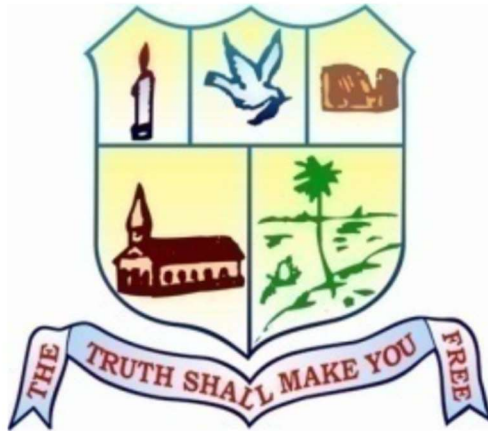


**SCOTT CHRISTIAN COLLEGE (AUTONOMOUS)
NAGERCOIL**



(Estd. 1893)

CURRICULUM AND SYLLABUS

DEPARTMENT OF COMPUTER APPLICATIONS

**(Approved by the Standing Committee of the Academic Councils
held on 21.10.2023 & 13.01.2024)**

POST-GRADUATE PROGRAMME (MCA)

CBCS-SEMESTER SYSTEM

(For those who join from 2023 to 2026)

From evolution to revolution ...

Education is crucial for attaining full human potential, developing an unbiased and evenhanded society and promoting national and global development. The education sector in India is witnessing a sweeping wave of change. The very first policy for education, *National Policy on Education* (NPE-1968) was promulgated in 1968, with the National Policy on Education (NPE- 1986) following in 1986. The National Policy on Education (NPE- 1992) and the Programme of Action 1992 (POA-1992) refined and implemented the NPE-1986. The National Education Policy 2020 (NEP 2020) is a landmark document and an evolution towards revolution in the Indian educational sector. It presents the vision for greater access, equity, excellence, inclusion, multiple entry and exit and affordability to help India emerge as the global knowledge superpower.

Providing access to quality education is the key to the curriculum and syllabus of Scott Christian College (Autonomous), in terms of social justice and equality, scientific advancement, cultural preservation and national and global integration. Students should have the freedom and flexibility in choosing their courses, skills, and capacities to become moral, successful, innovative, adaptable, and productive human beings.

Higher education plays an important role in promoting human as well as societal wellbeing and in contributing towards sustainable livelihoods and economic development. The present Outcome-Based Education (OBE) curriculum and syllabus, provides valuable insights and recommendations on aspects of education that include moving towards multidisciplinary and holistic education, mastery and high-order learning and promotion of quality research.

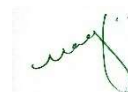
The current curriculum has been designed based on NEP 2020, the National Credit Framework (NCrF), the National Higher Education Qualifications Framework (NHEQF) and Curriculum and Credit Framework for Undergraduate Programmes (CCFUP) which envisage that students must develop into good, thoughtful, well-rounded, creative individuals with a standard of achievement. The themed curriculum aims to support teachers and students in developing their understanding of the curriculum design and delivery process as per the requirement of the world of work.



Dr. Sidney Shirly
Dean of Arts
Scott Christian College
(Autonomous)
Nagercoil



Dr. V. Robin Perinba Smith
Dean of Science
Scott Christian College
(Autonomous)
Nagercoil



Dr. B. Shamina Ross
Dean of IT and Technical Education
Scott Christian College
(Autonomous)
Nagercoil

DEPARTMENT OF COMPUTER APPLICATIONS

The Department of Computer Applications-PG was established in the 2020, with the objective of imparting quality education in the domain of Computer Science and Applications. With rapidly evolving technology and the continuous need for innovation, the department has always produced quality professionals, holding important positions in Information Technology industries in India and abroad. The Department updates its syllabi frequently to attract young talents from all over the country. The academic activities of the department, during the last three years, were centered on teaching and research programmes in computer science and applications with a view to train post-graduates and researchers who can contribute significantly to the requirements of professional organizations in the field.

VISION

Our Vision is to empower and educate with technology and innovation for being competitive in the global market and to carry out innovative cutting edge research and transfer technology for industrial and societal needs.

MISSION

Our Mission is

- To develop technically competitive students in global standards
- To focus on innovative research and technology
- To provide platform for interaction between industry and Information Technology
- To progress their career productively in academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enable services
- To develop leadership and managerial skills

Eligibility:

Candidates who have passed in any one of the following or equivalent are eligible to apply:

(i) BCA/B.Sc.(Computer Science)/B.Sc.(IT)/B.E.(CSE)/B.Tech.(CSE)/ B.E.(IT)/B.Tech.(IT) or equivalent Degree.

OR

(ii) Passed any graduation degree(e.g.:B.E./B.Tech./B.Sc./B.Com. / B.A./ B.Voc/etc.,) preferably with Mathematics at 10+2 level or at graduation Level. Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying examination. For students having no Mathematics background compulsory bridge course will be framed and additional bridge courses related

to computer subjects as per the norms of the concern University).

Bridge Course on Basics in Computer Science

Course duration: 30Hours

Course Modules:

Module1: Computer Organization and Architecture

Module2: Data Structures and Algorithms

Module3: Problem Solving Techniques

Module4: Operating Systems

Module5: Object oriented programming

Module6: Database Management System

Module 7: Software Engineering

Module 8: Computer Networks

Duration of the Programme and Medium

The programme shall be of two years duration spread over four semesters under choice based credit system. The Maximum duration to complete the course shall be three academic years after normal completion of the programme. The medium of instruction/study is English.

FACULTY MEMBERS

Sl. No.	NAME	DESIGNATION
1.	Dr. B. Shamina Ross M.Sc., M.Phil., Ph.D.	Associate Professor & Head of the Department
2.	Mrs. P. Ezhil Roja M.Sc., M.Tech., M.Phil.	Assistant Professor
3.	Dr. C. Thinkal Dayana MCA., Ph.D.	Assistant Professor
4.	Dr. M. Anline Rejula MCA., M.Phil., Ph.D.	Guest Lecturer

MEMBERS OF THE BOARD OF STUDIES

Sl. No.	NAME	AFFILIATION	ROLE
1.	Dr. B. Shamina Ross	Associate Professor & Head, MCA Department, Scott Christian College(Autonomous), Nagercoil. Ph. No.: 9443137232 shaminas@hotmail.com	Chairperson
2.	Mrs. P. Ezhil Roja	Assistant Professor, Department of Computer Applications, Scott Christian College(Autonomous), Nagercoil.	Member
3.	Dr. C. Thinkal Dayana	Assistant Professor, Department of Computer Applications, Scott Christian College(Autonomous), Nagercoil.	Member
4.	Dr. M. Anline Rejula	Guest Lecturer, Department of Computer Applications, Scott Christian College(Autonomous), Nagercoil.	Member
5.	Dr. V.Sindhu Janita Prakash	Professor & Head, Department of Computer Science, Cauvery College for Women(Autonomous), Trichy -620018	Subject Expert from outside Parent University
6.	Dr.C.Beulah Christalin Latha	Associate Professor, Department of Digital Sciences, Karunya Institute of Technology and Sciences, Coimbatore.	Subject Expert from outside Parent University
7.	Dr. P. Arockia Jansi Rani	Associate Professor, Department of Computer Science and Engineering, Manonmaniam Sundaranar University, Tirunelveli.	University Nominee
8.	Dr. P. Sundareswaran	Assistant Professor, Department of Computer Science and Engineering Manonmaniam Sundaranar University Tirunelveli-12	Subject Expert (Special Courses)
9.	Mr. T. Edwin Raj	Director, Loop Spring Technology and Consultancy Pvt. Ltd. Mulagumoodu.	Industrialist
10.	Ms. M. S. Sumi	Senior System Engineer, Cognizant Pvt. Ltd., Chennai.	Alumni

The Scott Christian College (Autonomous) defines the focus reinforcing its academic programmes and student life experience on campus through the Graduate Attributes (GA), that describe the knowledge, competencies, values and skills students imbibe for holistic development, multidisciplinary development and contribution to society. These attributes comprise characteristics that are transferable beyond the sphere of study into the national and international realm through curricular, co-curricular and extra-curricular engagements. They equip graduates for life long personal development and employment. Every Graduate of Scott Christian College (Autonomous) – (SCC) is desired to possess the following Graduate Attributes:

GA 1: Intellectual Competencies

Graduates of SCC

- have a comprehensive and incisive understanding of their domain of study as well as the ability for cross-disciplinary learning
- have the ability to apply the knowledge acquired through the curriculum as well as self-directed learning to a broad spectrum ranging from analytical thinking to synthesize new knowledge through research
- are able to have critical, independent and individual outlook regarding academic work and socially relevant issues

GA 2: Problem Solving

Graduates of SCC

- have the capacity to extrapolate from what has been learnt, translate concepts to real-life situations and apply acquired competencies in the required contexts to generate solutions to specific problems
- can view a problem or a situation from multiple perspectives and think ‘out of the box’ and generate solutions to complex problems in unfamiliar contexts
- are effective problems-solvers, able to apply critical, creative and evidence-based thinking to conceive innovative responses to challenges

GA 3: Communication Skills

Graduates of SCC

- listen carefully, analyse texts and research papers, and present complex information in a clear and concise manner
- express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media
- confidently express herself/himself and construct logical arguments using correct technical language related to a field of learning and area of professional practice

GA 4: Environmental Awareness

Graduates of SCC

- lessen the effects of environmental degradation, climate change, and pollution
- learn the nuances for cleanliness, conservation and wise use of resources so that it can be used for generations
- know the nuances of waste management, conservation of biological diversity, management of biological resources and biodiversity, and sustainable development and living

GA 5: Professional Ethics

Graduates of SCC

- develop principled and expert behavior, and this will be showcased in their chosen careers and constructive roles as citizens of the world at large
- imbibe intellectual integrity and ethics in scholarly engagement and develop a spirit of inclusiveness through interactions with diverse people at all levels in life
- acquire new knowledge and skills, including ‘learning how to learn’ skills, for pursuing learning activities throughout life and adapting to changing demands of the workplace through knowledge, skill development and reskilling, ethically

GA 6: Leadership Qualities

Graduates of SCC

- inculcate leadership qualities and attitudes, and team behaviour along autonomous

lines through curricular, co-curricular and extra-curricular activities

- develop managerial and entrepreneurial skills to create new opportunities for diverse careers and gear up to take up competitive examinations
- act together as a group or a team in the interests of a common cause and work efficiently as a member of a team

GA 7: Holistic Skill Development

Graduates of SCC

- develop critical thinking, problem-solving capacity, effective communication, and social skills
- are self-aware, flexible, resilient and have the capacity to accept and give constructive feedback and cope up with stress
- develop soft skills, e-skills and life skills to live, learn and work in the technically sound society globally and use appropriate digital methods for analysis of data

GA 8: Cross-Cultural Competencies

Graduates of SCC

- gain cross-cultural competencies through engaging with diverse linguistic, ethnic and religious communities and know how to understand, accept and appreciate individuals at local, national and international levels
- develop a global perspective through contemporary curriculum, culture, language and international exchange programmes
- acquire knowledge of the values and beliefs of multiple cultures and a global perspective to honour diversity, gender sensitivity and adopt gender-neutral approach and show empathy to the less advantaged and the differently-abled

GA 9: Community Engagement

Graduates of SCC

- are sensitive to social concerns and have conviction toward social justice through active social engagement
- are endowed with a strong sense of environmental awareness through the curriculum and a friendly and serene campus eco-system.

