and selection sort.
3. Program to implement binary search algorithm using DnC method.
4. Program to implement maxmin algorithm using DnC method.
5. Program to implement merge sort algorithm using DnC method.
6. Program to implement a quick sort algorithm using DnC method.
7. Program to implement knapsack problem using greedy method.
8. Program to implement Job Sequencing with Deadlines using greedy method.
9. Program to implement Prim's/Kruskal's Algorithm using Greedy method.
10. Program to implement graph traversal technique: BFS.
11. Program to implement graph traversal technique: DFS.

Semester-V

Course code: ITY23PCP302	**Course name:** Machine Learning Lab	**Course category:** PCC
Credits:1	**Teaching scheme:** P-2 Hrs/Week	**Evaluation scheme:** TW–30, PR–20

Pre-requisites:

1. Probability and statistics
2. Linear Algebra
3. Basics of Programming

Lab Objectives:

1.To familiarize students with the basic concepts, terminologies, and methodologies of machine learning.

2.To enable students to implement and experiment with supervised, unsupervised, and reinforcement learning algorithms.

3.To equip students with the ability to evaluate machine learning models using appropriate performance metrics.

Lab Outcomes: At the end of the course, the students will be able to -

LO1: Demonstrate proficiency in handling and preprocessing datasets for machine learning tasks.

LO2: Evaluate models using metrics such as accuracy, precision, recall, F1-score, and mean squared error and interpret their results.

LO3: Apply machine learning algorithms to solve real-world problems and develop solutions that generalize well.

LO4: Optimize the performance of machine learning models by tuning hyperparameters effectively.

List of Experiments

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Bayes rule in python to get the result.
2. Extract the data from the database using python.
3. Implement k-nearest neighbours classification using python.
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k means clustering with 3 means (i.e., 3 centroids) VAR1 VAR2 CLASS 1.713 1.586 0 0.180 1.786 1 0.353 1.240 1 0.940 1.566 0 1.486 0.759 1 1.266 1.106 0 1.540 0.419 1 0.459 1.799 1 0.773 0.186 1
5. Implement linear regression using python.
6. Implement Naïve Bayes theorem to classify the English text
7. Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset

8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm
10. Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data.

Semester-V

Course code: ITY23PCP303 **Course name:** Database Management System - Lab **Course category:** PCC
Credits:1 **Teaching scheme:** P-2 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites:
1. Basic Programming Knowledge
2. Understanding of Data Structures
Lab Objectives:
1.To introduce students to the foundational concepts of databases, including data modeling, database architecture, and relational algebra.
2.To enable students to write, execute, and debug SQL queries for data definition, data manipulation, and data control.
3. To provide hands-on experience in using popular DBMS tools and platforms, such as MySQL, PostgreSQL, or Oracle.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Demonstrate the ability to design and develop relational database schemas using Entity-Relationship (ER) modeling techniques.
LO2: Write and execute SQL queries for data definition, data manipulation, and data control, including complex queries using joins, subqueries, and aggregations.
LO3: Perform basic database administration tasks such as backup, restore, and user privilege management.
LO4: Gain proficiency in using database management tools like MySQL Workbench, PostgreSQL, SQL Server Management Studio, or Oracle SQL Developer.

List of Experiments

1. Study of E-R Diagram
2. Study of Data Definition Language command
3. Study of Data Manipulation Language
4. Study of data communication using SQL functions.
5. Writing subqueries in join operation
6. Creation of triggers.
7. Creating Views
8. Writing and Executing PL/SQL block
9. Study of GRANT and REVOKE DBA commands
10. Normalization in oracle

Semester – V

Course code: DSC23PEL301	**Course name:** Remote Sensing **Course category:** PEC
Credits: 3	**Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs	
Prerequisites: Digital Image Processing	
Course Objectives:	
1. To provide an overview of the principles and techniques of remote sensing.	
2. To familiarize students with different types of remote sensing data.	
3. To develop skills for image processing, analysis, and interpretation of remote sensing data.	
4. To apply remote sensing techniques in solving real-world problems in various fields, including data science.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Explain the fundamental principles and techniques of remote sensing, including sensor types and data acquisition methods.	
CO2: Classify different types of remote sensing data and their applications in various fields.	
CO3: Apply image processing techniques such as enhancement, classification, and feature extraction to analyze remote sensing data.	
CO4: Interpret remote sensing imagery to derive insights for solving real-world problems in environmental monitoring, urban planning, and disaster management.	

Contents:-

Unit	Content	Teaching hours
1	**Introduction to Remote Sensing-**Definition and importance of remote sensing, Electromagnetic radiation and the electromagnetic spectrum, Components of a remote sensing system, Types of remote sensing (passive and active) and their differences, Applications of remote sensing in various fields.	6
2	**Remote Sensing Platforms and Sensors -**Types of remote sensing platforms (satellites, aircraft, drones), Characteristics of remote sensing sensors (spatial, spectral, temporal, and radiometric resolution), Types of remote sensing sensors (optical, thermal, radar), Comparison of different types of sensors, Satellite orbits and their influence on data acquisition.	8
3	**Image Processing and Analysis -**Image pre-processing (correction, enhancement, and registration), Image classification (supervised and unsupervised), Accuracy assessment and error matrices, Change detection and time-series analysis, Image fusion (pan-sharpening, data integration), Geometric and radiometric correction.	8
4	**Remote Sensing Applications in Data Science-**Remote sensing data in data science, Remote sensing data sources (e.g., Landsat, Sentinel), Case studies on using remote sensing data in data science, Integration of remote sensing data with other data sources (e.g., socio-economic data, climatic data).	6
5	**Advanced Remote Sensing Techniques -**Hyperspectral remote sensing and its applications, Lidar remote sensing and its applications, Synthetic Aperture Radar (SAR) remote sensing and its applications, Microwave remote sensing and its applications.	8

6	**Future Directions in Remote Sensing -**Emerging trends in remote sensing (e.g., drones, big data), Challenges and opportunities in remote sensing, Ethical considerations in remote sensing.	**4**

Text Books:	1. Thomas M. Lillesand, Ralph W. Kiefer, P. K. Champati Ray, Jonathan W. Chipman (2022), "RemoteSensing and Image Interpretation ", 7 th edition, Wiley (Indian Edition).
	2. James B. Campbell and Randolph H. Wynne (2011) , "Introduction to Remote Sensing ", 2 nd edition, Guillford Press.
	3. Floyd F. Sabins Jr (2007), "Remote Sensing: Principles and Interpretation " 3 rd edition, Waveland Press Inc.
	4. John R. Jensen (2013), "Remote Sensing of the Environment: An Earth Resource Perspective ", 2 ndEdition, Pearson.
Reference Books:	1. George Joseph and C. Jeganathan (2018), "Fundamentals of Remote Sensing ", 3 rd edition, The OrientBlackswan.
	2. Rafael C. Gonzalez and Richard E. Woods (2018), "Digital Image Processing", 4 th edition, Pearson.
	3. Marcus Borengasser, Russell Watkins, William S. Hungate (2007) " Hyperspectral Remote Sensing: Principles and Applications ", 1 st edition, CRC Press.
	4. Cheng Wang, Xuebo Yang, Xiaohuan Xi, Sheng Nie, Pinliang Dong (2024) "Introduction to LiDAR Remote Sensing ", 1 st edition, CRC Press.
	5. Iain Woodhouse (2006), “Introduction to Microwave Remote Sensing”, 1 st edition, CRC Press.
Online Resources:	1. NPTEL Course on Remote Sensing - https://nptel.ac.in/courses/105108077
	2. NPTEL Course on Remote Sensing and GIS - https://onlinecourses.nptel.ac.in/noc22_ce84
	3. NPTEL Course on Remote Sensing Essentials - https://archive.nptel.ac.in/courses/105/107/105107201/

Semester-V

Course code: ITY23PEL303	**Course name:** Introduction to Big Data	**Course category:** PEC
Credits: 3	**Teaching scheme:** L-3 Hrs/Week	**Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs		
Pre-requisites: Any Programming Language (Java preferably), DBMS		
Course Objectives:		
1.To understand the Big Data Platform and its Use cases		
2. To provide HDFS Concepts and Interfacing with HDFS		
3. To understand Map Reduce Jobs		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the key issues in big data management		
CO2: Demonstrate knowledge of big data concepts, technologies, and applications		
CO3: Understand of Big Data Architecture		
CO4: Apply technical skills in data processing, modelling, and analysis using various tools and frameworks.		
CO5: Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics		

Contents –

Unit	Content	Teaching hours
1	**Fundamentals of Big Data -** What is Big data? Characteristics of big data and its role in current world, Types of Big Data: Defining Unstructured, Semi-Structure and Structured Data, Technologies being Used to handle and process Big data, Five V's of big data, Big data challenges, Fallbacks of traditional RDBMS in handling and processing Big data, Some Real-world Examples to adopt in major industries	9
2	**Understanding Hadoop Ecosystem-** What is Hadoop? Hadoop Key Characteristics, Differences between RDBMS & Hadoop, Brief History of Hadoop, Hadoop Ecosystem (Version 1.x & 2.x), Hadoop commands, Components of Hadoop (Version 2.x): HDFS & MapReduce, Architecture of HDFS & Map Reduce, Basic Operations to store and access from HDFS via Command Line, Phases in MapReduce Algorithm, YARN architecture, YARN advantages.	9
3	**Introduction to Apache Pig -**Pig Architecture, Modes of Pig Execution, Operations in Pig: Intro to Pig Latin, Pig Latin Data types, Basic Pig Latin Statements: Loading and Storing Data, Relational and Arithmetic Operators, Debugging Techniques (Dump, Describe, Explain etc.)	9
4	**Introduction to Apache Hive-**Hive architecture, Modes of Hive Execution, Operations in Hive: Intro to HiveQL, Basic HiveQL, Hive Tables (Managed Tables & External Tables), Hive Data Types and Data Models, commands: DDL Operations (creating, browsing, updating and deleting tables), DML Operations (Load, Update, Insert and delete data into Hive tables).	9
5	**HBase & Sqoop -** Apache HBase: HBase Architecture, HBase Vs RDBMS, HBase Shell Commands. Apache Sqoop: Sqoop Architecture, importing data: Transferring an	9

	entire table, specifying a target directory, importing only a subset of data, Incremental Uploads: Importing only new data.	

Text Books: 1. Tom White, Hadoop: The Definitive Guide. O'reilly, Fourth Edition, 2011.
2."Hadoop in Action" Third Edition, Chuck Lam.
Reference Books: 1. "Programming Hive", Jason Rutherglen, Dean Wampler & Edward Capriolo, O'Reilly Publication.
2. "Programming in Pig", Alan Gates, O'Reilly Publication.
3. "HBase: The Definite Guide", Lars George, O'Reilly Publication.
4. "Apache Sqoop Cookbook" Kathleen Ting, Jarek Jarcec Cecho, O'Reilly Publication.
Online Resources: 1. NPTEL / SWAYAM lectures.
1. https://cognitiveclass.ai/courses/introduction-to-hadoop **2.** https://cognitiveclass.ai/courses/course-v1:BDU+BD0133EN+v1 **3.** https://cognitiveclass.ai/courses/hadoop-hive **4.** https://cognitiveclass.ai/courses/using-hbase-for-real-time-access-to-your-big-data **5.** https://cognitiveclass.ai/courses/what-is-spark Big Data Computing by PROF. RAJIV MISRA, Dept. of Computer Science and Engineering, IIT Patna. NPTEL COURSE.

Semester-V

Course code: AIM23PEL302 **Course name:** Mathematical Foundation for Cyber Security **Course category:** PEC
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Basic mathematics, Data compression techniques
Course Objectives:
1. To provide a fundamental concept of abstract algebra.
2. To study basic concepts of set theory and binary operation.
3. To study different operations on algebraic structure.
4. To study advanced number theory concept
Course Outcomes: At the end of the course, the students will be able to -
CO1: Define the concepts related to the basics of set theory and binary operations.
CO2: Demonstrate knowledge and understanding of groups, subgroups, and order of an element in finite groups.
CO3: Develop understanding of algebraic structure, ring, and field.
CO4: Discover different operations on algebraic structure.
CO5: Choose appropriate algebraic structure for cryptographic operation.
CO6: Develop understanding of the use of algebraic structure in number theory algorithms.