- formulate an inspiring vision and build a team that can help achieve the vision, and motivate people to the right destination

GA 10: Value-Based Ethical Competency

Graduates of SCC

- are rooted in the principles of ethical responsibility and integrity permeated with Christian values, leading to the building of character and constitutional values
- develop virtues such as truth, love, courage, unity, integrity, brotherhood, industry and uprightness
- practise responsible national and global citizenship required for responding to contemporary challenges, enabling learners to become aware of and understand global issues and to become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies

Learning Outcomes Descriptors for a Higher Education Qualification at Level 6 on the NHEQF

The Bachelor’s degree (Honours / Honours with Research) or the Post-Graduate Diploma is awarded to students who have demonstrated the achievement of the outcomes located at level 6 on the NHEQF.

Descriptors for qualifications at levels 6 on the NHEQF

Element of the Descriptor	NHEQF Level Descriptors
Knowledge and understanding	The graduates should be able to demonstrate the acquisition of: <ul style="list-style-type: none"> • advanced knowledge about a specialized field of enquiry, with depth in one or more fields of learning within a broad interdisciplinary context. • a coherent understanding and awareness of the established methods and techniques of research and enquiry • procedural knowledge required for performing and accomplishing professional tasks
General, Technical and Professional Skills	The graduates should be able to demonstrate the acquisition of: <ul style="list-style-type: none"> • a range of cognitive and technical skills required for performing and accomplishing complex tasks required to undertake research to generate solutions to real-life problems • generating solutions to complex problems independently, requiring the exercise of full personal judgement, responsibility, and accountability for the

	<p>output of the initiatives taken as a practitioner</p> <ul style="list-style-type: none"> • apply advanced knowledge relating to research methods to carry out research and investigations to formulate evidence-based solutions to complex and unpredictable problems
Generic Learning Outcomes	<p>The graduates should be able to demonstrate the ability to:</p> <ul style="list-style-type: none"> • communicate technical information and explanations, and the findings/ results of the research studies relating to specialized fields of learning and pursue self-paced and self-directed learning • present in a concise manner one's views on the relevance and applications of the findings of research and evaluation studies in the context of emerging developments and issues. • define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships
Constitutional, Humanistic, Ethical, and Moral Values	<p>The graduates should be able to demonstrate the willingness and ability to:</p> <ul style="list-style-type: none"> • embrace and practice constitutional, humanistic, ethical, and moral values in professional practice and life. • present coherent arguments in support of relevant ethical and moral issues and participate in actions to address environmental and sustainable development issues. • follow ethical practices in all aspects of research and development
Employability and Entrepreneurship Skills	<p>The graduates should be able to demonstrate the acquisition of knowledge and skills required for:</p> <ul style="list-style-type: none"> • adapting to the future of work and to the demands of the fast pace of technological developments and innovations that drive a shift in employers' demands for skills • managing complex technical or professional activities or projects • should be willing to take a calculated risk and be open to new ideas
Credit Requirements	<p>A Post-Graduate Diploma programme builds on a 3-year/6-semester bachelor's degree and requires a minimum of 40 credits for individuals who have completed a Bachelor's programme.</p>
Entry Requirements	<ul style="list-style-type: none"> • An individual seeking admission to the bachelor's degree (Honours/ Honours with Research) in a specified field of learning would normally have completed all requirements of the relevant 3-year Bachelor's degree.

Learning Outcomes Descriptors for a Higher Education Qualification at Level 6.5 on the NHEQF

The Master's degree (e.g. M.A., M.Com., M.Sc., etc.) is awarded to students who have demonstrated the achievement of the outcomes located at level 6.5 on the NHEQF.

Descriptors for qualifications at levels 6.5 on the NHEQF

Element of the Descriptor	NHEQF Level Descriptors
Knowledge and Understanding	<p>The graduates should be able to demonstrate the acquisition of:</p> <ul style="list-style-type: none"> • advanced knowledge about a specialized field of enquiry with a critical understanding of the emerging developments and issues relating to one or more fields of learning • advanced knowledge and understanding of the research principles, methods, and techniques applicable to the chosen field of learning or professional practice, • procedural knowledge required for performing and accomplishing complex, specialized and professional tasks relating to teaching, and research and development.
General, Technical and Professional Skills	<p>The graduates should be able to demonstrate the acquisition of:</p> <ul style="list-style-type: none"> • advanced cognitive and technical skills required for performing and accomplishing complex tasks related to the chosen fields of learning. • advanced cognitive and technical skills required for evaluating research findings and designing and conducting relevant research that contributes to the generation of new knowledge. • specialized cognitive and technical skills relating to a body of knowledge and practice to analyze and synthesize complex information and problems.
Application of Knowledge and Skills	<p>The graduates should be able to demonstrate the ability to:</p> <ul style="list-style-type: none"> • apply the acquired advanced theoretical and/or technical knowledge about a specialized field of enquiry or professional practice and a range of cognitive and practical skills to identify and analyze problems and issues associated with the chosen fields of learning. • apply advanced knowledge relating to research methods to carry out research and investigations and to formulate evidence-based solutions to complex and unpredictable problems. • develop appropriate tools for data collection for research
Generic Learning Outcomes	<p>The graduates should be able to demonstrate the ability to:</p> <ul style="list-style-type: none"> • communicate in a well-structured manner, technical information and explanations, and the findings/results of the research studies undertaken in the chosen field of study, • evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and address opposing viewpoints • pursue self-paced and self-directed learning to upgrade knowledge and skills, including research-related skills, required to pursue a higher level of education and research.

Constitutional, Humanistic, Ethical, and Moral Values	The graduates should be able to demonstrate the willingness and ability to: <ul style="list-style-type: none"> • embrace and practice constitutional, humanistic, ethical, and moral values in one's life and in the field of study and professional practice, • participate in actions to address environmental protection and sustainable development issues, • follow ethical principles and practices in all aspects of research and development, including inducements for enrolling participants and avoid unethical practices
Employability and Entrepreneurship Skills	The graduates should be able to demonstrate the acquisition of knowledge and skill sets required for: <ul style="list-style-type: none"> • adapting to the future of work and responding to the demands of the fast pace of technological developments and innovations that drive the shift in employers' demands for skills • transition towards more technology-assisted work involving the creation of new forms of work and rapidly changing work and production processes. • exercising full personal responsibility for the output of own work as well as for group outputs and for managing work that is complex and unpredictable requiring new strategic approaches.
Credit Requirements	<ul style="list-style-type: none"> • The 2-year/4-semester Master's programme builds on a 3-year/6-semester bachelor's degree and requires a total of a minimum of 80 credits from the first and second years of the programme, with a minimum of 40 credits in the first year and minimum of 40 credits in the second year of the programme at level 6.5 on the NHEQF.
Entry Requirements	<ul style="list-style-type: none"> • A 3-year Bachelor's degree for the 2-year/4-semester Master's degree programme (e.g. M.A., M.Com., M.Sc., etc.).

PLO & GA Mapping

Programme Learning Outcome #	Programme Learning Outcome(PLO)	Description of PLO	PLO Mapped with GA#
PLO 1	Learning Dispositions	Recognize and reflect on the production of knowledge in multiple spaces	GA 1 GA 8
		Develop the leadership capacity to negotiate intercultural learning spaces	GA 1 GA 6 GA 8
		Engage dialogically with distinct and/or intersecting intellectual communities to develop the scope of inquiry	GA 2 GA 3
PLO 2	Domain specific knowledge	Develop intensive and extensive knowledge and expertise in their respective domains	GA 1

		Formulate and extrapolate the knowledge gained to be applied in real– life situations, for self-directed learning and in competitive examinations	GA 1 GA 2 GA 3
		Evaluate and create domain specific knowledge in areas of learning, research and industry	GA 1 GA 2
PLO 3	Application oriented knowledge and diverse perspectives	Translate theoretical understanding to experimental knowledge for solving complex problems	GA 1 GA 3
		Ability to solve problems using pragmatic, alternative and creative approaches	GA 1 GA 2 GA 3 GA 5
		Capacity to apply advanced knowledge and approaches to solve concrete and abstract problems in domain-related and multi-disciplinary issues.	GA 1 GA 2
PLO 4	Innovation and research	Develop aptitude for innovation and entrepreneurship	GA 6
		Identify contemporary research problems, analyze data qualitatively and quantitatively and propose solutions	GA 1 GA 2 GA 9
		Create new ideas, analyze problems, diagnose them and identify their causes independently and/or in groups	GA 6 GA 7
PLO 5	Scientific communication skills	Document, prepare and present research work as reports and articles in academic forums	GA 6
		Critically assess, review and present theories and concepts	GA 1
		Take technically complex scientific topics and craft them into accessible, informative, and compelling content for specific audiences	GA 1 GA 2
PLO 6	Digital competency	Use domain-related advanced software resources, computational skills and digital tools for data analysis and interpretation	GA 2 GA 5
		Ethically apply digital skills to creatively communicate ideas and issues related to academic experiences	GA 5 GA 10
		Acquire the ability to leverage digital technologies to communicate, collaborate, and analyze data	GA 5

PLO 7	Ethical reasoning	Apply domain specific ethical principles and practices in academic, professional and social engagements	GA 1 GA 5
		Transform the behaviour of students to preserve public interest, the environment and be a source of help	GA 4 GA 5
		Being honest and taking responsibility for academic work and environmental sustainability	GA 4 GA 5
PLO 8	Comparative and interdisciplinary knowledge practices	Develop an interdisciplinary approach to research	GA 1 GA 7
		Compare scientific, social and historical phenomena in order to yield new insights	GA 1 GA 9
		Articulate how the complexities of social differentiation, like sex, gender, disability, race, ethnicity, nation, class, and such give insights and shape intellectual projects	GA 3 GA 5 GA 8 GA 9
PLO 9	Career readiness	Choose from diverse career options available in local, national and international realms.	GA 8
		Find success in workplace, manage one's career and apply the skills learned	GA 7
		Carry out further research or pursue higher education in the country or abroad	GA 1
PLO 10	Creating collaboration with the corporate world	Cultivate relationship with mentors and advisors, whose expertise and experience can assist in the development of work	GA 3 GA 7
		Recognize and reflect on the value, effectiveness, and ethics of collaboration in different settings and situations	GA 5 GA 9
		Produce new knowledge by working at the intersection of multiple disciplines and interdisciplinary fields	GA 1