Contents –

Unit	Content	Teaching hours
1	**Fundamentals of Integer and Modular Arithmetic-** Integer arithmetic, modular arithmetic, matrices, Linear Congruence: Definition – Basic properties of congruence, Divisibility - Greatest common divisor, equivalence classes, residue classes.	8
2	**Prime Numbers, Congruences, and Computational Number Theory-** Primes, primality testing, factorization, Chinese remainder theorem, quadratic congruence, exponentiation and logarithm.	8
3	**Algebraic structures: groups, fields, rings, Modulo groups** - Primitive roots – Discrete logarithms. Finite fields – GF (p), GF(2n) – polynomial arithmetic	8
4	**Foundations of Cryptographic Security-** SHANNON'S THEORY: Introduction, Elementary Probability Theory, Perfect Secrecy, Entropy, Properties of Entropy, Spurious Keys & Unicity distance, Product Cryptosystems.	8
5	**Pseudorandom Number Generation and Cryptographic Security-** Pseudorandom Number Generation, Introduction and examples Indistinguishability of Probability Distributions - Next Bit Predictors - The Blum-Blum-Shub Generator – Security of the BBS Generator.	8

Text Books: 1. D.S. Dummit and R.M. Foote, “Abstract Algebra”, John Wiley
2. Michael Artin, “Algebra”, Pearson Education.
3. J.A. Gallian, “Contemporary Abstract Algebra”, Narosa Publishing House.
Reference Books: 1. I N. Herstein, “Topics in Algebra”, Wiley.
2. N. Jacobson, “Basic Algebra I”, Hindustan Publishing Company.
3. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education.
Online Resources: 1. NPTEL / SWAYAM lectures.

Semester – V

Course code: DSC23PEP301	**Course name:** Remote Sensing-Lab	**Course category:** PEC
Credits: 1	**Teaching scheme:** P-2 Hrs/Week	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Digital Image Processing

Lab Objectives:

1. Familiarize students with remote sensing software and data visualization tools.
2. Develop skills in image processing, classification, and accuracy assessment.
3. Analyze temporal changes using remote sensing data for environmental applications.
4. Integrate remote sensing data with other datasets for comprehensive analysis.
5. Apply advanced remote sensing techniques for practical and research-based projects.

Lab Outcomes: At the end of the course, the students will be able to -

LO1: Operate remote sensing software for data loading, visualization, and processing.
LO2: Perform image classification, enhancement, and accuracy assessment techniques.
LO3: Analyze time-series and change detection using remote sensing data.
LO4: Integrate different remote sensing datasets for meaningful data interpretation.
LO5: Develop a project using remote sensing techniques for practical applications.

List of Experiments:-

Experiment 1: Introduction to Remote Sensing Software
Introduction to remote sensing software (Free and Open Source), Familiarization with the software interface and tools, Loading and visualizing remote sensing data.

Experiment 2: Image Processing and Analysis
Pre-processing of remote sensing images (correction, enhancement, and registration), Image classification using supervised and unsupervised methods, Accuracy assessment and error matrices.

Experiment 3: Change Detection and Time-series Analysis
Detection of changes in remote sensing images using image differencing, Time-series analysis of remote sensing data for environmental monitoring, Analyzing temporal patterns and trends.

Experiment 4: Image Fusion and Data Integration
Fusion of multispectral and panchromatic remote sensing images, Integration of remote sensing data with other data sources, Visualization of fused and integrated data.

Experiment 5: Hyperspectral Remote Sensing
Processing and analysis of hyperspectral remote sensing data, Classification of hyperspectral images, Applications of hyperspectral remote sensing in data science.

Experiment 6: Lidar Remote Sensing
Processing and analysis of lidar remote sensing data, Digital terrain modeling and 3D visualization. Applications of lidar remote sensing in data science.

Experiment 7: Synthetic Aperture Radar (SAR) Remote Sensing
Processing and analysis of SAR remote sensing data, Interferometric SAR (InSAR) processing and analysis, Applications of SAR remote sensing in data science.

Experiment 8:Project Work – should be allotted at the beginning of the semester and achieved through practical sessions.
Working on a project using remote sensing data, Developing research questions, data collection, processing, analysis, and interpretation, Project presentation and evaluation.

Semester-V

Course code: ITY23PEP303	**Course name:** Introduction to Big Data Lab	**Course category:** PEC
Credits:1	**Teaching scheme:** P-2 Hrs/Week	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Basic Programming Skills

Lab Objectives:

1. To guide students in downloading, installing, and configuring Hadoop in different modes
2. To introduce students to Hadoop Distributed File System (HDFS) and its basic commands.
3. To implement real-world scenarios such as word counting, matrix multiplication, and weather data analysis using MapReduce.

Lab Outcomes: At the end of the course, the students will be able to -

LO1: Set up and configure virtual machines for distributed computing environments.

LO2: Write and execute MapReduce programs to solve problems like word counting, matrix multiplication, and weather data collection.

LO3: Develop hands-on skills for managing and analyzing large-scale data using distributed computing frameworks.

List of Experiments:

Sr. No.	Name of Practical
1	Installation of Hadoop; Understanding different Hadoop modes.
2	Hadoop Implementation of file management tasks, such as Adding files and directories, Retrieving files and Deleting files
3	Develop a MapReduce program to calculate the frequency of a given word in a given file.
4	Develop a MapReduce program to find the grades of students.
5	Develop a MapReduce program to implement Matrix Multiplication.
6	Write a Map Reduce program to count words from a given text file.
7	Write a Map Reduce program for weather data collection.
8	Implement the following using map reduce a) Sorting b) Indexing.
9	Installation of pig latin language.
10	Instructions executions in Pig Latin Language
11	Installation of single and multi node deployment using putty.
12	Case study: Hadoop and Hive at Facebook.

Semester-V

Course code: AIM23PEP302 **Course name:** Mathematical Foundation for Cyber Security Lab **Course category:** PEC
Credits: 1 **Teaching scheme:** P-2 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic Knowledge of Number Theory and Cryptography
Lab Objectives:
1. Implement modular arithmetic operations for cryptography.
2. Study and apply finite field and matrix operations in cryptographic algorithms.
3. Solve cryptographic problems using number theory techniques like GCD and discrete logarithms.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Apply modular arithmetic and finite field operations in cryptography.
LO2: Implement and analyze matrix-based encryption algorithms.
LO3: Use number theory to solve cryptographic problems and assess security.

List of Experiments

1. **Modular Arithmetic:**
   a. Implement modular arithmetic operations such as addition, subtraction, multiplication, and exponentiation.
   b. Use modular arithmetic to compute remainders, calculate modular inverses, and perform modular exponentiation.
   c. Apply modular arithmetic in cryptographic algorithms like RSA for key generation and encryption.

2. **Finite Fields:**
   a. Study finite fields (also known as Galois fields) and their properties relevant to cryptography.
   b. Implement arithmetic operations in finite fields, including addition, subtraction, multiplication, and exponentiation.
   c. Use finite fields in cryptographic algorithms like AES (Advanced Encryption Standard) for encryption and decryption.

3. **Matrix Operations:**
   a. Implement matrix operations such as addition, subtraction, multiplication, and inversion.
   b. Explore the role of matrices in cryptographic algorithms like Hill cipher for encryption and decryption.
   c. Analyze the security and efficiency of matrix-based encryption schemes.

4. **Discrete Logarithm Problem:**
   a. Study the discrete logarithm problem and its significance in cryptography.

b. Implement algorithms like baby-step-giant-step or Pollard's rho algorithm to solve the discrete logarithm problem. c. Apply discrete logarithm algorithms in cryptographic protocols like Diffie-Hellman key exchange.
5. **Prime Number Generation:** a. Develop algorithms to generate prime numbers of desired lengths. b. Implement primality tests such as the Miller-Rabin test or the AKS primality test to verify the primality of generated numbers. c. Use prime number generation in cryptographic algorithms for key generation and parameter selection.
6. **GCD and Extended Euclidean Algorithm:** a. Implement algorithms to calculate the greatest common divisor (GCD) of two numbers. b. Use the extended Euclidean algorithm to find modular inverses and solve linear Diophantine equations. c. Apply GCD and the extended Euclidean algorithm in cryptographic protocols like RSA for key generation.
7. **Statistical Analysis:** a. Study statistical techniques for analyzing cryptographic algorithms and protocols. b. Implement statistical tests such as frequency analysis, chi-square test, or randomness tests to assess the quality of random number generators. c. Use statistical analysis to evaluate the security and robustness of cryptographic systems against various attacks.

Semester – VI

Course code: DSC23PCL351 **Course name:** Deep Learning **Course category:** PCC	
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40	
Duration of Theory Exam: 2 Hrs	
Pre-requisites: Students should have basic understanding of mathematical formulations.	
Course Objectives:	
1. To make students comfortable with tools and techniques required in handling large amounts of datasets	
2. To make students understand the major differences between deep learning and other types of machine learning algorithms.	
3. To understand deep learning methods.	
4. To understand the challenges in development of Deep networks.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the mathematical composition of Deep learning models.	
CO2:.Understand machine learning basics of deep learning models.	
CO3: Understand the architecture of RBM,CNN, GBL.	
CO4: Understanding regularization and optimization techniques for training Deep Models.	

Contents:-

Unit	Content	Teaching hours
1	**Introduction to Deep learning-** Basics of Linear Algebra, example -Principal Component Analysis (PCA), Bayesian Rule, Information theory and structured Probabilistic models	8
2	**Numerical Computation & Machine learning basics-** Overflow, underflow, Gradient based optimization, constrained optimization, hyperparameters and validation sets, Maximum Likelihood Estimation (MLE), Supervised unsupervised learning algorithms	8
3	**Deep networks -**Restricted Boltzmann Machine , Auto encoders, Building blocks of CNN, Basic architecture of CNN, Backpropagation, Gradient based learning, hidden units, architecture design	8
4	**Regularization & optimization for training Deep Models -**Parameter norm penalties, dataset augmentation, noise robustness, early stopping, parameter tying and sharing, challenges in NN optimizations, basic optimization algorithms, algorithms with adaptive learning rate.	8
5	**Applications of Deep Learning-**Computer vision applications, such as object detection and segmentation, Natural language processing applications, such as sentiment analysis and language modelling, Robotics applications, such as control and perception.	8

Text Books: 1. Ian Goodfellow, Yoshua Bengio and Aaron Courville , Deep Learning , MIT press , 2016
2. Charu Aggarwal , Neural Networks and Deep Learning, Springer, Second Edition 2023

Reference Books: 1. Dr. Pablo Rivas “Deep Learning for Beginners” 2020 Packt Publishing
Online Resources: 1.NPTEL Deep Learning -Part 1 , IIT Madras , Prof Sudarshan Iyengar, Dr. Padmavati
2. NPTEL Deep Learning , IIT Khargpur, Prof. Prabir Kumar Biswas

Semester – VI

Course code: DSC23PCL352 **Course name:** Computer Vision and Pattern Recognition **Course category:**PCC
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites:1.Image processing 2.Programming logic and design 3.Any programming language like C/C++/Java/Python/Matlab
Course Objectives:
1. Understand computer vision and pattern recognition concepts, technologies, and algorithms.
2. Understand the underlying principle of Computer Vision and its usage in various applications.
3. Understand the underlying principle of Pattern Recognition and its usage in various applications.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Implement fundamental image processing techniques required for computer vision.
CO2: Identify various approaches of computer vision and pattern recognition.
CO3: Able to apply a variety of techniques and relevant knowledge for solving problems in computer vision and pattern recognition.

Contents:-

Unit	Content	Teaching hours
1	**Introduction to computer vision-** Sensing, seeing, and perceiving, Role of vision, Images, Sources of imagery, The physics of imaging. Geometry of Image Formation, Representing, acquiring, and displaying images, Grayscale, color, noise, lens distortion, and filtering	8
2	**Image classification and clustering-** Image classification and clustering, Linear classification, Higher-level representations, Object detection, Bag of words, Object recognition/categorization, Segmentation, Applications: Surveillance, Object detection.	8
3	**Introduction to Pattern Recognition-** Bayes Decision Theory: Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features. Linear discriminant functions: Gradient descent procedures; Perceptron; Support vector machines.	8
4	**Parameter Estimation Methods 1-** Maximum-Likelihood estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation	8
5	**Parameter Estimation Methods 2-** Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy	8

	estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.	

Text Books: 1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
4. Richard Szeliski, Computer Vision Algorithms and Applications, Springer, 2010.
Reference Books: 1. Simon Prince, "Computer Vision: Models, Learning and Inference", Cambridge University Press, 2012
2.Robert Schalkoff. "Digital Image Processing and Computer Vision", Wiley and sons, 1989
3. Manas Kamal Bhuyan, "Computer Vision and Image Processing Fundamentals and Applications" CRC press 2019.
4. Wang, Chen, Pau. "Handbook of Pattern Recognition and Computer Vision". World Scientific Pub Co . 1993.
Online Resources:
1. NPTEL / SWAYAM lectures.
2**.** Coursera courses on Computer Vision and Pattern Recognition.
3. Edu courses on Computer Vision and Pattern Recognition
4. Udemy courses on Computer Vision and Pattern Recognition.

Semester – VI

Course code: DSC23PCL353	**Course name:** Data Analytics	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2 Hrs/Week	**Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs		
Pre-requisites: 1.Basic Mathematics and Statistics: Understanding of fundamental mathematical concepts, including algebra and calculus. 2.Programming Basics: Familiarity with a programming language such as Python or R.		
Course Objectives:		
1. Understand the Fundamentals of Data Analytics		
2. Learn Data Collection and Cleaning Techniques		
3. Conduct Exploratory Data Analysis (EDA)		
4. Perform Statistical Analysis		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Knowledge Base: Understand fundamental concepts and principles of data analytics		
CO2:. Data Collection and Cleaning: Apply techniques for collecting and cleaning diverse datasets.		
CO3: Statistical Analysis: Apply statistical tests for hypothesis testing and draw valid inferences.		
CO4: Machine Learning: Select, train, and evaluate machine learning models for different types of data		
CO5: Big Data Analytics: Understand the challenges and opportunities of big data analytics. Work with tools like Hadoop and Spark to process and analyze large datasets		

Contents:-

Unit	Content	Teaching hours
1	**Introduction to Data Analytics -**Overview of Data Analytics, Importance and Applications of Data Analytics, Types of Data (Structured and Unstructured), Data Analytics Lifecycle, Definition and Overview, Scope and Applications, Data Analytics Lifecycle	7
2	**Data Collection and Cleaning-**Data Sources and Collection Methods, Data Cleaning and Preprocessing , Dealing with Missing Data, Outlier Detection and Treatment, Sampling Techniques: Random Sampling, Stratified Sampling, Convenience Sampling, Sampling Bias and Mitigation. Data Quality and Accuracy, Data Encoding	8
3	**Statistical Analysis -**Hypothesis Testing, Parametric and Non-Parametric Tests, Regression Analysis, Analysis of Variance (ANOVA), Basic Concepts of Machine Learning, Supervised and Unsupervised Learning,Model Selection and Evaluation**,** Inferential Statistics: Hypothesis Testing, Confidence Intervals, Regression Analysis. Non-parametric Statistics, Statistical Power and Significance.	8
4	**Big Data Analytics -**Introduction to Big Data, Hadoop and Spark, Processing and Analyzing Big Data, Introduction to Data Analytics Tools (e.g., Python, R), Hands-on Exercises with Data Analytics Libraries, Data Storage and Retrieval, Big Data Visualization, Big Data Analytics Tools and Platforms.	7

Text Books:
1. "Big Data: A Very Short Introduction" by Dawn E. Holmes, Oxford University Press, 2017
2. "Big Data Analytics Made Easy" by Y Laxmi, Notion Press, 2016.
3. "Python for Data Analysis" by Wes McKinney 3rd Edition, 2012.
Reference Books: 1. "Big Data: Principles and Best Practices of Scalable Realtime Data Systems",Nathan Marz and James Warren, 1st Edition, 2015
2. "Big Data: Techniques and Technologies in Geoinformatics",Hassan A. Karimi and Albert Y. Zomaya
3. "Big Data: Techniques and Technologies in Geoinformatics",Hassan A. Karimi and Albert Y. Zomaya, Taylor **&** Francis Group, 2017.
4. "Big Data Analytics: Methods and Applications", Saumyadipta Pyne B.L.S. Prakasa Rao,Springer, 2016.
5. "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing, and Presenting Data",John Wiley & Sons, 2015.

Semester – VI

Course code: DSC23PCP351	**Course name:** Deep Learning-Lab	**Course category:** PCC
Credits: 1	**Teaching scheme:** P-2 Hrs/Week	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Students should have basic understanding of mathematical formulations .

Lab Objectives:

1. 1. provide students with practical experience in implementing and applying various deeplearning algorithms to real-world problems, by teaching them how to build neural networks,tune hyperparameters, and evaluate model performance on different datasets.

2. To identify innovative research directions in Artificial Intelligence, Machine Learning andDeep Learning.

Lab Outcomes: At the end of the course, the students will be able to -

LO1: Make use of deep learning APIs like Keras.

LO2: Apply deep learning techniques for object identification and segmentation.

LO3: Implement RNN and CNN for multiple problems.

List of Experiments:-

Experiment 1: Implementation of different activation functions to train Neural Network.
Experiment 2: Implementation of different Learning Rules.
Experiment 3: Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
Experiment 4: Implement Naïve Bayes theorem to classify the English text
Experiment 5: Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
Experiment 6: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
Experiment 7: Implement k-nearest neighbours classification using python
Experiment 8: Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
Experiment 9: Implement the finite words classification system using Back-propagation algorithm.
Experiment 10: Pattern matching using different rules.

Semester – VI

Course code: DSC23PCP353	**Course name:** Data Analytics-Lab	**Course category:** PCC
Credits: 1	**Teaching scheme:** P-2 Hrs/Week	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Pre-university mathematics.		
Lab Objectives:		
1. Understand the fundamental concepts of descriptive statistics.		
2. To study and implement machine learning algorithms.		
Lab Outcomes: At the end of the course, the students will be able to -		
LO1: Apply statistical measures of central tendency and dispersion to real-world datasets.		
LO2: Create effective data visualizations by selecting appropriate chart types.		
LO3: Analyze datasets using statistical tests like chi-square and ANOVA.		
LO4: Evaluate the performance of various machine learning models.		

List of Experiments:-

Experiment 1: Find the statistical measures of central tendency and dispersion such as min(), max(), mean(), median(), quantile(), sd() ,var() and summary() for real world datasets.
Experiment 2: Demonstrate the different data visualization techniques. (Scatter Plot, Horizontal Bar Chart, Histogram, Visualization of Time Series data (Line Graphs) for applications such as weather analysis.
Experiment 3: Perform the chi-square test and ANOVA F-test on datasets
Experiment 4: Implement the PCA method for dimensionality reduction on datasets.
Experiment 5: Implement the RFE method and show the importance of features
Experiment 6: Implement the Decision Tree for given datasets and compute the accuracy of the model.
Experiment 7: Implement the K-Nearest Neighbour Algorithm for given datasets and analyze the results.
Experiment 8: Implement the Naïve Bayes method
Experiment 9: Implement a simple linear regression program to predict the future values and analyze the goodness of fit.
Experiment 10: Implement a multivariate linear regression program to predict the future values and analyze the goodness of fit.
Experiment 11: Implementation of Distributed Decision Trees

Semester – VI

Course code: DSC23PEL351 **Course name:** Spatial Statistics **Course category:** PEC
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites: 1. Remote Sensing 2. Geographic Information Systems
Course Objectives:
1. Understand the unique characteristics of spatial data and the importance of spatial statistics in data science
2. Familiarize with the basic concepts and methods of spatial statistics, including spatial autocorrelation, exploratory spatial data analysis, and spatial interpolation
3. Develop the ability to analyze spatial patterns in data using point pattern analysis and spatial regression modelinG
4. Learn to apply geostatistics techniques such as variogram modeling and kriging interpolation to spatial data
5. Gain knowledge of data mining techniques for spatial data, including clustering, classification, association rules, and outlier detection
6. Gain knowledge of data mining techniques for spatial data, including clustering, classification, association rules, and outlier detection
Course Outcomes: At the end of the course, the students will be able to -
CO1: Describe the importance of spatial statistics in data science
CO2: Explain the concept and methods of spatial statistics, including spatial autocorrelation, exploratory spatial data analysis, and spatial interpolation
CO3: Explain the concept and methods of spatial statistics, including spatial autocorrelation, exploratory spatial data analysis, and spatial interpolation
CO4: Apply geostatistics techniques such as variogram modeling and kriging interpolation to spatial data
CO5: Develop a spatial decision support system

Contents:-

Unit	Content	Teaching hours
1	**Introduction to Spatial Statistics-** Introduction to spatial data and its unique characteristics, Basic concepts and methods of spatial statistics, Spatial autocorrelation and spatial dependence, Exploratory spatial data analysis (ESDA)	6
2	**Spatial Interpolation-** Spatial interpolation methods such as inverse distance weighting (IDW), kriging, and spline interpolation Cross-validation and model selection for spatial interpolation, Applications of spatial interpolation in data science	6
3	**Point Pattern Analysis-** Types of point patterns and their characteristics, Measures of spatial patterns such as nearest neighbor analysis, Ripley's K function, and spatial autocorrelation, Simulation-based inference for point patterns, Applications of point pattern analysis in data science	8
4	**Spatial Regression-** Simple linear regression and multiple linear regression models	6

	in spatial context, Spatial dependence models such as spatial autoregressive models and spatial error models, Spatial panel data models, Model selection and diagnostics in spatial regression	
5	**Geostatistics -** Maximum-Likelihood estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation.	**6**
6	**Spatial Data Mining and Decision Support Systems-** Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.	**8**

Text Books:
1. Christopher D. Lloyd (2009), "Spatial Data Analysis: An introduction for GIS Users & quot;, 1 st edition, Oxford University Press.
2. A. Gelfand, P. Diggle, M. Fuentes, and L. Guttorp (2010) "Handbook of Spatial Statistics & quot;, 1 st edition,CRC Press.
3. Roger S. Bivand, Edzer J. Pebesma, and Virgilio Gómez-Rubio, "Applied Spatial Data Analysis with R", 2 nd edition, Springer.
4. Peter Diggle (2023), "Statistical Analysis of Spatial and Spatio-Temporal Point Patterns & quot; 3 rd edition, Routledge.
5. Margaret A. Oliver and R. Webster (2007) "Geostatistics for Environmental Scientists & quot;, 1 st edition, John Wiley and Sons.
Reference Books:
1. Trevor Hastie, Robert Tibshirani, and Jerome Friedman (2009), "The Elements of Statistical Learning:Data Mining, Inference, and Prediction & quot;, 2 nd edition, Springer.
2. Robert P. Haining, Guangquan Li (2020) "Modeling Spatial and Spatial-Temporal Data: A Bayesian Approach & quot;, 1 st edition, Routledge.
3. Christopher D. Lloyd (2014), "Exploring Spatial Scale in Geography & quot;, 1 st edition, John Wiley and Sons.
4. Marie-Josée Fortin and Mark R. T. Dale (2014), "Spatial Analysis: A Guide for Ecologists & quot;, 2 nd edition, Cambridge University Press.

Semester-VI

Course code: ITY23PEL353 **Course name:** Big Data Modelling and Management **Course category:** PEC
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Any one Programming Language (Java preferably), DBMS
Course Objectives:
1. To understand the Big Data Platform and its Use cases
2. To provide HDFS Concepts and Interfacing with HDFS
Course Outcomes: At the end of the course, the students will be able to -
CO1: Identify the Issues for Big Data
CO2: Manage data Storage in Hadoop Environment
CO3: Access and Process Data on Distributed File System

Contents –

Unit	Content	Teaching hours
1	**Management Issues for Big Data-** Challenges of big data-a. Storage b. Infrastructure c. Technologies d. Processing, key management issues for big data- a. Staffing b. Skillsets c. Strategies d. Total cost of ownership, service provisions for big data management- a. Sourcing (ingestion) b. Storage c. Quality d. Operations e. Scalability, security, ethical and legal considerations-a. Personal data b. Internal data c. Considerations of data privacy in national laws, e.g. EU GDPR, US data regulations and UK data privacy regulations	9
2	**Storage, data and programming interface models used for Big Data -** Key storage data, data types and documentation-a. Key-value b. Relational c. Extensible d. Document, data storage- a. Block b. File c. Object-based, data modelling. Structured data b. Unstructured data c. Streamed data, data modelling in real time-Pipelines with Kafka and similar technologies, Compare programming interface models a. Hadoop b. MapReduce c. Spark d. Yarn.	9
3	**Data Storage and Management** - NoSQL databases- introduction to MongoDB Document-oriented data modeling, Cassandra) Importance of effective data storage Data Warehousing-Traditional vs. modern data warehousing	9
4	**Columnar Data Model -** Data warehousing schemas: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes, Indexing, Adaptive Indexing and Database Cracking. Advanced techniques: Vectorized Processing, Compression, Write penalty, Operating Directly on Compressed Data	9
5	**Architecture for Big Data and Big Data infrastructures-** techniques for storing data in secondary storage- a. MapReduce b. HDFS c. Yarn, compare noSQL and RDBMS- Definition, benefits, and comparison to RDBMS b. ACID properties, Brewers theorem-Use of CAP 9 Consistency Availability Partition Tolerance Correct in NoSQL frameworks, use of data with cloud-based networks- a. In-house b.	9

	Outsourced, distributed file systems - Specialised applications, e.g. GFS, ownership and financial implications of cloud use.	

Text Books: 1. Vignesh Prajapati,"Big Data Analytics With R and Hadoop.
2. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012
3. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015
Reference Books: 1.Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012
2. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
3. "Hadoop in Action", Third Edition, Chuck Lam
Online Resources: 1. NPTEL / SWAYAM lectures.

Semester-VI

Course code: AIM23PEL352 **Course name:** Cryptography and Data Compression **Course category:** PEC
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Linear algebra
Course Objectives:
1. To have the knowledge of security, types of attack experienced,encryption and authentication for deal with attacks.
2. To have knowledge what is data compression, needs and techniques of data compression.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand plain text, cipher text, and cryptographic algorithms, including RSA.
CO2: Implement key distribution methods and communication models in cryptography.
CO3: Implement various data compression models and their applications.