METHODS OF ASSESSMENT

Remembering (K1)	<ul style="list-style-type: none"> • The lowest level of questions require students to recall information from the course content • Knowledge questions usually require students to identify information in the textbook
Understanding (K2)	<ul style="list-style-type: none"> • Understanding of acts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words • The questions go beyond simple recall and require students to combine the ideas together
Application (K3)	<ul style="list-style-type: none"> • Students have to solve problems by using/applying a concept learned in the classroom • Students must use their knowledge to determine exact response
Analyze (K4)	<ul style="list-style-type: none"> • Analyzing the question by asking students to break down something into its component parts • Analyzing requires students to identify reasons, causes or motives and reach conclusions or generalizations
Evaluate (K5)	<ul style="list-style-type: none"> • Evaluation requires an individual to make judgment on something • Questions to judge the value of an idea, a character, a work of art, or a solution to a problem • Students are engaged in decision-making and problem-solving
Create (K6)	<ul style="list-style-type: none"> • The questions of this category challenge students to get engaged in creative and original thinking • Developing original ideas and problem solving skills

Cognitive Level (CL)

No.	Code	Cognitive Level
1	R	Remember
2	U	Understanding
3	Ap	Apply
4	An	Analyse
5	E	Evaluate
6	C	Create

Knowledge Category (KC)

No	Code	Knowledge
1	F	Factual
2	C	Conceptual
3	P	Procedural
4	M	Metacognitive

Learning Activities

A. Participative Learning

No	Code	Description
1	GD	Group Discussion
2	SI	Simulation
3	OO	One to One Learning
4	RF	Rapid Fire
5	KWL	Know, Want to Know, Learned
6	Sem	Seminar
7	WSQ	Watch Summarise Question
8	FC	Flipped Class

B. Cooperative Learning

No	Code	Description
1	Lec	Lecture
2	Soc	Socrates Method
3	BS	Brain Storming
4	GT	Group Learning
5	OT	One to One Tutoring

C. Peer Learning

No	Code	Description
1	TPS	Think Pair Share
2	RPT	Reciprocal Peer learning
3	PT	Peer Learning

D. Experiential Learning

No	Code	Description
1	RP	Roleplay
2	FW	Fieldwork
3	MPr	Micro/Mini Project
4	Pr	Project
5	Viv	Viva-Voce
6	Rep	Report Writing
7	Rev	Review Writing
8	CW	Critique Writing

E. Problem Solving Method

No	Code	Description
1	CS	Case Study
2	Ess	Essay
3	AW	Article Writing
4	SP	Solution to Problem
5	PF	Problem Finding

Assessment Task

No	Code	Description
1	CA	Class Assignment
2	HrA	Hour Assignment
3	CT	Class Test
4	ST	Self Test
5	OT	Online Test
6	OBT	Open Book Test
7	Qui	Quiz
8	HoA	Home Assignment
9	MCQ	Multiple Choice Question
10	SA	Short Answer
11	Ess	Essay

METHODS OF EVALUATION

Evaluation	Methods	Marks
Internal	Continuous Internal Assessment Test	40
	Assignments / Snap Test / Quiz	
	Seminars	
	Attendance and Class Participation	
External	End Semester Examination	60
Total		100

Project work, Mini Project work, Seminar, Internship in industry

Name of the Programme	Semester	field projects/ internships/ student projects	Hours	Credit	Duration
Report Writing	II		-	2	4 weeks
Mini Project	III	Student Projects	30	2	I semester
Internship	III	Internship	Summer vacation	2	14 days
Project	IV	Industrial Projects	450	20	1 full semester

- Report Writing- 2 credits will be given to students upon submission of the certificate of presentation in conferences/ seminars or publication of articles in journal or MOOCS certification (Duration: minimum 4 weeks).
- Mini Project- 2 credits will be given to individual Mini project done for a duration of 2 hours/week for one semester.
- Internship- 2 credits for getting training in a reputed industry/Research lab for a minimum

period of 14 days.

- Project- 20 credits will be given for industrial projects (Duration: I Semester – 30 hours per week) done in the fourth semester (Full-time project).
- The method of grading the students undertaking industrial project is as given below.

Reviews for the FINAL Year MCA Students for their Mini project work

Reviews	Details to Submit	Marks
I	Project Title, Language Used (Front and Back end) &Confirmation letter, Abstract.	20
II	PPT Presentation about the Project and its salient features.	20
III	PPT Presentation of Abstract & Explanation of Project with Tables, Forms and Analysis Report.	20
IV	PPT Presentation of complete flow of project with Design Tools. Live Demo if Possible.	20
V	Submission of Final Mini Project in the prescribed Format (2 copies) + 1 CD.	20

The method of grading the students undertaking industrial project is as given below.

Reviews for the FINAL Year MCA Students for their project work

Reviews	Details to Submit	Marks
I	Company Profile, Project Title, Language Used (Front and Back end) &Confirmation letter, Abstract.	20
II	PPT Presentation about the Project and its salient features.	20
III	PPT Presentation of Abstract, Literature Survey & Explanation of Project with Tables, Forms and Analysis Report.	20
IV	PPT Presentation of complete flow of project with Design Tools. Live Demo if Possible.	20
V	Submission of Final Project Dissertation in the prescribed Format (2 copies) + 1 CD.	20

The above student projects/internships/industrial projects will enable the students to develop a holistic view. This exercise helps the students to enhance their knowledge using logical and analytical skills which ultimately helps them to assimilate concept learnt in the classroom.

CURRICULUM TABLE 2023-2026

Year	Semester	Course No.	Courses		Course Code	Hours							Total Hours	Credit	Credit Points
						Lecture	Tutorial	Practical	Internship	Self-Learning	Demonstration	Research Project			
I	I	1.1	Core Course 1	Discrete Mathematics	23PR11	3	1						4	4	24
		1.2	Core Course 2	Linux and Shell Programming	23PR12	2	2						4	4	24
		1.3	Core Course 3	Python Programming	23PR13	2	2						4	4	24
		1.4	Elective I	Data Engineering and Management	23PRED	2	1				1		4	4	24
				Architecture and Frameworks	23PREE										
				Multimedia Technologies	23PREA										
		1.5	Elective II	Software Development Technologies	23PREF	2	1				1		4	4	24
				Soft Computing	23PREB										
				Software Engineering	23PREG										
		1.6	Elective Lab I	Data Engineering and Management Lab	23PRP7				3			1	4	2	12
				Architecture and Frameworks Lab	23PRP8										
				Multimedia Technologies Lab	23PRP1										
		1.7	Core Lab 1	Python Programming Lab	23PRP2			3			1		4	2	12
		1.8	Skill Enhancement Professional Competency Skill		23PRS1		1				1		2	1	6
II	2.1	Core Course 4	Data Structures and Algorithms	23PR21	2	2						4	4	24	

		2.2	Core Course 5	Database Systems	23PR22	2	1				1	4	4	24		
		2.3	Core Course 6	Advanced Machine Learning Using R	23PR23	2	1				1	4	4	24		
		2.4	Elective III	Cyber Security	23PREH	2	1			1		4	4	24		
				Dot Net Technologies	23PREC											
				Block Chain Technologies	23PREI											
		2.5	Elective IV	Principles of Management	23PAN1	3	2			1		6	5	30		
				Management Information Systems	23PRN1											
				E-Commerce and Web Applications	23PREJ											
		2.6	Core Lab 2	Data Structures and Algorithms Lab	23PRP3							2	1	6		
		2.7	Core Lab 3	Database Systems Lab	23PRP4							2	1	6		
		2.8	Core Lab 4	Advanced Machine Learning Using R lab	23PRP5							2	1	6		
		2.9	Elective Lab II	Cyber Security Lab	23PRP9							2	1	6		
				Dot Net Technologies Lab	23PRP6											
				Block Chain Technologies Lab	23PRP10											
		2.10	Report Writing		23PRS2								2	12		
II	III	3.1	Core Course 7	Cryptography and Network Security	23PR31	1	1					2	2	13		
		3.2	Core Course 8	Web Technologies	23PR32	1	1					2	2	13		
		3.3	Core Course 9	Computer Vision	23PR33	1	1					2	2	13		
		3.4	Elective V	Internet of Things	23PREK	2	1							3	3	19.5
				Social Network	23PREL											
				Advanced Java Programming	23PREM											

	3.5	Elective VI	Data Science	23PREN	2	1			1	1		5	4	26
			Big Data Analytics	23PREO										
			Digital Forensics	23PREP										
	3.6	Core Lab 5	Cryptography and Network Security Lab	23PRP11			4					4	2	13
	3.7	Core Lab 6	Web Technologies Lab	23PRP12			4					4	2	13
	3.8	Core Lab 7	Computer Vision Lab	23PRP13			4					4	2	13
	3.9	Elective Lab III	Internet of Things Lab	23PRP14			2					2	1	6.5
			Social Network Lab	23PRP15										
			Advanced Java Programming Lab	23PRP16										
	3.10	Mini Project		23PRD2			2				2	2	2	13
	3.11	Internship		23PRD3									2	13
IV	Project		23PRD1							30	30	20	130	
	Total										120	96	598	

SEMESTER - I

Course Title: Core Course 1 – 1.1 Discrete Mathematics

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PR11

Pass-Out Policy: Minimum Contact Hours: 36
Total Score %: 100 Internal: 40 External: 60
Minimum Pass %: 50 [No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	to understand the concepts of propositional logics, equivalences predicates and quantifier	2(3), 3(4), 5(3), 7(6), 10(4)	1, 2, 5, 8, 10	U	M, F, C
CLO-2	to understand and analyze sets, functions	2(3), 3(6), 5(3), 7(4), 10(4)	1, 2, 5, 8, 10	U, An	M, C
CLO-3	to evaluate and solve various types of graphs	2(3), 3(4), 5(4), 7(5), 10(4)	1, 2, 5, 8, 10	Ap, E	M, C, P
CLO-4	to evaluate and solve various types of trees	2(4), 3(4), 5(4), 7(4), 10(4)	1, 2, 5, 8, 10	Ap, E	M, C, P
CLO-5	to evaluate and solve Boolean algebra	2(3), 3(5), 5(4), 7(5), 10(3)	1, 2, 5, 8, 10	Ap, E	M, C, P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	The Foundations: Propositional Logic	3	1[25]	BS	CT	1
1.2	Propositional Equivalences	4	1[33]	OO	ST	1
1.3	Predicates and Quantifiers	5	1[42]	OT	CA	1
2.1	Basic Structures: Set Operations	3	2[25]	RF	HrA	1
2.2	Functions	5	2[33]	Soc	HoA	1
2.3	Recursive Functions	4	2[42]	WSQ	Qui	1