Contents –

Unit	Content	Teaching hours
1	**Introduction to Security -** Need for security, Security approaches, Principles of security, Types of attacks. Encryption Techniques: Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.	9
2	**Symmetric & Asymmetric Key Cryptography -** Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Asymmetric key together, Digital signature, Knapsack algorithm.	9
3	**Case Studies of Cryptography -** Denial of service attacks, IP spoofing attacks, Conventional Encryption and Message Confidentiality, Conventional Encryption Algorithms, Key Distribution. Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management, Firewall	9
4	**Introduction to data compression-** Need for data compression, Fundamental concept of data compression & coding, Communication model, Compression ratio, Requirements of data compression, Classification. Methods of Data Compression: Data compression-- Lossless & Lossy.	9
5	**Recent Trends-** Recent trends in encryption and data compression techniques.	9

Text Books: 1. Cryptography and Network Security, Mohammad Amjad, John Wiley & Sons
2. Cryptography & Network Security by Atul Kahate, TMH.
Reference Books: 1. Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley & Sons.
2. Cryptography and Network Security by B. Forouzan, McGraw-Hill.
3. The Data Compression Book by Nelson, BPB.

Online Resources: 1. NPTEL / SWAYAM lectures.

Semester – VI

Course code: DSC23PEP351	**Course name:** Spatial Statistics-Lab **Course category:** PEC
Credits: 1	**Teaching scheme:** P-2 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: 1. Remote Sensing 2. Geographic Information Systems	
Lab Objectives:	
1. Introduce students to R programming for spatial data analysis techniques.	
2. Develop skills in spatial data visualization and mapping using R.	
3. Apply interpolation, cross-validation, and model selection techniques in R.	
4. Analyze spatial patterns, autocorrelation, and regression modeling in R.	
5. Evaluate geostatistical models using selection, diagnostics, and validation methods.	
Lab Outcomes: At the end of the course, the students will be able to -	
LO1: Implement spatial data visualization and mapping techniques using R.	
LO2: Perform spatial interpolation and cross-validation for accurate predictions.	
LO3: Analyze spatial patterns using nearest neighbor and Ripley's K.	
LO4: Develop spatial regression models and perform diagnostic assessments.	
LO5: Evaluate geostatistical models through selection, validation, and interpretation.	

List of Experiments:-

Experiment 1: Introduction to R for Spatial Data Analysis
Experiment 2: Spatial Data Visualization and Mapping in R
Experiment 3: Spatial Interpolation in R
Experiment 4: Cross-validation and Model Selection for Spatial Interpolation in R
Experiment 5: Point Pattern Analysis in R
Experiment 6: Nearest Neighbor Analysis, Ripley's K Function, and Spatial Autocorrelation in R
Experiment 7: Spatial Regression Modeling in R
Experiment 8: Model Selection and Diagnostics in Spatial Regression in R
Experiment 9: Geostatistics in R
Experiment 10: Model Selection and Validation in Geostatistics in R

Semester-VI

Course code: ITY23PEP353 **Course name:** Big Data Modelling and Management - lab **Course category:** PEC
Credits: 1 **Teaching scheme:** P-2 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Any one Programming Language (Java preferably), DBMS
Lab Objectives:
1. To introduce students to the basics of configuring and deploying a Hadoop mini-cluster for distributed computing.
2. To implement foundational MapReduce programs for large-scale data processing.
3. To introduce students to Apache Spark and its advantages over traditional Hadoop MapReduce.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Configure and deploy a basic Hadoop cluster for distributed computing.
LO2: Understand Apache Spark and its operations for processing big data in real-time and batch modes.
LO3: Apply machine learning models to large datasets using big data tools.

List of Experiments

Sr. No.	Name of Practical
1	Set Up a Mini Hadoop Cluster
2	Implement Basic MapReduce Programs
3	Write a Map Reduce program to count words from a given text file.
4	Write a Map Reduce program for weather data collection
5	Explore Apache Spark
6	Build Data Pipelines
7	Practice Data Cleaning and Transformation
8	Analyze Real-World Data with Machine Learning
9	Visualize Big Data Insights
10	How to Participate in Open-Source Projects

Semester-VI

Course code: AIM23PEP352 **Course name:** Cryptography and Data Compression Lab **Course category:** PEC
Credits: 1 **Teaching scheme:** P-2 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic Knowledge of Cryptography and Programming.
Lab Objectives:
1.Develop a hybrid encryption program combining symmetric (AES) and asymmetric (RSA) techniques for secure communication.
2. Implement data compression and encryption together, optimizing storage and transmission.
3. Create an encrypted archive tool integrating compression and encryption, and evaluate its performance.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Implement hybrid encryption schemes combining symmetric and asymmetric algorithms for secure data communication.
LO2: Apply data compression techniques to encrypted data and evaluate size and security.
LO3: Develop and assess tools that combine encryption and compression for efficient data storage and transmission.

List of Experiments

1. **Hybrid Encryption:** a. Develop a program that combines symmetric and asymmetric encryption techniques for secure communication. b. Use asymmetric encryption (e.g., RSA) to exchange a symmetric encryption key securely.
2. Implement symmetric encryption (e.g., AES) to encrypt the actual data efficiently.
3. Evaluate the performance and security of the hybrid encryption scheme.
4. **Compressed Cryptography:** a. Explore techniques for integrating data compression with encryption to optimize storage and transmission. b. Develop a program that compresses plaintext data using algorithms like Huffman coding or LZ77.
5. Apply encryption to the compressed data using symmetric encryption (e.g., AES). Compare the size and security of the compressed ciphertext with uncompressed ciphertext.
6. **Encrypted Archive Tool:** a. Create a tool for creating encrypted archives that combine compression and encryption functionalities. b. Allow users to select files or directories for compression and encryption.

7. Implement encryption using a symmetric cipher like AES with a user-provided passphrase.
8. Evaluate the efficiency of the tool by comparing the size of encrypted archives with and without compression.

Semester – VI

Course code: DSC23PEL352 **Course name:** Spatial Econometrics **Course category:** PEC	
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40	
Duration of Theory Exam: 2 Hrs	
Pre-requisites: 1. Remote Sensing 2. Geographic Information Systems 3. Spatial Statistics	
Course Objectives:	
1. Understand the basics of spatial econometrics, including the nature of spatial data and spatial dependence.	
2. Use spatial regression models to analyze spatial data.	
3. Understand the differences between cross-sectional and panel data models, and apply spatial econometric techniques to panel data.	
4. Analyze endogeneity in spatial data, and use instrumental variables to account for it.	
5. Apply spatial econometric techniques to spatial interaction and hedonic pricing models.	
6. Understand advanced topics in spatial econometrics, such as Bayesian spatial econometrics and spatial nonlinear models.	
7. Analyze and interpret the results of spatial econometric analyses.	
8. Use statistical software to estimate and interpret spatial econometric models.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Use spatial regression models to analyze cross-sectional and panel data.	
CO2: Analyze endogeneity in spatial data, and use instrumental variables to account for it.	
CO3: Apply spatial econometric techniques to spatial interaction and hedonic pricing models.	
CO4: Analyze and interpret the results of spatial econometric analyses.	
CO5: Critically evaluate the use of spatial econometric techniques in empirical research.	
CO6: Explain advanced topics in Spatial Econometrics.	

Contents:-

Unit	Content	Teaching hours
1	**Introduction to Spatial Econometrics** Introduction to spatial data and its unique characteristics, Basic concepts and methods of spatial statistics, Spatial autocorrelation and spatial dependence, Exploratory spatial data analysis (ESDA)	6
2	**Spatial Regression Models** Spatial interpolation methods such as inverse distance weighting (IDW), kriging, and spline interpolation Cross-validation and model selection for spatial interpolation, Applications of spatial interpolation in data science	6
3	**Spatial Panel Data Models** Types of point patterns and their characteristics, Measures of spatial patterns such as nearest neighbor analysis, Ripley's K function, and spatial autocorrelation, Simulation-based inference for point patterns, Applications of point pattern analysis in data science	6
4	**Endogeneity and Instrumental Variables**	6

	Simple linear regression and multiple linear regression models in spatial context, Spatial dependence models such as spatial autoregressive models and spatial error models, Spatial panel data models, Model selection and diagnostics in spatial regression	
5	**Spatial Econometric Techniques for Spatial Interaction and Hedonic Pricing** Maximum-Likelihood estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation.	**8**
6	**Advanced Topics in Spatial Econometrics** Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.	**8**

Text Books:
1. Luc Anselin (1988) "Spatial Econometrics: Methods and Models", 1 st edition, Springer.
2. Roger S. Bivand, Edzer J. Pebesma, and Virgilio Gómez-Rubio (2013) "Applied Spatial Data Analysis with R", 2 nd edition, Springer.
3. James LeSage and R. Kelley Pace (2009), "Introduction to Spatial Econometrics", 1 st edition, Chapman and Hall / CRC.
4. Giuseppe Arbia (2024) "A Primer for Spatial Econometrics: With Applications in R, STATA and Python", 2 nd edition, Springer.
5. J. Paul Elhorst (2014) "Spatial Econometrics: From Cross-Sectional Data to Spatial Panels", 1 st edition, Springer.
Reference Books:
1. Vernon Henderson and Jacques-Francois Thisse (2004), "Handbook of Regional and Urban Economics, Volume 4: Cities and Geography", 1 st edition, Elsevier.
2. Faye Anderson (2020), "Spatial Analysis by Example: Hands-on approach using R", 1 st edition, Independent.
3. Robert Haining (2003), "Spatial Data Analysis: Theory and Practice”, 1 st edition, Cambridge University Press.
4. Marie-Josée Fortin and Mark R.T. Dale (2014), "Spatial Analysis: A Guide for Ecologists" 2 nd edition,Cambridge University Press.

Semester-VI

Course code: ITY23PEL356 **Course name:** Big Data Integration and Processing (Elective III) **Course category:** PEC
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites:
1. Any programming Language (Java preferably), Basics of DBMS
Course Objectives:
1. To equip students with the theoretical and practical knowledge of big data integration and processing techniques.
2. To develop skills in designing, implementing, and managing big data pipelines.
3. To understand the challenges and solutions related to data diversity, volume, and velocity.
4. To apply various tools and frameworks for big data integration and processing tasks.
5. To gain insights into the applications of big data in different engineering disciplines
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand theoretical and practical knowledge of big data integration and processing techniques.
CO2: Develop skills in designing, implementing, and managing big data pipelines
CO3: Understand the challenges and solutions related to data diversity, volume, and velocity.
CO4: Apply various tools and frameworks for big data integration and processing tasks.
CO5: Gain insights into the applications of big data in different engineering disciplines.

Contents –

Unit	Content	Teaching hours
1	**Introduction to Big Data -** Introduction to Big Data, What is Big Data? Definition, Characteristics, and Challenges V Model, Sources of Big Data (Sensor Data, Social Media, Web Logs, etc.), Applications of Big Data in Engineering (Manufacturing, Energy, Robotics.	8
2	**Big Data Integration-** Data Integration Challenges (Heterogeneity, Schema Matching, Privacy), Data Warehouse vs. Data Lake Architectures, ETL (Extract, Transform, Load) Processes for Data Integration, Introduction to Apache Spark for Data Integration Pipelines, Building and Managing Data Pipelines with Cloud Platforms (AWS Glue, Azure Data Factory).	8
3	**Big Data Processing Techniques -** Distributed File Systems (Hadoop, HDFS), Map Reduce Programming for Big Data Processing, Introduction to Apache Spark for Big Data Processing (RDDs, DataFrames), Real-time Data Processing with Apache Kafka, Stream Processing Applications in Engineering, Data Cleaning and Transformation Techniques, Data Quality Management in Big Data Environments	8
4	**Big Data Analytics and Visualization -**	8

	Introduction to Big Data Analytics Tools (Pig, Hive, Spark SQL), Machine Learning for Big Data Analysis -Regression, Classification, Clustering, Big Data Visualization Techniques, Interactive Dashboards and Reporting with Big Data	
5	**Case Studies and Applications -** Big Data in Smart Grid and Energy Management, Predictive Maintenance and Anomaly Detection in Industrial Processes, Big Data for Personalized Learning and Educational Technology, Big Data for Disaster Management and Environmental Monitoring	8

Text Books:
1. Big Data: A Revolution That Will Transform How We Live, Work, and Think, Viktor Mayer-Schönberger and Kenneth Cukier
2. Hadoop: The Definitive Guide, by Tom White
3. Spark: The Definitive Guide, Bill Chambers and Matei Zaharia
4. Data Integration: Tools and Techniques for Building a Unified View of Your Data, by William H. Inmon
Reference Books:
1. Designing Data-Intensive Applications, Martin Kleppmann 2. Big Data: Principles and Best Practices, Thomas Erl, Wajid Khattak, and Paul Buhler
3. Data Science for Business, Foster Provost and Tom Fawcett
4. Learning Scala for Spark and Big Data, O'Reilly Media
Online Resources: 1. NPTEL / SWAYAM lectures.