3.1	Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs	4	3[33]	GD	SA	1
3.2	Representing Graphs and Graph Isomorphism	4	3[34]	WSQ	Ess	1
3.3	Connectivity	4	3[33]	SP	MCQ	1
4.1	Trees: Introduction to Trees	2	4[16]	Lec	SA	1
4.2	Applications of Trees	5	4[42]	Sem	Ess	1
4.3	Tree Traversal	5	4[42]	RPL	HrA	1
5.1	Boolean Algebra: Boolean functions	3	5[25]	GD	HoA	1
5.2	Representing Boolean Functions	3	5[25]	GT	SA	1
5.3	Logic Gates	6	5[50]	TPS	Ess	1

Reference Books

1. Kenneth H Rosen, “*Discrete Mathematics And Its Applications With Combinations And Graph Theory*”, McGraw Hill Education, Seventh Edition, 2019.
2. Swapan Kumar Chakaraborty, Bikash Kanti Sarkar, “*Discrete Mathematics*”, Oxford Higher Education, Ninth Edition, 2020.
3. Swapan Kumar Sarkar, “*A Text Book Of Discrete Mathematics*” S.Chand & Company Pvt. Ltd, First Edition, 2003.

SEMESTER - I

Course Title: Core Course 2 - 1.2 Linux and Shell Programming

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PR12

Pass-Out Policy : Minimum Contact Hours: 36
 Total Score %:100 Internal: 25 External: 75
 Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	remember the basics of operating system and system structure	2(7), 3(7), 7(6)	1, 3, 5	R	F, M
CLO-2	understand and Apply process concept and multithread programming	2(5), 3(5), 5(5), 7(5)	1, 2, 3, 5	U, Ap	F, P
CLO-3	evaluate synchronization and deadlocks	2(6), 3(6), 5(4), 7(4)	1, 2, 3, 5	E	C, M
CLO-4	analyze memory management and	2(7), 3(7), 7(6)	1, 3, 5	Ap, An	C, M

	understand file system & implementation				
CLO-5	understand system security & protection	2(5), 3(5), 5(5), 7(5)	1, 2, 3, 5	An	M

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	The What and Why of Scripting with Bash, Technical requirements, Types of Linux shells, What is bash Scripting?, The bash command hierarchy, Preparing text editors for scripting, Creating and executing scripts, Declaring Variables, Variable Scope, Command Substitution, Debugging your Scripts	4	1[34]	Lec	MCQ	1
1.2	Creating Interactive Scripts, Technical requirements, Using echo with options, Basic Script, using read, script comments, Enhancing scripts with read prompts	4	1[33]	KWL	CA	1
1.3	Limiting the number of entered characters Controlling the visibility of the entered text, passing options, Try to be Standard, Enhancing learning with simple scripts	4	1[33]	TPS	Ess	1
2.1	Conditions Attached, Technical requirements, Simple decision paths using command line lists, verifying user input with lists, using the test shell built in	3	2[25]	Sem	HoA	1
2.2	Creating conditional statements using if , Extending if with else, Test command with the if command, More conditions with elif, Using case Statements , Recipe-building a frontend with grep	3	2[25]	PT	CT	1
2.3	Creating code snippets, technical requirements, Abbreviations, using code snippets, Creating snippets using VS code	3	2[25]	OO	Qui	1
2.4	Alternative syntax, Technical requirement, Recapping the test Command, Providing Parameter defaults, when in doubt-quote, Advanced tests using, Arithmetic operations using	3	2[25]	BS	ST	1
3.1	Iterating with Loops, Technical requirement, for loops, Advanced for loops. Then IFS, Counting directories and files, C-Style for loops, Nested loops, Redirecting loop output, while loops and until loops, Reading input from files, Creating operator menus	6	3[50]	Lec	MCQ	1
3.2	Creating Building Blocks with functions, Technical Requirements, Introducing functions, Passing Parameters to functions, Variable Scope, Returning Values from functions, Recursive functions, Using functions in menus	6	3[50]	SI	SA	1
4.1	Introducing the Stream editor, Technical Requirements, Using grep to display text, Understanding the basics of sed, Other sed Commands, Multiple sed Commands	4	4[34]	TPS	HrA	1

4.2	Automating Apache Virtual Hosts, technical Requirements, Apache name based Virtual Hosts, Automating Virtual host creation	4	4[33]	OT	CT	1
4.3	AWK Fundamentals, Technical Requirements, the history behind AWK, Displaying and filtering content from files, AWK Variables, Conditional Statements, Formatting Output, Further filtering to display users by UID, AWK Control Files	4	4[33]	GD	OBT	1
5.1	Regular Expressions, Technical Requirements, Regular expression engines, Defining BRE Patterns, Using grep	4	5[33]	FC	SA	1
5.2	Summarizing logs with AWK, Technical Requirements, The HTTPD log file format, Displaying data from web logs, Displaying the highest ranking IP address, Displaying the browser data, Working with email logs	4	5[34]	OT	CA	1
5.3	A better lastlog with AWK, Technical Requirements, Using AWK ranges to exclude data, Conditions based on the number of fields, Manipulating the AWK record separator to report on XML data	4	5[33]	Sem	ST	1

Reference Books

1. Mokhtar Ebrahim, Andrew Mallett, “*Mastering Linux Shell Scripting*”, Packt Publishing, Second Edition, 2018.
2. Richard Blum, Christine Bresnahan, “*Linux Command Line and Shell Scripting BIBLE*”, Wiley Publishing, Third Edition, 2015.
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “*Operating Systems Concepts*”, Wiley India Pvt. Ltd, Ninth Edition, Reprint 2016.
4. A.S. Tanenbaum, “*Modern Operating Systems*”, Pearson Education, Third Edition, 2007.
5. G. Nutt, “*Operating Systems: A Modern Perspective*”, Pearson Education, Second Edition, 1997.

SEMESTER - I

Course Title: Core Course 3 – 1.3 Python Programming

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PR13

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	remember and understand Digital computer, apply and create problem solving Strategies	2(5), 3(6), 4(5), 10(4)	1, 2, 5, 9, 10	R, U, Ap, C	F, M, P
CLO-2	understand Apply and create Python expression	2(4), 3(5), 4(4), 5(5), 7(2)	1, 2, 4, 5, 6, 7	U, Ap, C	M, P, C
CLO-3	create and Apply Functions	2(5), 3(5), 4(5), 5(5)	1, 2, 6, 7	C, Ap	P, C
CLO-4	create, analyzing and Apply strings and lists, Tuples and Dictionaries	2(5), 3(4), 4(4), 5(4), 7(3)	1, 2, 4, 5, 6, 7	C, Ap	P, C
CLO-5	understand Create and Apply Files and Exceptions, Classes and Objects	2(3), 3(5), 4(5), 5(4), 7(3)	1, 2, 4, 5, 6, 7	U, C, Ap	M, P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activity	Assessment Tasks	Reference
1.1	Introduction to Digital Computer: Introduction, Von Neumann Concept, Storage	3	1[25]	Lec	CA	1
1.2	Programming Languages, Translators, Hardware and Software, Operating Systems	3	1[25]	KWL	MCQ	1
1.3	Problem Solving Strategies: Problem Analysis, Algorithms	3	1[25]	SP	HrA	1
1.4	Flow Charts, Examples of Algorithms and flow Charts	3	1[25]	PF	HoA	1
2.1	Introduction to Python: Introduction, Python overview, Getting Standard with Python	3	2[25]	TPS	SA	1
2.2	Comments, Python Identifiers, Reserved Keywords, Variables	3	2[25]	Sem	HrA	1
2.3	Standard data Types, Operators, Statement and Expression, String Operations	3	2[25]	WSQ	HoA	1
2.4	Boolean Expressions, Control Statements, Iteration-While Statement, Input from Keyboard	3	2[25]	OT	Qui	1
3.1	Functions: Introduction, Built-in Functions, Composition of Functions	3	3[25]	PT	Ess	1
3.2	User Defined Functions, Parameters and Arguments	3	3[25]	OO	CT	1
3.3	Function Calls, The return Statement, Python Recursive Function	3	3[25]	SI	MCQ	1
3.4	The Anonymous Functions, Writing Python Scripts	3	3[25]	GD	CA	1
4.1	Strings and Lists: Strings, Lists	6	4[50]	RF	SA	1

4.2	Tuples and Dictionaries: Tuples, Dictionaries	6	4[50]	GT	HrA	1
5.1	Files and Exceptions: Text Files, Directories, Exceptions	3	5[25]	Sem	Ess	1
5.2	Exception with Arguments, User- Defined Exceptions	3	5[25]	BS	CT	1
5.3	Classes and Objects: Overview of OOP (Object-Oriented Programming), Class Definition, Creating Objects, Objects as Arguments, Objects as Return values	3	5[25]	CS	MCQ	1
5.4	Built-in Class Attributes, Inheritance, Method Overriding, Data encapsulation, Data Hiding	3	5[25]	SP	CA	1

Reference Books

1. E. Balaguruswamy, “*Problem Solving And Python Programming*”, McGraw Hill Education (India) private Limited, 2018.
2. Reema Thareja, “*Python Programming Using Problem Solving Approach*”, OXFORD University Press, Ninth Edition, 2022.
3. Dr. R. Nageswara Rao, “*Core Python Programming*”, Dreamtech, Third Edition, 2021.
4. Martin C. Brown, “*The Complete Reference Python*”, McGraw Hill Education (India) private Limited, Fifth Edition, 2019.

SEMESTER - I

Course Title: Elective 1 – 1.4 Data Engineering and Management

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PRED

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	comprehend the Data Management concepts and analyse the relationship with the enterprise	2(4), 3(5), 4(4), 5(3), 7(4)	1, 2, 4, 5, 6, 7, 9	U, An	F, C
CLO-2	analyze Data Modelling concepts and assess its quality	2(6), 3(5), 5(5), 7(4)	1, 2, 6, 7	An	C

CLO-3	understand and implement business modelling techniques	2(2), 3(2), 4(4), 5(4), 7(8)	1, 2, 4, 5, 6, 7, 9	U, Ap	M, P
CLO-4	evaluate the use of Artificial Intelligence and Machine Learning in CRM	2(3), 3(3), 4(6), 5(4), 7(4)	1, 2, 4, 5, 6, 7	E	C
CLO-5	develop CRM applications in cloud	2(3), 3(4), 4(7), 5(3), 7(3)	1, 2, 4, 5, 7	C	P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activity	Assessment Tasks	Reference
1.1	Database Development: Database architecture of an information system-Overview of the database development process	3	1[25]	Lec	CA	1
1.2	Conceptual data modeling-Relational data analysis-Roles of a data model-Physical database design.	3	1[25]	TPS	SA	1
1.3	Data Management: Problems encountered without data management-Data management responsibilities-Data management	3	1[25]	Sem	HrA	1
1.4	Roles within data management-Benefits of data management-Relationship between data management and enterprise.	3	1[25]	WSQ	HoA	1
2.1	Corporate Data Modelling: Need for a corporate data model- Nature of a corporate data model- Develop a corporate data model - Corporate data model principles Data Definition and Naming: Elements of a data definition, Data naming conventions.	6	2[50]	OT	Qui	1
2.2	Data Quality: Issues associated with poor data quality-Causes of poor data quality-Dimensions of data quality-Data model quality-Improving data quality. Data Accessibility: Data Security, Data integrity, Data recovery.	6	2[50]	PT	Ess	1
3.1	Use of Packaged Application Software: Application software packages, Impact on data management.	3	3[25]	KWL	CT	1
3.2	Distributed Data And Databases: Rationale for distributing data, Perfect distributed database system, Top-down fragmentation and partitioning Bottom-up integration The management of replication.	3	3[25]	SP	MCQ	1
3.3	Business Intelligence: Data warehousing-Multidimensional model of data-Standard reporting tools.	3	3[25]	PF	CA	1
3.4	Online analytical processing OLAP-Relational schema for a data warehouse.	3	3[25]	OO	SA	1
4.1	CRM: Three main pillars of CRM. Getting To Know Your Customer: 360-degree client view.	4	4[33]	SI	HrA	2

4.2	Utilizing Artificial Intelligence And Machine Learning In Your CRM Strategy: Evolution of AI-Current state of AI-Teaming up AI with people	4	4[34]	GD	Ess	2
4.3	Applying AI to your CRM solution-ethical aspects of AI-An example of AI in CRM processes	4	4[33]	RF	CT	2
5.1	Cloud Versus On Premise Versus Hybrid: Factors influencing vendor selection, Hybrid deployment, what are your options.	4	5[34]	Sem	MCQ	2
5.2	CRM Differentiators: It's not about the feature list; it's about the ecosystem-Fourth industrial revolution and CRM-AI and smart cloud-To cloud or not to cloud-	4	5[33]	BS	HrA	2
5.3	Leveraging smart cloud into CRM-Big data-Social selling and advertising-Implementation tools-Sustainable CRM platform.	4	5[33]	CS	HoA	2

Reference Books

1. Keith Gordon, *“Principles of Data Management Facilitating Information Sharing”*, BCS Learning, Second Edition, 2013.
2. Max Fatouretchi, *“The Art of CRM”*, Packt Publishing, First Edition, 2019.
3. Peter Ghavami, *“Big Data Management_ Data Governance Principles for Big Data Analytics”*, De Gruyter, 2020.
4. Francis Buttle, *Stan Maklan, Customer Relationship Management Concepts and Technologies*, Routledge, Fourth Edition, 2019.

SEMESTER - I

Course Title: Elective 1 – 1.4 Architecture and Frameworks

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PREE

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand, analyze and evaluate the purpose of Software architecture and development methodologies with consideration of risk management	2(5), 7(8), 10(7)	1, 2, 3, 5, 9	U, An, E	M, C

CLO-2	comprehend, apply and evaluate the domain knowledge for software development process and determine the impact of quality attributes.	2(6), 3(6), 5(6), 10(2)	1, 2, 3, 5, 9	Ap, E	P, C
CLO-3	understand, track and analyze the systematic approach for various software design models with effective document process	1(2), 2(3), 3(3), 4(5), 5(3), 10(4)	1, 2, 3, 6, 9	U, An	M, C
CLO-4	illustrate and summarize the functions of orthogonal systems with complexity, design principles and design pattern for software architecture	2(3), 3(3), 4(6), 5(4), 7(4)	1, 2, 3, 4, 5, 6, 9	U	M
CLO-5	comprehend, analyze and evaluate the performance and security measures for Server, Web and Database applications in order to create the secure software systems for various domain applications	2(1), 2(2), 3(2), 4(6), 5(6), 7(3)	1, 2, 4, 5, 6	An, E	C, M

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activity	Assessment Tasks	Reference
1.1	Software architecture introduction, Importance of Software architecture, Software architecture consumers	3	1[25]	Lec	CA	1
1.2	Architect role, software architecture in an organization, Types of software architects.	3	1[25]	KWL	MCQ	1
1.3	Software development methodologies, Project management, Office politics	3	1[25]	SP	HrA	1
1.4	Software risk management, Configuration management, Software product lines	3	1[25]	PF	HoA	1
2.1	Domain Knowledge, Developing business acumen, Domain-driven design, requirement engineering.	6	2[50]	TPS	SA	1
2.2	Requirement elicitation, Software Quality attributes: Maintainability, Usability, Availability, Portability, Interoperability, Testability	6	2[50]	Sem	HrA	1
3.1	Software Architectures design, Importance, Top-down Versus bottom-up design approaches	3	3[25]	WSQ	HoA	1
3.2	Architectural drivers, Documenting the Software architecture design	3	3[25]	OT	Qui	1

3.3	Systematic approach, Attribute-driven design, Microsoft's technique for architecture and design	2	3[16]	PT	Ess	1
3.4	Architecture-centric design method, Architecture development method	2	3[17]	OO	CT	1
3.5	Tracking the progress of the software architecture's design	2	3[17]	SI	MCQ	1
4.1	Designing orthogonal software systems, Minimizing complexity, SOLID design principles, Software architecture patterns	6	4[50]	GD	CA	1
4.2	Layered, Event-driven architecture, Model-View patterns, Service-oriented architecture	6	4[50]	RF	SA	1
5.1	Architecting Modern Applications, Importance of Performance, Performance improvement	4	5[33]	GT	HrA	1
5.2	Server side caching, Web application performance, Database performance	4	5[33]	Sem	Ess	1
5.3	Securing software systems, Threat modeling, Secure by design	4	5[34]	BS	CT	1

Reference Books

1. Joseph Ingeno, "Software Architect's Handbook" First Edition, Packt Publishing, 2018.
2. Oliver Vogel, Indo Arnold, Arif Chughtai and Timo Kehrer, "Software Architecture" Springer, Verlag, 2011.
3. Ian Gorton, "Essential Software architecture", Second Edition, Springer, 2011.
4. Len Bass, Paul Clements and Rick Kazman, "Software architecture in practice", Third edition, Addison-Wesley, 2013.

SEMESTER – I

Course Title: Elective I – 1.4 Multimedia Technologies

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PREA

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
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CLO-1	understand text and images in multimedia	2(7), 3(6), 4(7)	1, 2, 3, 5, 9	U	M
CLO-2	apply animation using sound and video	2(5), 3(4), 4(4), 7(3), 10(4)	1, 2, 3, 5, 9	Ap	P
CLO-3	analyze the stages of multimedia and planning and costing	2(2), 3(2), 7(10), 10(6)	1, 2, 3, 5, 9	An	C
CLO-4	create projects	1(2), 2(2), 3(2), 4(2), 7(8), 10(4)	1, 2, 3, 4, 5, 6, 8, 9	C	P
CLO-5	understand mobile multimedia, testing and delivering	2(2), 3(2), 4(2), 5(2), 7(8), 10(4)	1, 2, 3, 4, 5, 6, 9	U	M, C

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activity	Assessment Tasks	Reference
1.1	What is Multimedia: Definitions, Multimedia in Business, Multimedia in Schools, Multimedia at Home, Multimedia in Public Places, Virtual Reality, Delivering Multimedia, CD-ROM, DVD, Flash Drivers, The broadband Internet,	4	1[33]	Lec	CA	1
1.2	Images: Before You Start to Create, Making Still Images, Color, Image File Formats	4	1[33]	SI	HrA	1
1.3	Sound: The Power of Sound, Digital Audio, MIDI Audio, MIDI vs. Digital Audio, Multimedia System Sounds, Audio File Formats, Vaughan's Law of Multimedia Minimums, Adding Sound to Your Multimedia Project	4	1[34]	GD	Ess	1
2.1	Animation: The Power of Motion, Principles of Animation, Animation by Computer, Making Animations that work	6	2[50]	RF	CT	1
2.2	Video: Using Video, How Video Works and Is Displayed, Digital Video Containers, Obtaining Video Clips, Shooting and Editing Video	6	2[50]	Sem	MCQ	1
3.1	Making Multimedia: The Stages of a Multimedia Project, What You Need: The Intangibles, What You Need: Multimedia Skills, What You Need: Hardware,	6	3[50]	BS	HrA	1
3.2	What You Need: Software, What You Need: Authoring Systems	6	3[50]	CS	HoA	1
4.1	Designing and Producing: Designing, Producing	6	4[50]	Sem	MCQ	1
4.2	Content and Talent: Acquiring Content, Ownership of Content Created for a Project, Acquiring Talent	6	4[50]	TPS	SA	1

5.1	Internet and Multimedia: Internet History, Internetworking, Multimedia on the Web, Developing for the Web, Text for the Web, Images for the Web, Sound for the Web, Animation for the Web, Video for the Web	6	5[50]	Sem	HrA	1
5.2	Mobile Multimedia: Digital Revolution Worldwide, Mobile Hardware, connection Mobile Operating Systems	6	5[50]	WSQ	HoA	1

Reference Books

1. Tay Vaughan, “Multimedia: Making It Work”, Tata McGraw Hill, Ninth Edition, 2016.
2. S. Heath, “Multimedia & Communication Systems”, Focal Press, Second Edition, 1999.
3. K.Andleighand K.Thakkar, “Multimedia System Design”, PHI learning Private Limited, Second Edition, 2000.