Semester-VI

Course code: AIM23PEL354 **Course name:** Steganography and Digital Watermarking **Course category:** PEC
Credits: 3 **Teaching scheme:** L-3 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs
Pre-requisites: Network security, Cryptography
Course Objectives:
1. To provide an insight to steganography techniques and watermarking methods.
2. To explore attacks on data hiding and ensure data integrity.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Explore watermarking techniques and understand the concept through examples.
CO2: Learn the concept of information hiding.
CO3: Survey current steganography techniques and understand how to detect and extract hidden information.

Contents –

Unit	Content	Teaching hours
1	**Introduction -** Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.). Steganalysis: Active and Malicious Attackers, Active and passive Steganalysis.	9
2	**Automatic Speech Recognition-** Frameworks for secret communication (pure steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive).	9
3	**HMM for Acoustic Modelling -** Steganography techniques: Substitution systems, Spatial Domain, transform domain techniques, Spread spectrum, Statistical steganography, Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets	9
4	**Neural network acoustic models-** Digital Watermarking: Introduction, Difference between Watermarking and Steganography, Classification (Characteristics and Applications), types and techniques (Spatial-domain, Frequency-domain, and Vector quantization based watermarking), Watermark security & authentication	9
5	**Machine Learning in Dialog -** Recent trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSB Steganalysis using primary sets.	9

Text Books:

1. Peter Wayner, "Disappearing Cryptography – Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002

2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, "Digital Watermarking and Steganography", Margan Kaufmann Publishers, New York, 2008.

Reference Books: 1. Information Hiding: Steganography and Watermarking-Attacks and Countermeasures by Neil F. Johnson, Zoran Duric, Sushil Jajodia.
2. Information Hiding Techniques for Steganography and Digital Watermarking by Stefan Katzenbeisser, Fabien A. P. Petitcolas.
Online Resources: 1. NPTEL / SWAYAM lectures.
1. Cyber Security, https://swayam.gov.in/nd2_cec20_cs09/preview.
2. Introduction to Cyber Security, https://swayam.gov.in/nd2_nou20_cs01/preview

Semester – VI

Course code: DSC23PEL352	**Course name:** Spatial Econometrics-Lab	**Course category:** PEC
Credits: 1	**Teaching scheme:** P-2 Hrs/Week	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: 1. Remote Sensing
2. Geographic Information Systems
3. Spatial Statistics

Lab Objectives:

1. Introduce spatial econometric techniques for analyzing spatial economic data using R.
2. Develop skills in estimating spatial regression and panel data models.
3. Apply spatial interaction, hedonic pricing, and instrumental variable techniques.
4. Explore Bayesian spatial econometrics and nonlinear models for economic analysis.
5. Analyze real-world economic problems using spatial econometric modeling techniques.

Lab Outcomes: At the end of the course, the students will be able to -

LO1: Analyze spatial autocorrelation in economic data using statistical techniques.
LO2: Estimate spatial regression and panel data models in R.
LO3: Implement instrumental variable estimation and hedonic pricing models.
LO4: Evaluate Bayesian and nonlinear spatial econometric models in economic studies.
LO5: Apply spatial econometric techniques to real-world housing and labor markets.

List of Experiments:-

Experiment 1: Exploring Spatial Autocorrelation in Economic Data
Experiment 2: Estimating Spatial Regression Models using R
Experiment 3: Estimating Spatial Panel Data Models using R
Experiment 4: Implementing IV Estimation in Spatial Econometrics using R
Experiment 5: Estimating Spatial Interaction and Hedonic Pricing Models using R
Experiment 6: Spatial Data Visualization and Mapping using GIS tools
Experiment 7: Application of Spatial Econometrics in a Real-World Problem
Experiment 8: Exploring Bayesian Spatial Econometrics using R
Experiment 9: Spatial Nonlinear Models and their Application in Economic Data
Experiment 10: Spatial Analysis of Housing and Labor Markets using Real-World Data

Semester-VI

Course code: ITY23PEP356 **Course name:** Big Data Integration and Processing -LAB **Course category:** PEC
Credits:1 **Teaching scheme:** P-2 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites:
Lab Objectives:
1. To introduce the architecture and setup of a Hadoop cluster on virtual machines or cloud platforms.
2. To implement basic MapReduce programs for large-scale data processing tasks.
3. To practice data preprocessing techniques such as cleaning, filtering, and transforming raw data for analytical use.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Gain practical knowledge of setting up and managing Hadoop clusters.
LO2: Apply machine learning algorithms to real-world datasets for predictive and descriptive analysis.
LO3: Use tools like Tableau, Power BI, or libraries like Matplotlib and D3.js for visualization.

List of Experiments

Sr. No.	Name of Practical
1	Set up a Hadoop cluster using a virtual machine or cloud platform
2	Implement basic MapReduce programs for data processing tasks
3	Work with Apache Spark for real-time and batch processing
4	Build a data pipeline using ETL tools and cloud platforms
5	Practice data cleaning and transformation techniques with big data tools.
6	Analyze real-world datasets using machine learning algorithms.
7	Visualize big data insights using interactive dashboards and tools.
8	Participate in open-source big data projects or contribute to online coding challenges.

Semester-VI

Course code: AIM23PEP354 **Course name:** Steganography and Digital Watermarking Lab **Course category:** PEC
Credits: 1 **Teaching scheme:** P-2 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic Understanding of Cryptography and Multimedia Processing
Lab Objectives:
1.To implement various steganography techniques to hide and extract messages within images, audio, text, and files.
2. To explore digital watermarking techniques and assess the robustness of watermarked images.
3. To use steganalysis tools to detect hidden information and evaluate their effectiveness.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Apply steganography methods to embed and extract hidden messages in different media (image, audio, text, file).
LO2: Implement watermarking techniques and evaluate their resilience against image transformations.
LO3: Use steganalysis tools to detect hidden data and assess the effectiveness of various detection methods.

List of Experiments

1. **Image Steganography:** a. Use a steganography tool or library to hide a text message within an image file. b. Experiment with different encoding techniques (LSB, DCT, etc.) to embed the message and observe the impact on image quality. c. Try to extract the hidden message from the steganographic image and verify its accuracy.
2. **Audio Steganography:** a. Hide a short audio clip or message within a longer audio file using a steganography tool. b. Explore different methods like LSB modification in the frequency domain or spread spectrum techniques. c. Verify the successful extraction of the hidden audio message and compare it with the original.
3. **Text Steganography:** a. Conceal a secret message within a piece of text using techniques like whitespace steganography or modifying letter casing. b. Share the modified text with others and challenge them to extract the hidden message without prior knowledge
4. **File Steganography:** a. Hide a file (such as a document or an image) within another file format (like an audio or video file). b. Utilize appropriate steganography tools to embed the file and ensure its retrieval without corruption.

5. **Digital Image Watermarking:**
    a. Select an image and embed a visible watermark containing your name or a logo.
    b. Explore different watermarking techniques (e.g., spatial domain, frequency domain) and compare their effectiveness.
    c. Assess the robustness of the watermark by subjecting the watermarked image to various transformations (resizing, compression, etc.).

6. **Steganalysis:**
    a. Use steganalysis tools or techniques to detect the presence of hidden information within steganographic images or audio files.
    b. Analyze the characteristics of steganographic content and develop strategies for detecting hidden data.
    c. Experiment with different steganalysis methods and assess their accuracy in identifying steganographic content.

Semester-VI

Course code: ITY23VSP301 **Course name:** Mobile Application Development Lab **Course category:** VSEC
Credits: 2 **Teaching scheme:** P-4 Hrs/Week **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Fundamentals of Programming Logic
Lab Objectives:
1. To enable the students to understand the core principles of the Object-Oriented Language
2. To understand the concept of packages and applet programming
3. To understand the concept of Multi-threading
4. To understand the concept of graphic programming
5. Introduce the students to database connectivity
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Apply Object Oriented concepts to develop programs in Java.
LO2: Develop programs using packages and applet programming.
LO3: Develop programs using Inheritance, Interfaces. Multithreading.
LO4: Develop programs using graphic programming
LO5: Develop applications using databases.

Contents –

Unit	Content
1	**Introduction To android-** A little Background about mobile technologies • Android – An Open Platform for Mobile development • Native Android Application • Android SDK Features •what does Android run on? Free Additional Benefits Only At WEBCOM • Why Develop for Mobile? • Why develop for Android? • Android Development Framework • Android Application Architecture • Android Libraries
2	**User Interface -** •Developing for Android • First Android application Using Android Studio/Visual studio xamarin • Running and Debugging •Creating Application and Activities • Application Manifest Introduction • Android Application Life Cycle • Application Priority and process states• Fundamental Android UI Design •Study of different layouts (Linear, relative, table, absolute, frame, Constraint) • Introducing Views • Creating new Views • Draw able Resources • Creating and Using menus
3	**Intent and Broadcast receiver-** • I Introducing Intents • Intents and Intent filters • What are Pending Intents • Adapters • Internet Resources • Notifications • Introducing Dialogs • Saving Application Data in external and internal memory• Creating and saving preferences • Retrieving shared preferences• Creating a standard preference activity • Saving Activity State • Saving and Loading Files • Including static files as Resources • File management tools
4	**Database Content Provider -** Introducing Android Databases • Introducing SQLite • Cursors and content values • Working with SQLite Database • Creating new content Provider •Introduction to Firebase •Real time/ Cloud

	•Authentication in firebase• Introduction to MySQL database •Connecting to MySQL by JSON, PHP scripts.
5	**Telephony, hardware, network services, google services/map and multimedi-** Telephony • Reading Phone device details • Reading Sims Details • Incoming and outgoing call monitoring• Tracking Service Change • Introducing SMS and MMS • Sending SMS and MMS • Sending SMS messages manually• Use of Bluetooth • Managing Network Connectivity • Managing Wi-Fi Google Map - Layout file • Google Map – Android Manifest file • Customizing Google Map • Adding Marker • Changing Map Type •Enable/Disable zoom• Using Sensors and Sensor Manager Interpreting sensor values • Using Compass, Accelerometer and orientation services • Controlling Device Vibration • Working with multimedia players (Audio/Video)

Text Books/ Reference Books/ Internet Resource:

1. Hello Android: Pragmatic Bookshelf 2009
2. Professional Android Development, Wrox
3. Mobile App Development

List of Experiments: Design, develop and implement following assignments using Android Studio/ Visual studio Xamarin.

Sr. No.	Name of Practical
1	Design and develop Android Application to display "Hello World" using basic Widgets
2	Design and develop Android Application to demonstrate Activity Life Cycle
3	Design and develop Android Application to demonstrate GUI by using different Layouts/widgets
4	Design and develop Android Application to demonstrate views in Android
5	Design and develop Android Application to demonstrate Intents(Implicit/ Explicit)
6	Design and develop Android Application to demonstrate Broadcast Receivers/Services
7	Design and develop Android Application to demonstrate Saving Files in External/Internal Storage
8	Design and develop Android Application to demonstrate Content Providers
9	Design and develop Android Application to demonstrate SQLite database (Dictionary, Quiz, etc.)
10	Design and develop Android Application to demonstrate firebase operations (data push, retrieval, delete, update etc.)
11	Design and develop Android Application to demonstrate MySQL database
12	Design and develop Android Application to demonstrate use of Telephony (Call/SMS)
13	Design and develop Android Application to demonstrate use of Bluetooth/wi-fi
14	Design and develop Android Application to demonstrate use of google map API
15	Design and develop Android Application to play audio/video files
16	Design and develop Android Application to demonstrate sensors (Accelerometer/Campass)

Semester-VII

Course code: DSC23PCL401 **Course name:** Generative Adversarial Networks **Course category:** PCC
Credits: 3 **Teaching scheme:** L-3 Hrs/week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2Hrs
Pre-requisites: Basic understanding of machine learning methods
Course Objectives:
1. To provide the basic understanding of the fundamental concept of GAN and CNN.
2. To provide understanding of architecture of GAN and its integration with CNN
3. To provide understanding of the application of GAN and CNN.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Gain proficiency in Fundamental concepts of GAN And CNN.
CO2: GAN and CNN Architecture and variants.
CO3: Apply GAN And CNN to real world problems.
CO4: Ethical Considerations and Responsible Use of GAN and CNN

Contents –

Unit	Contents	Teaching hours
1	**Introduction to Generative Adversarial Networks -** Overview of Generative Models, Introduction to GANs, Basic architecture of GANs, Training GANs, Challenges and common issues in GAN training.	9
2	**Convolutional Neural Networks (CNN) Fundamentals -** Basics of Convolutional Neural Networks, CNN architecture and components, Convolutional layers, pooling, and fully connected layers, Training CNNs for image classification tasks, Transfer learning with pre-trained CNNs	9
3	**GAN Architectures and Variants -** Deep Convolutional GAN, Conditional GANs, Info GAN (Information Maximizing GAN), Style GAN and StyleGAN2, Wasserstein GAN (WGAN) and WGAN-GP, Cycle GAN and Pix2Pix	9
4	**Application of GANs and CNNs -** Image-to-Image Translation, Super-Resolution, Face Aging and DE aging Image Synthesis and Style Transfer, Deep fake Generation, GANs in Healthcare and Biology	9
5	**Advanced Topics and Research Directions -**Progressive GANs, Self-Supervised Learning with GANs, Adversarial Auto encoders ,GANs for Anomaly Detection, Ethical Considerations in GANs, Future Trends and Emerging Research Areas.	9

Text Books:
1 Devid Foster,"Generative Deep Learning", 1st edition O′Reilly (12 July 2019) , ISBN-10 : 1492041947
2. Jakub Langr and Daniel Kodex , "GANs in Action", 1st edition, Manning, ISBN-13 ,978-1638354239

Reference Books:

1. Rafael Valley ”Hands-On Generative Adversarial Networks with Keras”, Packt Publishing Limited (3 May 2019), ISBN-10 : 1789538203, ISBN-13 : 978-1789538205
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville “Deep Learning", Lakshmi Narain Agarwal (31 December 2024), IBISBIL

Online Resources: 1. NPTEL / SWAYAM lectures.