SEMESTER - I

Course Title: Elective II – 1.5 Software Development Technologies

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PREF

Pass-Out Policy: Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

Course Creator

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	to understand, apply and summarize the basic concepts of Micro services communication Microsoft Azure and DevOps for software development life cycle	2(6), 4(8), 6(6)	1, 6, 9	U, Ap, R	M, P, F
CLO-2	to illustrate, and implement Azure Kubernetes Service tools for software development life cycle	2(4), 3(4), 4(12)	1, 2, 3, 5, 9	Ap	P
CLO-3	to recognize, analyse and summarize the functionalities of .NET DevOps for Azure applications	2(4), 3(4), 4(9), 7(3)	1, 2, 3, 5, 9	R, An	F, C
CLO-4	to understand, design and evaluate the principles and architecture service tools for software development life cycle.	2(4), 3(4), 4(12)	1, 2, 3, 5, 9	U, C, E	M, C, P

CLO-5	to comprehend, implement and review the functionalities of API and API gateways for cloud and Azure applications	2(4), 3(3), 4(8), 6(5)	1, 2, 3, 5, 6, 9	Ap, R	P, F
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Module	Course Description	Hours	% of CLO mapping with Module	Learning Activity	Assessment Tasks	Reference
1.1	Implementing Microservices: Client to microservices communication, Interservice communication, data considerations, security, monitoring, microservices hosting platform options	4	1[33]	Lec	CA	1
1.2	Azure Service Fabric: Introduction, core concepts, supported programming models, service fabric clusters, develop and deploy applications of service fabric	4	1[33]	TPS	SA	1
1.3	Monitoring Azure Service Fabric Clusters: Azure application, resource manager template, Adding Application Monitoring to a Stateless Service Using Application Insights, Cluster monitoring, Infrastructure monitoring	4	1[34]	Sem	HrA	1
2.1	Azure Kubernetes Service (AKS): Introduction to kubernetes and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, monitoring AKS clusters, native kubernetes dashboard, Prometheus and Grafana	3	2[25]	WSQ	HoA	1
2.2	Securing Microservices: Authentication in microservices, Implementing security using API gateway pattern, Creating application using Ocrlot and securing APIs with Azure AD	3	2[25]	OT	Qui	1
2.3	Database Design for Microservices: Data stores, monolithic approach, Microservices approach, harnessing cloud computing, database options on MS Azure, overcoming application development challenges	3	2[25]	PT	Ess	1
2.4	Building Microservices on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises simplified, SaaS on Azure stack	3	2[25]	KWL	CT	1
3.1	.NET DevOps for Azure: DevOps introduction, Problem and solution. Professional Grade DevOps Environment: The state of DevOps, professional grade DevOps vision, DevOps architecture, tools for professional DevOps environment, DevOps centered application	4	3[33]	SP	MCQ	1
3.2	Tracking work: Process template, Types of work items, Customizing the process, Working with the process	4	3[34]	PF	CA	1

3.3	Tracking code: Number of repositories, Git repository, structure, branching pattern, Azure repos configuration, Git and Azure	4	3[33]	OO	SA	1
4.1	Building the code: Structure of build, using builds with .NET core and Azure pipelines, Validating the code: Strategy for defect detection, Implementing defect detection	4	4[34]	SI	HrA	1
4.2	Release candidate creation: Designing release candidate architecture, Azure artifacts workflow for release candidates Implementing deployment in Azure pipelines	4	4[33]	GD	Ess	1
4.3	Deploying the release: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability	4	4[33]	RF	CT	1
5.1	Introduction to APIs: Introduction, API economy, APIs in public sector. API Strategy and Architecture: API Strategy, API value chain, API architecture, API management	6	5[50]	Sem	MCQ	1
5.2	API Development: Considerations, Standards, kick-start API development, team orientation. API Gateways: API Gateways in public cloud, Azure API management, AWS API gateway. API Security: Request-based security, Authentication and authorization	6	5[50]	BS	HrA	1

Reference Books

1. Harsh Chawla and Hemant Kathuria, “*Building Microservices Applications on Microsoft Azure- Designing*”, Developing, Deploying, and Monitoring, Apress, First Edition, 2019.
2. Jeffrey Palermo,” *NET DevOps for Azure A Developer’s Guide to DevOps Architecture the Right Way*”, Apress, First Edition, 2019.
3. Thurupathan and Vijayakumar, “*Practical API Architecture and Development with Azure and AWS - Design and Implementation of APIs for the Cloud*”, Apress, 2018

SEMESTER - I

Course Title: Elective II – 1.5 Soft Computing
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Course Type: Theory

Total Hours: 60	Hours/Week: 4	Credits: 4
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Course Code: 23PREB

Pass-Out Policy : Minimum Contact Hours: 36 Total Score %:100 Internal: 40 External: 60 Minimum Pass %: 50[No Minimum for Internal]

Course Creator

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	to provide an introduction to the basic principles, techniques, and applications of soft computing	2(3), 3(4), 4(3), 6(5), 10(5)	1, 2, 3, 5, 9, 10	R	M, C
CLO-2	to get familiar with Neural network architectures and supervised learning algorithms	2(4), 3(3), 4(3), 6(4), 7(2), 10(4)	1, 2, 3, 5, 9, 10	Ap	C
CLO-3	to understand the architectures and algorithms of Unsupervised Learning techniques	2(3), 3(2), 4(4), 5(2), 6(4), 10(5)	1, 2, 3, 5, 9, 10	U	M
CLO-4	develop the skills to gain a basic understanding of fuzzy logic theory and fuzzy inference systems	2(3), 3(2), 4(6), 5(6), 10(3)	1, 2, 3, 5, 9, 10	C	P
CLO-5	ability to learn traditional optimization and search techniques and genetic programming	2(2), 3(4), 4(3), 5(3), 6(2), 7(2), 8(2), 10(2)	1, 2, 3, 5, 7, 9, 10	U, E	M, C

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activity	Assessment Tasks	Reference
1.1	Introduction To Soft Computing: Artificial Neural Networks, Biological Neurons, Basic Models of Artificial Neural Networks, Connections, Learning	6	1[50]	Lec	CA	1
1.2	Activation Functions, Important Terminologies of ANNs, Muculloch and Pitts Neuron, Linear Separability-Hebb Network, Flowchart of Training Process, Training Algorithm	6	1[50]	SI	HrA	1
2.1	Supervised Learning Network: Perceptron Networks, Perceptron Learning Rule, Architecture, Flowchart for Training Process, Perceptron Training Algorithms for Single Output Classes, Perceptron Training Algorithm for Multiple Output Classes, Perceptron Network Testing Algorithm	4	2[33]	GD	Ess	1
2.2	Adaptive Linear Neuron, Delta Rule for Single Output Unit, Flowchart for training algorithm, Training Algorithm, Testing Algorithm, Multiple Adaptive Linear Neurons, Architecture, Flowchart of Training Process, Training Algorithm	4	2[33]	RF	CT	1

2.3	Back Propagation Network, Architecture, Flowchart for Training Process, Training Algorithm, Learning Factors of Back, Propagation Network, Radial Basis Function Network, Architecture, Flowchart for Training Process, Training Algorithm	4	2[34]	Sem	MCQ	1
3.1	Unsupervised Learning Network: Associative Memory Networks, Auto Associative Memory Network, Architecture, Flowchart for Training Process, Training Algorithm, Testing Algorithm	4	3[33]	BS	HrA	1
3.2	Bidirectional Associative Memory, Architecture, Discrete Bidirectional Associative Memory, Iterative Auto Associative Memory Networks	4	3[33]	CS	HoA	1
3.3	Linear Auto Associative Memory, Kohonen Self-Organizing Feature Map, Architecture, Flowchart for Training Process, Training Algorithm	4	3[34]	Sem	MCQ	1
4.1	Introduction To Fuzzy Logic: Classical Sets, Operations on Classical Sets, Fuzzy sets, Fuzzy Sets Operations, Properties of Fuzzy Sets	6	4[50]	TPS	SA	1
4.2	Fuzzy Relations, Formation of Rules, Fuzzy Inference Systems (FIS), Fuzzy Logic Control Systems	6	4[50]	SM	HrA	1
5.1	GENETIC ALGORITHM: Introduction, Biological Background, Traditional Optimization and Search Techniques, Gradient Based Local Optimization Method, Random Search, Stochastic Hill Climbing, Simulated Annealing, Symbolic Artificial Intelligence	6	5[50]	WSQ	HoA	1
5.2	Operators in Genetic Algorithm, Encoding, Selection, Crossover, Mutation, Stopping Conditions for Genetic Algorithm Flow, Genetic Programming, Working of Genetic Programming, Characteristics of Genetic Programming, Data Representation	6	5[50]	Sem	HrA	1

Reference Books

1. S.N. Sivanandam, S.N.Deepa, “*Principles of Soft Computing*”, Wiley, Third Edition, 2019.
2. Amit, K. “*Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain*”. CRC Press. 2018.
3. Rajasekaran, S., & Pai, G. V. “*Neural networks, fuzzy logic and genetic algorithm: synthesis and applications*” (with cd). PHI Learning Pvt. Ltd, 2011.
4. Jang, J. S. R., Sun, C. T., & Mizutani, E. “*Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence*” [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484, 2004.

SEMESTER – I

Course Title: Elective II- 1.5 Software Engineering

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PREG

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand software engineering and software process structure.	2(3), 4(5), 6(7)	1, 9, 10	U	M
CLO-2	understand the requirements of software and requirements modeling.	2(3), 3(3), 4(12), 7(2)	1, 2, 3, 4, 5, 9	An	C
CLO-3	analyze architectural design of software.	2(3), 3(3), 4(6), 7(4), 10(4)	1, 3, 4, 9, 10	An	C
CLO-4	understand component level design.	2(3), 4(10), 6(7)	1, 9, 10	E	C, M
CLO-5	understand testing conventional applications.	2(3), 3(3), 4(10), 7(4)	1, 2, 3, 4, 5, 9	Ap	P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activity	Assessment Tasks	Reference
1.1	Software Engineering: Defining the Discipline, The Software Process, Software Engineering Practice, Software Development Myths	3	1[25]	Lec	CA	1
1.2	Software Process Structure: A Generic Process Model, defining a Framework Activity, Identifying a task Set, Process Patterns, Process Assessment and Improvement	3	1[25]	BS	HrA	1
1.3	Process Models: Prescriptive Process Models, Specialized process Models, The Unified Process	3	1[25]	CS	HoA	1

1.4	Personal and Team Process Models, process technology, Product and process	3	1[25]	Sem	MCQ	1
2.1	Principles That Guide Practice: Software Engineering Knowledge, Core Principles, Principles that guide each framework activity	4	2[34]	TPS	SA	1
2.2	Understanding Requirements: Requirements Engineering, Establishing the groundwork, Eliciting Requirements, Developing Use Cases, Building the Analysis Model, Negotiating Requirements, Requirements Monitoring, Validating Requirements, Avoiding Common Mistakes	4	2[33]	Sem	HrA	1
2.3	Requirements Modeling Scenario Based Method: Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement, The Use Case	4	2[33]	WSQ	HoA	1
3.1	Design Concepts: Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model	4	3[33]	SI	HrA	1
3.2	Architectural Design: Software Architecture, Architectural Genres, Architectural styles, Architectural Considerations, Architectural Decisions, Architectural Design	4	3[33]	GD	Ess	1
3.3	Assessing Alternative Architectural Design Pattern-based Architecture Review, Architecture Conformance Checking, Agility and Architecture	4	3[34]	RF	CT	1
4.1	Component Level Design: What is a component?, Designing Class-Based Component	6	4[50]	Sem	MCQ	1
4.2	Conducting component-level design, component-level design for web Apps, Designing Traditional Component, component based development	6	4[50]	BS	HrA	1
5.1	Testing Conventional Applications: Software Testing Fundamental, Internal and External Views of Testing, White-Box testing, Basis path testing, Control structure testing	6	5[50]	CS	HoA	1
5.2	Block-Box Testing, Model-Based Testing, Testing Documentation and Help Facilities, Testing for Real Time Systems, Patterns for Software Testing	6	5[50]	Sem	MCQ	1

Reference Books

1. Roger S. Pressman, Bruce R. Maxim, “*Software Engineering A Practitioner’s Approach*”, Tata McGraw-Hill Education, Eighth Edition, 2019.
2. Ian Sommerville, “*Software Engineering*”, Pearson Education, Sixth Edition, 2001.
3. Rod Stephens, “*Beginning Software Engineering*”, PHI, John Wiley & Sons, Tenth Edition, 2017.
4. Steve McConnell, “*Software Estimation: Demystifying the Black Art*”, Microsoft Press, First Edition, 2006.

SEMESTER - I

Course Title: Elective Lab I – 1.6 Data Engineering and Management - Lab

Course Type: Practical

Total Hours: 60

Hours/Week: 4

Credits: 2

Course Code: 23PRP7

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

Course Creator

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	comprehend the Data Management concepts and analyse the relationship with the enterprise	2(4), 3(5), 4(4), 5(3), 7(4)	1, 2, 3, 4, 5, 6, 9	U, An	F, C
CLO-2	analyze Data Modeling concepts and assess its quality	2(6), 3(5), 5(5), 7(4)	1, 2, 3, 4, 5, 6	An	C
CLO-3	understand and implement business modeling techniques	2(2), 3(2), 4(4), 5(4), 7(8)	1, 2, 3, 4, 5, 6, 9	U, Ap	M, P
CLO-4	evaluate the use of Artificial Intelligence and Machine Learning in CRM	2(3), 3(3), 4(6), 5(4), 7(4)	1, 2, 3, 4, 5, 6, 9	E	C
CLO-5	develop CRM applications in cloud	2(3), 3(4), 4(7), 5(3), 7(3)	1, 2, 3, 4, 5, 6, 9	C	P

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	MongoDB database and perform insert operation	4	1[100]	SP	ST	1
2	MongoDB script to perform query operations	4		SP	ST	1
3	MongoDB Script to perform update operations	5		SP	ST	1
4	MongoDB Script to update documents with aggregation pipeline	4	2[100]	SP	ST	1
5	MongoDB script to delete single and multiple documents	4		SP	ST	1
6	MongoDB script to perform string aggregation operations	4		SP	ST	1
7	Data Model for MongoDB using DbVisualizer	5	3[100]	SP	ST	1

8	Perform CRUD operations using DbVisualizer	4	4[100]	SP	ST	1
9	Zoho CRM account and organize yourTasks, Meetings and Deals	4		SP	ST	1
10	Program to Create and maintain a project using Zoho CRM features	4		SP	ST	1
11	Identify the facts and dimensions for banking environment	5		SP	ST	1
12	SQL queries for implementing different OLAP operations	4		SP	ST	1
13	Compute all the cuboids of 4D cube using group-bys	5	5[100]	SP	ST	1
14	Compute all the cuboids of 4D cube using Rollup and Cube operators	4		SP	ST	1

Reference Books

1. Keith Gordon, “Principles of Data Management Facilitating Information Sharing”, BCS Learning, Second Edition, 2013.
2. Max Fatouretchi, “The Art of CRM”, Packt Publishing, First Edition, 2019.
3. Peter Ghavami, “Big Data Management Data Governance Principles for Big Data Analytics”, De Gruyter, 2020.
4. Francis Buttle, Stan Maklan, “Customer Relationship Management Concepts and Technologies”, Routledge, Fourth Edition, 2019.

SEMESTER – I

Course Title: Elective Lab 1 – 1.6 Architecture and Frameworks - lab

Course Type: Practical

Total Hours: 60 Hours/Week: 4 Credits: 2

Course Code: 23PRP8

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

Course Creator

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand, analyze and evaluate the purpose of Software architecture and development methodologies with consideration of risk management	2(5), 7(8), 10(7)	1, 2, 3, 5, 9	U, An, E	M, C

CLO-2	comprehend, apply and evaluate the domain knowledge for software development process and determine the impact of quality attributes.	2(6), 3(6), 5(6), 10(2)	1, 2, 3, 5, 9	Ap, E	P, C
CLO-3	understand, track and analyze the systematic approach for various software design models with effective document process	1(2), 2(3), 3(3), 4(5), 5(3), 10(4)	1, 2, 3, 6, 9	U, An	M, C
CLO-4	illustrate and summarize the functions of orthogonal systems with complexity, design principles and design pattern for software architecture	2(3), 3(3), 4(6), 5(4), 7(4)	1, 2, 3, 4, 5, 6, 9	U	M
CLO-5	comprehend, analyze and evaluate the performance and security measures for Server, Web and Database applications in order to create the secure software systems for various domain applications	2(1), 2(2), 3(2), 4(6), 5(6), 7(3)	1, 2, 4, 5, 6	An, E	C, M

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Find the WebID profile document and display the necessary attributes	4	1[100]	SP	ST	1
2	Set and access the primary authentications with account recovery mechanisms	4		SP	ST	1
3	Set and access the secondary authentications with account recovery mechanisms	5		SP	ST	1
4	Design authorization and web access control	4	2[100]	SP	ST	1
5	Find the content representation	4		SP	ST	1
6	Reading resources from HTTP REST API and WebSockets API	4	3[100]	SP	ST	1
7	Writing resources from HTTP REST API and WebSockets API	5		SP	ST	1
8	Data notification using Social Web App protocol	4		SP	ST	1
9	Managing subscriptions and friends list using Social Web App protocol	4	4[100]	SP	ST	1
10	Managing list of followers and following list using Social Web App protocol	4		SP	ST	1
11	Hibernate application to store employee object to the database.4	5		SP	ST	1
12	Getting system date time using NodeJS.5	4	5[100]	SP	ST	1
13	Login activity using servlet.2	5		SP	ST	1

14	Sending and receiving messages using JMS.8	4		SP	ST	1
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Reference Books

1. Joseph Ingeno, “*Software Architect’s Handbook*” Packt Publishing 2018.
2. Oliver Vogel, Indo Arnold, Arif Chughtai and Timo Kehrer, “*Software Architecture*” Springer, Verlag, 2011.
3. Ian Gorton, “*Essential Software Architecture*”, Second Edition, Springer, 2011.
4. Len Bass, Paul Clements and Rick Kazman, “*Software architecture in practice*”, Third edition, Addison Wesley, 2013.

SEMESTER - I

Course Title: Elective Lab I – 1.6 Multimedia Technologies Lab

Course Type: Practical

Total Hours: 60 Hours/Week: 4 Credits: 2

Course Code: 23PRP1

Pass-Out Policy : Minimum Contact Hours: 36
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand text and images in multimedia	2(7), 3(6), 4(7)	1, 2, 3, 5, 9	U	M
CLO-2	apply animation using sound and video	2(5), 3(4), 4(4), 7(3), 10(4)	1, 2, 3, 5, 9	Ap	P
CLO-3	analyze the stages of multimedia and planning and costing	2(2), 3(2), 7(10), 10(6)	1, 2, 3, 5, 9	An	C
CLO-4	create projects	1(2), 2(2), 3(2), 4(2), 7(8), 10(4)	1, 2, 3, 4, 5, 6, 8, 9	C	P
CLO-5	understand mobile multimedia, testing and delivering	2(2), 3(2), 4(2), 5(2), 7(8), 10(4)	1, 2, 3, 5, 9	U	M, C

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
Flash						
1	To Move an object in the path	3	1[100]	SP	ST	1
2	Text flip, Text color Change	3		SP	ST	1
3	Creating a link Using Texts and objects, change the color of the object	3		SP	ST	1
4	Shape tweening and Using shape hints, Motion Tweening , Hybrid Tweening	3	2[100]	SP	ST	1
5	Character Animation, Object Animation, Drawing Images Character Animation, Drawing Images	4		SP	ST	1
6	An application to show the Masking Effect	4		SP	ST	1
7	Slide Show Presentation	4		SP	ST	1
Photoshop						
8	Greeting Card, Create Background Picture	4	3[100]	SP	ST	1
9	Text Effects, Photo Effects	4		SP	ST	1
10	Color, Buttons	4		SP	ST	1
11	Editing Images	4		SP	ST	1
12	Designing web pages	4		SP	ST	1
Dream Weaver						
13	Text Management	4	4[100]	SP	ST	1
14	Tables, Layers	3		SP	ST	1
15	Creating Menu Bar	3		SP	ST	1
16	Creating Pages and Sites	3	5[100]	SP	ST	1
17	Animation Images	3		SP	ST	1

Reference Books

1. TayVaughan, “*Multimedia: Making It Work*”, Tata McGraw Hill, Ninth Edition, 2016.
2. S. Heath, “*Multimedia & Communication Systems*”, Focal Press, Second Edition, 1999.
3. K. Andleighand K. Thakkar, “*Multimedia System Design*”, PHI learning Private Limited, Second Edition, 2000.