Semester-VII

Course code: ITY23PCL402	**Course name:** Cloud Computing	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2 Hrs/Week	**Evaluation scheme:** CA–40, MSE–20, ESE–40
Theory Exam Duration: 2 Hrs		
Pre-requisites: Computer Networks		
Course Objectives:		
1. To give students an insight into the basics of cloud computing along with virtualization.		
2. To provide the students basic understanding about cloud and virtualization along with how one can migrate over it		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the concepts of Cloud Computing		
CO2: Classify the different services in Cloud service models		
CO3: Identify various virtualization techniques		
CO4: Demonstrate the virtualization process using a simulator.		

Contents –

Unit	Content	Teaching hours
1	**Introduction -** Cloud concept The Emergence of Cloud Computing, Cloud deployment Models, Characteristics of Cloud Computing, Challenges for the Cloud.	6
2	**Cloud Service Models -** Introduction to IaaS - IaaS definition, Examples: Amazon EC2 - Renting, EC2 Compute Unit, Platform and Storage, pricing. Introduction to PaaS -What is PaaS, Cloud Platform and Management -Computation, Storage,.Google App Engine , Microsoft Azure.Software as a Service (SaaS)- Introduction to SaaS, Web services, SalesForce.com platform.	8
3	**Virtualization -** Transaction Speed, Transaction Fees, Network Size, Complexity, Interoperability Problems, Lack of Standardization. Lack of Supportive Regulations Related to Blockchain Applications.	8
4	**Cloud Simulator -** Cloud Simulators CloudSim and GreenCloud Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud	8

Text Books: 1. "Cloud Computing: Concepts, Technology & Architecture" By Ricardo Puttini, Thomas Erl, and Zaigham Mahmood, ISBN- 9789332535923, Pearson Education
Reference Books: 1. Gautam Shroff, " Enterprise Cloud Computing Technology, Architecture, Applications", Cambridge University press.

Semester-VII

Course code: ITY23PCP402	**Course name:** Cloud Computing Lab	**Course category:** PCC
Credits: 1	**Teaching scheme:** P-2 Hrs/Week	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Computer Networks

Lab Objectives:

1.To study the emergence and evolution of cloud computing

2.To understand and explore different cloud service models

3. To study and demonstrate virtualization techniques using various virtualization tools

Lab Outcomes: At the end of the course, the students will be able to -

LO1: Use Google Cloud services for printing and collaborative tasks effectively.

LO2: Apply and analyze virtualization techniques using different tools and platforms.

LO3: Access and utilize AWS cloud services for basic computing and storage requirements.

LO4: Identify and differentiate between various cloud services and deployment models

List of Experiments

1. To study emergence of cloud computing
2. To study different cloud services
3. Demonstration of Google cloud Print
4. Collaborating on Google Calendars, Google docs, sheets and Presentations
5. Creating a warehouse application in salesforce.com
6. Demonstration of Virtualization techniques using different tools
7. Demonstration of AWS service using Amazon
8. Virtualization using a Cloud Simulator

Semester-VII

Course code: DSC23PCL402 **Course name:** Cognitive Computing **Course category:** PCC
Credits:2 **Teaching scheme:** L- 2Hrs/ Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Pre-requisites: Python programming, probability and statistics, linear algebra, and introductory concepts of artificial intelligence and machine learning**.**
Course Objectives:
1. To familiarize Use the Innovation Canvas to justify potentially successful products.
2. To learn various ways in which to develop a product idea.
3. To understand about how Big Data can play vital role in Cognitive Computing
4. To know about the business applications of Cognitive Computing
Course Outcomes: At the end of the course, the students will be able to -
CO1: Explain applications in Cognitive Computing.
CO2: Describe Natural language processor role in Cognitive computing.
CO3: Explain future directions of Cognitive Computing
CO4: Evaluate the process of taking a product to market
CO5: Comprehend the applications involved in this domain.

Contents –

Unit	Content	Teaching hours
1	**FOUNDATION OF COGNITIVE COMPUTING** Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation, and visualization services	06
2	**NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS** Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.	06
3	**BIG DATA AND COGNITIVE COMPUTING** Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, using advanced analytics to create value, Impact of open source tools on advanced analytics.	06
4	**BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING**	06

	Preparing for change ,advantages of new disruptive models , knowledge meaning to business, difference with a cognitive systems approach , meshing data together differently, using business knowledge to plan for the future , answering business questions in new ways , building business specific solutions , making cognitive computing a reality , cognitive application changing the market The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing	
5	**APPLICATION OF COGNITIVE COMPUTING** Building a cognitive health care application: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem, learning from patterns in healthcare Data, Building on a foundation of big data analytics, cognitive applications across the health care eco system, starting with a cognitive application for healthcare, using cognitive applications to improve health and wellness, using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching	06

Text Books:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics", Wiley, 2015
2. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999.

Reference Books:

1. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.orgPublishing Company Private Limited, New Delhi.

Semester-VII

Course code: ITY23PCL404 **Course name:** Advanced Web Programming **Course category:** PCC
Credits: 2 **Teaching scheme:** L-2 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Theory Exam Duration: 2 Hrs/Week
Pre-requisites: basic knowledge of HTML5, JAVAScript, CSS
Course Objectives:
1. To deepen understanding of the Java Servlet and JavaServer Pages (JSP) technologies
2. To explore advanced web application concepts like security, concurrency, and scalability
3. To introduce popular Java web frameworks for efficient development
4. To build real-world web applications using best practices
Course Outcomes: At the end of the course, the students will be able to -
CO1: Demonstrate an in-depth understanding of the Java Servlet and JavaServer Pages (JSP) technologies
CO2: Explore advanced web application concepts like security, concurrency, and scalability
CO3: Identify and use popular Java web frameworks for efficient development
CO4: Build real-world web applications using best practices

Contents –

Unit	Content	Teaching hours
1	**Java Enterprise Edition -** Introduction, Overview of J2EE, J2EE Architectures JEE Services, HTTP protocol: Request and Response, Web Containers, Web Server., Introduction to Ajax, XML HTTP Request & Response, Introduction to RMI, RMI Architecture	7
2	**Servlet Programming & Java Server Pages(JSP) -** Basics of Servlet,Introduction to JSP: Life cycle of JSP, JSP API , Architecture. Scripting elements: scriptlet tag, expression tag, declaration tag ,Implicit Objects: out, request, response, config, application, session, pageContext, page, exception, Directive Elements: page directive, include directive , taglib directive, Exception Handling, Action Elements: jsp:forward, jsp:include, Bean class, jsp:useBean, jsp:setProperty & jsp:getProperty, Displaying applet in JSP, Custom tags: Custom Tag : What and Why? Custom Tag API? Custom Tag Example, Attributes, Iteration, Custom URI	8
3	**Hibernet -** Introduction to Hibernate: Overview of ORM and its importance Introduction to Hibernate framework Hibernate architecture and components 2. Setting Up Hibernate:Downloading and configuring Hibernate Configuring Hibernate properties Integrating Hibernate with Java applications 3. Hibernate Mapping: Entity mapping and Hibernate annotations Hibernate XML mapping files Composite keys and associations Inheritance mapping strategies 4. Hibernate Query Language (HQL): Basics of HQL and its syntax Retrieving and updating entities using HQL Named queries and native SQL queries Query caching and performance optimization	8
4	**Introduction to spring -** Introduction to Spring :Overview of Spring, Spring Architecture and Container, dependency injection, Spring Web MVC Framework.	7

Text Books: 1. Subrahmanyam Allamaraju, Samir Tyagi, Karl Avedal, John Griffin, "Professional Java Server Programming", Wrox Publication.
2. James Holmes, "The Complete Reference Struts", TataMcGraw Hill.
Reference Books: 1. Java Server Programming (Java EE 5) Black Book by Wiley Publication. 2. Sharanam Shah, Vaishali Shah, "Java EE 6 for Beginners", Shroff Publishers & Distributors Pvt. Ltd.

Semester-VII

Course code: DSC23PCP402 **Course name:** Cognitive computing Lab **Course category:** PCC
Credits: 1 **Teaching scheme:** P- 2 Hrs/ week **Evaluation scheme:** TW–30, PR–20
Course Objectives:
1. To introduce the fundamentals of cognitive computing, including NLP, speech recognition, computer vision, and neural networks.
2. To provide hands-on experience with deep learning frameworks such as TensorFlow and PyTorch for building intelligent systems.
3. To develop the ability to design, implement, and evaluate cognitive models and human-computer interaction systems**.**
4. To create awareness of ethical considerations, interpretability, and usability in cognitive computing applications.
Course Outcomes: At the end of the course, the students will be able to -
LO1: Implement basic cognitive computing components such as NLP systems, filtering techniques, and speech recognition applications**.**
LO2: Develop intelligent models using TensorFlow and PyTorch for tasks like emotion recognition and decision-making analysis.
LO3: Design and evaluate human-computer interaction systems and simple cognitive models simulating human cognition.
LO4: Analyze model interpretability, decision-making processes, and ethical issues related to cognitive computing systems.

List of Experiments:

1. Implement a basic NLP library
2. Study of TensorFlow and PyTorch
3. Study of speech recognition system using tools like Google's Speech recognition API.
4. Study of filtering techniques
5. Create a system that recognizes emotions from facial expressions using computer vision techniques.
6. Develop a simple cognitive model to simulate a specific aspect of human cognition.
7. To understand and visualize the decision-making process of a neural network model
8. Design and implement a human-computer interaction evaluate the usability of a system.
9. Discuss and analyze ethical issues related to cognitive computing
10. Implement a chatbot or virtual assistant using NLP and deep learning techniques.

Semester-VII

Course code: ITY23PCP404 **Course name:** Advanced Web Programming Lab **Course category:** PCC		
Credits: 1	**Teaching scheme:** P-2 Hrs/Week	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: core JAVA, OOP principles, web fundamentals		
Lab Objectives:		
1. To deepen understanding of the Java Servlet and JavaServer Pages (JSP) technologies		
2. To explore advanced web application concepts like security, concurrency, and scalability		
3. To introduce popular Java web frameworks for efficient development		
4. To build real-world web applications using best practices		

Lab Outcomes: At the end of the course, the students will be able to -
LO1: To deepen understanding of the Java Servlet and JavaServer Pages (JSP) technologies
LO2: To explore advanced web application concepts like security, concurrency, and scalability
LO3: To introduce popular Java web frameworks for efficient development
LO4: To build real-world web applications using best practices

List of Experiments

1. Develop simple applications using AJAX and JSON.
2. Develop application using for Servlet life cycle
3. Develop a Servlet program to print HTTP header information.
4. Develop application using JSP
5. Develop application using JSP Elements: Directives, Scripting, Action tags
6. Develop application using JSP Directives, Scripting, Action tags,
7. Develop application using JSP object scope page, request, session
8. Develop application program using custom tags
9. Develop application stateless JavaBeans
10. Develop application stateful JavaBeans
11. Develop application entity JavaBeans
12. Develop a hibernate application to store the feedback of website visitors in database
13. Develop a simple Hibernate application using any Database.
14. Develop Simple MVC Spring application.

Semester-VII

Course code: ITY23RML401 **Course name:** Research Methodology **Course category:** RM
Credits: 4 **Teaching scheme:** L- 4 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Theory Exam Duration: 2 Hrs
Pre-requisites: Knowledge of Mathematics and Statistics, Analytical and Logical Thinking
Course Objectives:
1. To explain the nature and role of research in engineering practice
2. To formulate research problems and objectives from engineering contexts
3. To design appropriate research and experimental strategies
4. To interpret engineering data and justify conclusions logically
5. To apply ethical principles and IPR concepts in research work
6. To prepare structured technical reports and research presentations
Course Outcomes: At the end of the course, the students will be able to -
CO1: Apply fundamental research concepts to engineering problems
CO2: Analyze real-world problems to frame researchable questions
CO3: Develop logically sound research designs
CO4: Analyze and interpret data to support engineering decisions
CO5: Evaluate ethical, legal, and societal implications of research
CO6: Create clear and structured research documents and presentations

Contents –

Unit	Content	Teaching hours
1	**Foundations of Research in Engineering -** Meaning and objectives of research; Engineering research vs. scientific research; Types of research: exploratory, descriptive, analytical, experimental, design-oriented; Basic research, applied research, translational research; Role of research in innovation, patents, and societal impact; Interdisciplinary and multidisciplinary research.	10
2	**Problem Identification and research design -** Identifying real-world engineering problems; Research gaps: literature-driven vs. practice-driven; Formulating research questions, objectives, and hypotheses; Variables, assumptions, and constraints; Research design types: experimental, quasi- experimental, observational, design-based; Validity and reliability (conceptual level).	10
3	**Data, Measurement and Experimental Planning -** Types of data: qualitative and quantitative; Scales of measurement; Sampling concepts and sample size logic; Design of experiments (introductory, non-mathematical); Error, uncertainty, and bias in engineering data; Ethical data collection practices.	10

4	**Data analysis and interpretation -** Descriptive statistics for engineers; Conceptual understanding of inferential statistics; Trend analysis and correlation; Model validation and interpretation of results; Logical reasoning from data to conclusions; Common pitfalls in analysis and interpretation	10
5	**Research ethics, IPR and academic integrity -** Ethics in engineering research; Plagiarism, fabrication, falsification; Authorship and publication ethics; Intellectual Property Rights: patents, copyrights, trade secrets; Introduction to standards, codes, and compliance; Responsible research and innovation.	10
6	**Technical writing and research communication-** Structure of technical papers and theses; Writing research objectives, methodology, and conclusions; Use of figures, tables, and citations; Referencing styles and literature management; Peer review process and responding to reviewers; Oral presentation of research	10

Text Books:

1. Booth, W.C., Colomb, G.G., & Williams, J.M. (2016), The Craft of Research, 4th Edition, University of Chicago Press

2. Creswell, J.W. (2014), Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 4th Edition, SAGE Publications

3. Kothari, C.R. (2019), Research Methodology: Methods and Techniques, 4th Edition, New Age International Publishers

4. Deb, D., Dey, R., & Balas, V.E. (2018), Engineering Research Methodology: A Practical Insight, Springer.

5. David Thiel (2014), Research Methods for Engineers, Cambridge University Press

6. P. Pandey & S.C. Pandey (2015), Research

Reference Books:

1.Ranjit Kumar (2019), Research Methodology: A Step-by-Step Guide for Beginners, 4th Edition, SAGE Publications

2. Uwe Flick (2018), Introducing Research Methodology: A Beginner's Guide, 2nd Edition, SAGE Publications

3. Saunders, M., Lewis, P., & Thornhill, A. (2019), Research Methods for Business Students, 7th Edition, Pearson

4. Dipak Bhattacharya (2018), Research Methodology: Principles and Practices, 5th Edition, Excel Books

5. Herman Tang (2023), Engineering Research: Design, Methods, and Publication, Wiley.

6. R.A. Fisher (1935), The Design of Experiments, Oliver & Boyd Ltd.

Semester-VII

Course code: ITY23RPJ401 **Course name:** Research Project **Course category:** RP
Credits: 4 **Teaching scheme:** P- 8 Hrs/Week **Evaluation scheme:** TW–60, PR–40
Pre-requisites: Knowledge of Mathematics and Statistics, Analytical and Logical Thinking
Lab Objectives:
1. To identify and analyze a real-world engineering problem
2. To design and develop a systematic solution or prototype
3. To implement and validate the proposed methodology through experimentation, simulation, or real-time data analysis.
4.To evaluate the performance of the proposed system using suitable metrics and compare it with baseline or existing approaches.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Apply engineering knowledge and problem-solving skills to develop an effective and feasible technical solution.
LO2: Demonstrate research aptitude, including literature review, methodology formulation, experimentation, and result interpretation..
LO3: Hands-on experience with modern engineering tools and technologies relevant to the chosen domain
LO4: Enhance professional skills, including technical documentation, teamwork, presentation, and ethical responsibility.

PROJECT GUIDELINES

1. Project Group size should be of maximum 4 students.

2. The project is to be taken up at the start of semester I and the project must be completed by the end of semester II.

3. While submitting project proposal care is to be taken that the project will be completed within the available time of two terms.

4. Project title should be precise and clear. Selection and approval of topic: Topic should be related to real life or commercial application in the field of Information Technology.

OR

Investigation of the latest development in a specific field of Information Technology.

OR

Commercial and Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.

5. The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by guide. This data should be used for finding the total man hours and estimating the cost of the project.

6. The group is expected to complete details Literature Survey, system/problem definition, analysis, design, etc. in (B.E. first Term) seventh term, as a part of term work in the form of a joint report.

Project report must be submitted in the prescribed format only. No variation in the format will be accepted.

7. The guides should regularly monitor the progress of the project work.

8. Assessment of the project for award of term work marks shall be done by the guide and a departmental committee as per the guidelines given in the following table.

9. The suggestive format of the report is as follows:

(Only one report should be submitted per group as a part of term work submission.)

Title of the Project:

Names & Roll Numbers of the students:

Name of the guide:

Chapter 1: Introduction

Chapter 2: Literature Survey

Chapter 3: System Development

A) Assessment of project –I Term Work B. Tech. First Term

Name of the Project:_____

Name of the Guide:_____

Sr. No.	Exam Seat No.	Name of the Student	Assessment by Guide (70%)					Assessment by Departmental Committee (30%)			
			Literature Survey	Topic Selection	Documentation	Attendance	Total	Evaluation	Presentation	Total	Grand Total
		Marks	05	2.5	7.5	2.5	17.5	2.5	5	7.5	25

Semester-VIII

Course code: DSC23PEL451 **Course name:** Time Series Analysis **Course category:**PEC
Credits:4 **Teaching scheme:**4 Hrs/ week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Pre-requisites: Probability and statistics, linear algebra, and Python programming**,** with an introductory understanding of data analysis concepts.
Course Objectives:
1. To introduce the fundamentals of time series analysis and predictive analytics along with their practical applications.
2. To develop the ability to analyze, decompose, and smooth time series data using appropriate statistical techniques.
3. To enable students to build classical time series and regression models and assess their assumptions and performance.
4. To equip students with data preparation, modeling, and evaluation skills for effective prediction and forecasting.
Course Outcomes:
CO1: Explain the characteristics, components, and exploratory techniques of time series data and identify suitable forecasting contexts.
CO2: Apply decomposition and smoothing methods, including moving averages and exponential smoothing, to analyze trends and seasonality.
CO3: Assess stationarity and develop AR, MA, and ARMA models using ACF/PACF and residual diagnostics.
CO4: Build ARIMA and introductory SARIMA models and evaluate forecast performance using appropriate accuracy measures.
CO5: Prepare data for predictive analytics by performing cleaning, transformation, exploratory analysis, and feature selection while avoiding data leakage.
CO6: Develop and evaluate regression-based predictive models using suitable metrics, diagnostics, and regularization techniques.

Contents –

Unit	Content	Teaching hours
1	**Introduction to Time Series and Exploratory Analysis**: definition and scope, types of time series, components (trend, seasonality, cyclic, irregular), visualization and exploratory tools, lag plots, rolling statistics, introduction to forecasting applications.	9
2	**Decomposition and Smoothing Methods:** additive and multiplicative decomposition, moving averages (simple and weighted), exponential smoothing (SES), Holt's trend method, Holt-Winters seasonal method, seasonal indices and pattern identification.	9
3	**Stationarity and Classical Statistical Models:** stationarity concept, transformation methods, differencing, white noise, ACF and PACF interpretation, AR, MA and ARMA models, parameter identification and residual diagnostics.	8

4	**ARIMA Forecasting and Performance Evaluation:** ARIMA (p,d,q), introduction to SARIMA, forecasting procedure, train-test split for time series, walk-forward validation, forecast accuracy metrics (MAE, MSE, RMSE, MAPE) and interpretation.	9
5	**Introduction to Predictive Analytics and Data Preparation:** predictive analytics workflow and applications, regression vs classification, data understanding, data cleaning (missing values, outliers), transformation (scaling, normalization, encoding), EDA for prediction, feature selection basics, data leakage concept.	8
6	**Regression Modelling for Prediction:** linear regression assumptions and interpretation, multiple linear regression, polynomial regression and overfitting, regularization (ridge and lasso), evaluation metrics (MAE, MSE, RMSE, R^2), residual analysis and diagnostics, regression case studies.	9

Text Books:

1.Robert H. Shumway and David S. Stoffer (2016), Time Series Analysis and Its Applications: with R examples, 4th edition, Springer.

2. James D. Hamilton (2012), Time Series Analysis, Levant Books – Paperback edition.

3. James, G., Witten, D., Hastie, T. And Tibshirani, R. (2021), An Introduction to Statistical Learning: With Applications in R, 2nd Edition, Springer.

Reference Books:

1. Chris Chatfield (2003), The Analysis of Time Series: An Introduction, 6th edition, CRC Press.
2. Brockwell and Davis (2016), Introduction to Time Series and Forecasting, 3rd edition, Springer.
3. Hastie, T., Tibshirani, R. And Friedman, J. (2017), The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, Springer.

Online Resources:

1. NPTEL Lectures on Time Series / Forecasting.
2. Python documentation: Pandas Time Series, Statsmodels TSA.
3. Kaggle Time Series datasets and notebooks.

Semester-VIII

Course code: ITY23PEL453 **Course name:** Machine Learning With Big Data **Course category:** PEC
Credits: 4 **Teaching scheme:** L-4 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Theory Exam Duration: 2 Hrs
Pre-requisites: 1. Foundational Data Science Knowledge
2. Data Analysis and Visualization Tools
3. Machine Learning Fundamentals
Course Objectives:
1. To understanding Data Visualization Principles
2. To learn human-Computer Interaction and User-Centric Design.
3. To explore techniques for visualizing and interpreting predictions made by time series and sequence models.
4. To learn how to create compelling visual narratives to convey findings to diverse audiences
Course Outcomes: At the end of the course, the students will be able to -
CO1: Apply Exploratory Data Analysis (EDA) Skills
CO2: Apply Dimensionality Reduction Methods
CO3: Apply Human-Computer Interaction Principles
CO4: Apply Knowledge in Practical Projects
CO5: Collaborate on Interpretability Challenges

Contents –

Unit	Content	Teaching hours
1	**Foundations of Machine Learning and Big Data -** Introduction to machine learning and big data, covering foundational concepts. Distinguishing between supervised and unsupervised learning. overview of big data characteristics, challenges, and distributed computing Difference between machine learning and Big data, 5Vs in Big data	9
2	**Big Data Technologies and Data Preprocessing -** Intricacies of distributed computing frameworks such as Hadoop and Spark. Hadoop's architecture, components, and the Hadoop Distributed File System (HDFS). data preprocessing techniques, missing data, feature scaling, and categorical data encoding	9
3	**Supervised Learning Algorithms -**Linear regression, logistic regression, and decision trees. fundamentals of predictive modeling and classification, developing a foundational understanding of algorithms crucial for handling large datasets	9
4	**Unsupervised Learning Algorithms-** clustering algorithm- K-means and hierarchical clustering. Dimensionality reduction techniques-Principal Component Analysis (PCA) and t-Distributed Stochastic Neighbor Embedding (t-SNE).	9
5	**Big data application -** Overview of Big Data Machine Learning, Mahout, Big Data Machine learning Algorithms in Mahoutkmeans, Naive Bayes etc. Machine learning with Spark, Machine Learning Algorithms in Spark, Spark MLlib, Deep Learning for Big Data, Graph Processing: Pregel, Giraph, Spark GraphX.	9

6	**Big data ML Case studies -** Real-World Big Data ML Case Studies, Recommendation Systems, Anomaly and Fraud Detection, Predictive Analytics, Model Deployment and Monitoring, Ethical Issues in Big Data and ML, Data Privacy and Security, Future Trends in Big Data Machine Learning	9

Text Books: 1. "Data Science for Business" by Foster Provost and Tom Fawcett, Oreilly Publications

2. "Interactive Data Visualization for the Web" by Scott Murray, Oreilly Publications

3. "Visualization Analysis and Design" by Tamara Munzner, CRC Press, Taylor and Francis Publications

Reference Books:

1. "The Visual Display of Quantitative Information" by Edward R. Tufte
2. "Information Visualization: Perception for Design" by Colin Ware
3. "Interactive Data Visualization: Foundations, Techniques, and Applications" by Matthew O. Ward, Georges Grinstein, and Daniel Keim
4. "Applied Plotting, Charting & Data Representation in Python" by Benjamin Root
5. "Big Data Visualization" by James D. Miller

Semester-VIII

Course Code: AIM23PEL452 **Course name:** Cyber Security and Digital Forensics **Course category:** PEC
Credits: 4 **Teaching scheme:** L-4 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs

Pre-requisites: Basic Knowledge of Cryptography and Networks security

Course Objectives:
1. To introduce the fundamental concepts of computer and network security,
2. To provide a strong foundation in symmetric and public key cryptographic algorithms
3. To understand and apply authentication mechanisms using hash functions and digital signatures
4. To acquaint with the digital forensic investigation process
5. To learn the process of data acquisition in a digital crime scene
6. To understand the various file system analysis and understand various pieces of evidence on the internet.

Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand the fundamentals of computer and networks security, security architecture
CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms and public key cryptography
CO3: Apply the various Authentication schemes to simulate different applications.
CO4: Understand the digital forensic investigation process.
CO5: Understand the process of data acquisition in a digital crime scene
CO6: Analyze the evidence from the file system

Contents –

Unit	Content	Teaching hours
1	**INTRODUCTION TO SECURITY & SYMMETRIC ENCRYPTION** Conventional encryption, Security attacks, Security, Model for network security, classical encryption techniques, DES, Triple DES, AES, block cipher modes, stream ciphers, key distribution, random number generation.	9
2	**PUBLIC KEY CRYPTOGRAPHY**: Introduction to number theory, Public - Key cryptography, principles of public – key cryptosystems, RSA algorithm, key management, distribution of public keys, public key – distribution of secret keys, elliptic curve cryptography.	9
3	**AUTHENTICATION USING HASH FUNCTIONS**: Message authentication and hash functions, hash and MAC algorithms, digital signatures, authentication protocols, Kerberos, x- 509 directory. **APPLICATIONS OF SECURITY:** intrusion detection, malicious software, firewalls	9
4	**Introduction To Computer Forensics:** Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Incident and Incident Response(IR) methodology – Forensic duplication and investigation. Preparation for IR.	9
5	**Data Acquisition:** Understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools and other forensics acquisitions Tools	9

6	**File System Analysis:** Windows System Forensics, Linux System Forensics, Case study on Cyber Forensics . **Securing SDN**: Network Forensics Investigation and Digital Evidence: Email analysis, Network analysis , Study of Forensic Tools (Wireshark, nmap, etc.)	9

Text Books:

1. B.A. Forouzan and Debdeep Mukhopadhyay, " Cryptography and Network Security;, Tata McGraw Hill, 2nd Edition**.**

2.William Stalling, "Cryptography and Network Security, Principles & Practices, Pearson Education Publication Fifth Edition.

3. John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", 2nd Edition, Charles, River Media, 2005 ISBN: 1584503890 , 9781584503897.

Reference Books:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt. Ltd

2. Nina Godbole, Sunit Belapure, "Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt.Ltd

Semester-VIII

Course code: DSC23PEL452 **Course name:** Predictive Analytics and Basic Simulation **Course category:** PEC
Credits:4 **Teaching scheme:** L 4 Hrs/ Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Pre-requisites: Time Series Analysis
Course Objectives:
1. To introduce classification techniques, tree-based models, and ensemble learning methods for predictive analytics.
2. To develop skills in model validation, performance evaluation, and interpretability for responsible data-driven decision making.
3. To provide foundational knowledge of simulation, randomness, and input modelling for uncertainty analysis.
4. To enable students to apply Monte Carlo and system simulation techniques to real-world risk and estimation problems.
Course Outcomes:
CO1: Apply classification algorithms and evaluate their performance using appropriate metrics while addressing class imbalance and cost sensitivity.
CO2: Develop tree-based and ensemble models, analyze feature importance, and compare models for optimal selection.
CO3: Perform model validation and hyperparameter tuning, interpret predictive models responsibly, and relate predictive analytics to real-world case studies.
CO4: Explain the principles of simulation and randomness and implement basic simulation models using appropriate distributions and sampling techniques.
CO5: Generate random numbers, model input distributions, and create synthetic data using standard transformation and fitting methods.

Contents –

Unit	Content	Teaching hours
1	**Classification Techniques and Performance Evaluation: l**ogistic regression, KNN classification, Naïve Bayes, confusion matrix, accuracy, precision, recall, F1-score, ROC curve and AUC, imbalanced data handling (sampling, SMOTE – introduction), threshold tuning and cost-sensitive learning.	9
2	**Tree-based Models and Ensemble Learning:** decision trees and splitting criteria (Gini/Entropy), pruning concept, random forest and bagging, gradient boosting overview, XGBoost/LightGBM (intro), feature importance, model comparison and selection.	9
3	**Model Validation, Interpretability and Predictive Analytics in Practice:** train-test split vs cross-validation, hyperparameter tuning (grid/random search), bias-variance trade-off, interpretability (SHAP/LIME – introduction), ethics and fairness, deployment overview, case studies (predictive maintenance, demand forecasting, student performance prediction).	9

4	**Fundamentals of Simulation and Randomness:** introduction to simulation, applications in Data Science, deterministic vs stochastic simulation, discrete vs continuous models, simulation workflow, randomness and uncertainty modelling, review of random variables and distributions, pseudo-random number generation and seeds, sampling basics, introduction to simulation using Python.	9
5	**Random Number Generation and Input Modelling:** uniform random number generation, transforming uniform samples to other distributions, common distributions (Normal, Exponential, Poisson, Binomial, Gamma, Weibull – introduction), inverse transform method, acceptance-rejection method (concept), fitting distributions to data and goodness of fit (introduction), synthetic data generation.	9
6	**Monte Carlo Simulation and Statistical Estimation:** Monte Carlo concept, estimation of mean and variance, confidence intervals, law of large numbers and convergence, Monte Carlo integration, bootstrap simulation, risk modelling examples, uncertainty propagation, System Simulation Models and Applications: discrete-event simulation concept, simulation output analysis and visualization,	9

Text Books:

1. Kelleher, J. D., Mac Namee, B. And D'arcy, A. (2020), Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies, 2nd Edition, MIT Press.
2. Banks, J., Carson, J. S., Nelson, B. L. And Nicol, D. M. (2010), Discrete-Event System Simulation, 5th Edition, Pearson.
3. Ross, S. M. (2013), Simulation, 5th Edition, Academic Press (Elsevier).

Reference Books:

1. Kuhn, M. And Johnson, K. (2013), Applied Predictive Modeling, 1st Edition, Springer.
2. Goodfellow, I., Bengio, Y. And Courville, A. (2016), Deep Learning, 1st Edition, MIT Press.
3. Law, A. M. (2015), Simulation Modeling and Analysis, 5th Edition, McGraw-Hill Education.,
4. Rubinstein, R. Y. And Kroese, D. P. (2016), Simulation and the Monte Carlo Method, 3rd Edition, Wiley.

Online Resources:

1. Kaggle predictive modelling notebooks.
2. Kaggle and GitHub notebooks on Monte Carlo simulation.

Semester-VIII

Course code: ITY23PEL456 **Course name:** Graph Analytics for Big Data **Course category:** PEC
Credits: 4 **Teaching scheme:** L-4 Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Theory Exam Duration: 2 Hrs

Pre-requisites: Programming Fundamentals, Data Structures and Algorithms, Computer Networks

Course Objectives:
1. To understand Scalability Concepts
2. To explore Performance Optimization Techniques
3. To learn distributed Systems Scalability
4. To study database and Network Scalability
5. To explore the Graph application tools

Course Outcomes: At the end of the course, the students will be able to -
CO1: Design and Implement Distributed Systems for Scalability
CO2. Utilize Cloud Scalability
CO3. Optimize Code and Algorithms
CO4. Apply Memory Management Optimization
CO5. Conduct Performance Testing and Analysis

Contents –

Unit	Content	Teaching hours
1	**Graph Algorithms** - Traversal Algorithms, Centrality Algorithms, Community Detection Algorithms, PageRank and variants, Shortest Path Algorithms, Graph Database Technologies, Apache Giraph, Amazon Neptune, Microsoft Azure Cosmos DB, Graph Representation, Adjacency Matrix, Directed and Undirected Graphs, Graph Storage Model, Traversal and Path Finding, ACID Compliance	9
2	**Big Data Platforms and Tools** - Apache Spark Graph X, Apache Flink, Hadoop Map Reduce, Graph Processing in Distributed Systems, Parallel and Distributed Graph Processing, Graph Partitioning, Fault Tolerance, Hadoop Ecosystem, Apache Spark, NoSQL Databases, Distributed Storage Systems, Distributed Graph Processing Frameworks, Parallel Graph Algorithms, Communication and Message Passing	9
3	**Graph Analytics in Social Networks** - Friendship and Connection Analysis, Influence Propagation, Community Structure Analysis, Fraud Detection and Anomaly Detection, Graph-based Fraud Detection, Anomaly Detection in Graphs, Centrality Analysis, Community Detection, Graph-Based Anomaly Detection, Cross-Network Analysis, Supervised Learning Approaches, Unsupervised Learning Approaches, Semi-Supervised Learning, Blockchain -Based Fraud Detection	9
4	**Biological and Chemical Applications** - Bioinformatics, Cheminformatics, Temporal and Dynamic Graphs, Temporal Graph Analysis, Dynamic Network Analysis, Chemical Education and Visualization, Systems Biology, Structural Bioinformatics, Dynamic Graph Evolution Models, Dynamic Graph Algorithms, Real-World Applications of Temporal and Dynamic Graphs	9

5	**Scalability and Performance Optimization -** Optimizing Graph Algorithms for Scalability, Hardware Acceleration, Graph-based Machine Learning, Graph Neural Networks (GNNs), Graph Embeddings, Visualization and Interpretability, Graph Visualization Techniques, Interpretable Graph Analytics, Database Performance Optimization, Memory Management Optimization, Machine Learning Model Optimization	9
6	**Graph Analytics Applications & Case studies -** Navigating Complex Fraud Schemes, Identifying Money Laundering Circles, Recommendation Engines, Supply Chain Optimization, Mapping Digital Threat, Optimizing Cloud Costs. Neo4j, Oracle Graph, Amazon Neptune, ArangoDB	9

Text Books: 1. "Scalability Rules: 50 Principles for Scaling Web Sites" by Martin L. Abbott and Michael T. Fisher

2. "Systems Performance: Enterprise and the Cloud" by Brendan Gregg, Prentice Hall

3. "Cloud Native Patterns: Designing Change-Tolerant Software" by Cornelia Davis, Manning Publications

Reference Books:

1."The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling" by Raj Jain, Publisher: Wiley, ISBN: 0471503361

2."Scalability Rules: Principles for Scaling Web Sites" by Martin L. Abbott and Michael T. Fisher

3. "Scalability Rules: 50 Principles for Scaling Web Applications" by Martin L. Abbott and Michael T. Fisher

4. "The Performance of Open Source Applications" edited by Tavish Armstrong and Brendan Gregg

Semester-VIII

Course code: AIM23PEL453 **Course name:** Intellectual Property Rights **Course Category:** PEC
Credits: 4 **Teaching scheme:** L-4Hrs/Week **Evaluation scheme:** CA–40, MSE–20, ESE–40
Duration of Theory Exam: 2 Hrs

Pre-requisites: Awareness of IPR, Patent act 1970

Course Objectives:

1. To explain the formulation of a Research Problem.
2. To explain the importance of ideas, concepts and creativity.
3. To transfer the knowledge about the IPR required for Engineer's
4. To describe how IPR creates National wealth.
5. To teach National and International IP System

Course Outcomes: At the end of the course, the students will be able to -

CO1: Formulate the research problem with appropriate objectives
CO2: Understand the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
CO3: Identify different types of Intellectual Properties (IPs)
CO4: Discover how IPR are regarded as a source of national wealth and mark of an economic leadership in context of global market scenario
CO5: Analyze national & International IP system

Contents –

Unit	Content	Teaching hours
1	**Introduction to Research problem**: Meaning of research problem, Sources of research problem, Criteria characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations, Effective literature studies approaches, analysis Plagiarism, Research ethics	9
2	**Introduction to Intellectual Property:** Introduction to the concepts Property and Intellectual Property, Nature and Importance of Intellectual Property Rights Understanding the types of Intellectual Property Rights:-Patents, Designs, Trademarks (Registered and unregistered trademarks), Copyright, Traditional Knowledge, Geographical Indications, Trade Secrets, Idea Patenting, (Case Studies)	9
3	**Introduction to Trade Marks**: Purpose and function of trademarks, Acquisition of trade mark rights, transfer of rights, Selecting and evaluating trademark, registration of trademarks, claims. Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, trade secret litigation.	9
4	**Introduction to Copyrights** Geographical Indication of Goods: Basic aspects and need for the registration, Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright.	9

5	**Introduction to Patent:** New Developments in IPR, Process of Patenting and Development: technological research, innovation, patenting, development, International Scenario: WIPO, TRIPs, Indian Patent Office and its Administration	9
6	**Intellectual Property Rights Act, 1970 and Amendments**: Overview of the Indian Patents Act, 1970, Key Provisions of the Act, Amendments to the Patents Act, Patent Filing and Examination Process, Case Studies	9

Text Books: 1. "Intellectual property right" by Deborah E Bouchoux
2. Intellectual property rights" by N.K Acharya

Reference Books:
1.Intellectual property rights by P. Radhakrishnan Wayne Goddard and Stuart Melville,
2. Research methodology: a step by step guide for beginners, Ranjit Kumar , 4th edn, SAGE Publications Pvt. Ltd