SEMESTER - I

Course Title: Lab II – 1.7 Python Programming – Lab

Course Type: Practical

Total Hours: 60 Hours/Week: 4 Credits: 2

Course Code: 23PRP2

Pass-Out Policy: Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	remember and understand Digital computer, Apply and create problemsolving Strategies	2(5), 3(6), 4(5), 10(4)	1, 2, 5, 9, 10	R, U, Ap, C	F, M, P
CLO-2	understand Apply and create Pythonexpression	2(4), 3(5), 4(4), 5(5), 7(2)	1, 2, 4, 5, 6, 7	U, Ap, C	M, P, C
CLO-3	create and Apply Functions	2(5), 3(5), 4(5), 5(5)	1, 2, 6, 7	C, Ap	P, C
CLO-4	create, analyzing and Apply strings andlists, Tuples and Dictionaries	2(5), 3(4), 4(4), 5(4), 7(3)	1, 2, 4, 5, 6, 7	C, Ap	P, C
CLO-5	understand Create and Apply Files and Exceptions, Classes and Objects	2(3), 3(5), 4(5), 5(4), 7(3)	1, 2, 4, 5, 6, 7	U, C, Ap	M, P

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Sum of their Squares	4	1[100]	SP	ST	1
2	Fibonacci number	4		SP	ST	1
3	Factorial of a non-negative integer	4		SP	ST	1
4	Power of a specific exponent	5		SP	ST	1
5	Anonymous Function Square()	4	2[100]	SP	ST	1
6	List	5		SP	ST	1

7	Tuples	5	3[100]	SP	ST	1
8	Dictionaries	4		SP	ST	1
9	Exceptions	5	4[100]	SP	ST	1
10	Exception handling using try, except, finally, raise, and catch.	4		SP	ST	1
11	File Handling	4		SP	ST	1
12	Inheritance	4	5[100]	SP	ST	1
13	Method Overriding	4		SP	ST	1
14	Encapsulation	4		SP	ST	1

Reference Books

1. E. Balaguruswamy, “*Problem Solving And Python Programming*”, McGraw Hill Education (India) private Limited, 2018.
2. ReemaThareja, “*Python Programming Using Problem Solving Approach*”, OXFORD University Press, Ninth Edition, 2022.
3. Dr. R. Nageswara Rao, “*Core Python Programming*”, Dreamtech, Third Edition, 2021.

SEMESTER - I

Course Title: 1.8 Skill Enhancement Professional Competency Skill

Course Type: Practical

Total Hours: 30 Hours/Week: 2 Credits: 1

Course Code: 23PRS1

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

Course Creator

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	enable students to gain basic communication skills in professional and social contexts effectively.	1(14), 8(3), 10(3)	1, 6, 7, 8, 9	R, Ap	F, M, C
CLO-2	acquire useful words and apply them insituational context.	1(14), 8(3), 10(3)	2, 3, 7, 9	Ap	F, M, C
CLO-3	develop listening and reading skills through comprehension passages	1(10), 8(4), 10(6)	1, 3, 5, 6, 8, 9	Ap, C	F, M, C

CLO-4	enrich the leadership qualities and interpersonal communication	1(10), 8(8), 10(2)	1, 6, 7, 8	Ap	F, M, C
CLO-5	enhance essential characteristics	1(14), 8(3), 10(3)	2, 3, 5, 8, 9	Ap	F, M, C

Sl. No.	Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Practice for writing E-mails/Technical Blogs/Forums	3	1[100]	SP	ST	1
2	PPT Preparation / Demonstration of Technical Presentation	2		SP	ST	1
3	Preparation of Resume	3	2[100]	SP	ST	1
4	Preparation for Job Interviews / Mock Interview Section	2		SP	ST	1
5	Group Discussion Skills	3	3[100]	SP	ST	1
6	Developing Listening Skill(Comprehension)	3		SP	ST	1
7	Practice for Short Speeches / Situational Conversation	2		SP	ST	1
8	English through Mass Media	2	4[100]	SP	ST	1
9	Essential Grammar	3		SP	ST	1
10	Communicating and collaborating with peer members	3	5[100]	SP	ST	1
11	Team Empowerment	2		SP	ST	1
12	Persuasive Communication	2		SP	ST	1

Reference Books

1. Uma Narula, “*Development Communication: Theory and Practice*”, Revised Edition, Har-Aanad Publication, 2019.
2. Annette Capel and Wendy Sharp, “*Cambridge English: Objective First*”, Fourth Edition, Cambridge University Press, 2013.
3. Emma Sue-Prince, “*The Advantage: The 7 Soft Skills You Need to Stay One Step Ahead*”, First Edition, FT Press, 2013.
4. Guy Brook-Hart, “*Cambridge English: Business Benchmark*”, Second Edition, Cambridge University Press, 2014.
5. Norman Lewis, “*How to Read Better & Faster*”, Binny Publishing House, New Delhi, 1978.
6. Michael McCarthy and Felicity O’Dell, “*English Vocabulary in Use:100 Units of Vocabulary Reference and Practice*”, Cambridge University Press, 1996.
7. Murphy, Raymond, “*Intermediate English Grammar*”, Second Edition, Cambridge University Press, 1999.

SEMESTER - II

Course Title: Core Course 4 – 2.1 Data Structures and Algorithms

Course Type: Theory

Total Hours: 60

Hours/Week: 4

Credits: 4

Course Code: 23PR21

Pass-Out Policy: Minimum Contact Hours: 36
Total Score %: 100 Internal: 40 External: 60
Minimum Pass %: 50 [No Minimum for Internal]

Course Creator

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand the basic concepts of data structures & analyze how to represent arrays	2(4), 3(7), 4(5), 6(4)	1, 2, 3, 5, 9, 10	U, An	F, C
CLO-2	apply stack, queues & linked lists structures to data & analyze the representations	2(5), 4(5), 5(5), 7(5)	1, 3, 4, 5, 6, 7	Ap, An	P, C
CLO-3	apply binary tree structure to data, evaluate the time & space complexity	2(2), 3(4), 4(4), 5(5), 7(5)	1, 3, 4, 5, 6, 7	Ap, E	P, Cm
CLO-4	apply & analyze the graph structures	2(4), 3(7), 4(5), 6(4)	1, 2, 3, 5, 9, 10	Ap, An	P, C
CLO-5	apply and create sorting techniques	1(3), 2(2), 3(2), 4(5), 5(4), 6(4)	1, 3, 5, 6, 9, 10	Ap, C	C, P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	BASIC CONCEPTS: Overview: System Life Cycle, Object-Oriented Design, Data Abstraction and Encapsulation, Basics of C++, Algorithm Specification, The Standard Template Library, Performance Analysis and Measurement	4	1[33]	Lec	HrA	1

1.2	ARRAYS: Abstract Data Types and the C++ Class, The Array as an Abstract Data type, The Polynomial Abstract Data Type	4	1[34]	Lec	HoA	1
1.3	Sparse Matrices, Representation of Arrays, The String Abstract Data Type	4	1[33]	KWL	SA	1
2.1	STACKS AND QUEUES: Templates in C++, The Stack Abstract Data type, The Queue abstract Data type, Subtyping and Inheritance in C++, A Mazing Problem, Evaluation of Expressions	3	2[25]	OO	MCQ	1
2.2	LINKED LISTS: Singly Linked Lists and Chains, Representing Chains in C++, The Template Class Chain	4	2[33]	Lec	Ess	1
2.3	Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials, Equivalence Classes, Sparse Matrices, Doubly Linked Lists, Generalized Lists	5	2[42]	Sem	CA	1
3.1	TREES: Introduction, Binary Trees, Binary Tree Traversal and Tree Iterators	4	3[34]	BS	HoA	1
3.2	Additional Binary Tree Operations, Threaded Binary Trees, Heaps, Binary Search Trees,	4	3[33]	GT	CT	1
3.3	Selection Trees, Forests, Representation of Disjoint Sets, Counting Binary Trees	4	3[33]	GD	Qui	1
4.1	GRAPHS: The Graph Abstract Data Type	4	4[33]	SI	HrA	1
4.2	Elementary Graph Operations, Minimum Cost Spanning Trees	4	4[44]	CS	Ess	1
4.3	Shortest Paths and Transitive Closure, Activity Networks	4	5[23]	Lec	HoA	1
5.1	SORTING: Motivation, Insertion Sort, Quick Sort, How fast Can We Sort?	3	5[25]	Sem	HrA	1
5.2	Merge Sort, Heap Sort	3	5[25]	BS	CA	1
5.3	Sorting on Several Keys, List and Table Sorts	3	5[25]	GT	CT	1
5.4	Summary of Internal Sorting, External Sorting	3	5[25]	Sem	SA	1

Reference Books

1. Ellis Horowitz, Sahni, Dinesh Mehta, “*Fundamentals of Data Structures in C++*”, Universities Press, Second Edition, 2008.
2. Gilberge Forouzan, “*Data Structures A Pseudocode Approach with C++*”, Tata McGraw Hill, Fifth Edition, 2004.
3. Alfred Aho, John E. Hopcroft, Jeffrey D. Ullman, “*Data Structures & Algorithms*”, Pearson Education India, First Edition, 2002.

SEMESTER – I

Course Title: Core Course 5 – 2.2 Database Systems

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PR22

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %: Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

Course Creator

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand the basic concepts of database management system	2(7), 3(7), 5(6)	1, 2, 3, 5, 6	U	C, M
CLO-2	analyze and apply advanced SQL functions	2(4), 3(4), 4(4), 5(6), 7(2)	1, 2, 3, 5, 6, 7	Ap	M, P
CLO-3	create normalized database, store, and retrieve and manipulate the stored data	1(2), 2(3), 3(5), 4(3), 5(5), 7(2)	1, 2, 3, 5, 6, 7, 8	C	P, C
CLO-4	understand storage, indexing and hashing functions	1(2), 2(3), 3(5), 4(3), 5(5), 7(2)	1, 2, 3, 5, 6, 7, 8	U	M, C
CLO-5	apply suitable concurrency control mechanism	2(4), 3(5), 4(3), 5(5), 7(3)	1, 2, 3, 5, 6, 7	Ap	P, C

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Task	Reference
1.1	Introduction to the Relational Databases: Structure of Relational Databases, Database Schema, Keys	3	1[25]	Lec	Qui	1
1.2	Schema Diagrams, Relational Query Languages, Relational Operations	3	1[25]	OT	HrA	1
1.3	Introduction to SQL: Overview of The SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries	3	1[25]	TPS	CT	1

1.4	Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database	3	1[25]	Soc	CA	1
2.1	Intermediate SQL: Join Expressions, Views, Transactions	3	2[25]	Lec	HoA	1
2.2	Integrity Constraints, SQL Data Types and Schemas, Authorization	4	2[33]	KWL	SA	1
2.3	Formal Relational Query Languages: The Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus	5	2[42]	OO	MCQ	1
3.1	Database Design and The E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets	3	3[25]	Lec	OBT	1
3.2	Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data	3	3[25]	Sem	CA	1
3.3	Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies	3	3[25]	BS	HoA	1
3.4	Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms, Database Design Process, Modeling Temporal Data	3	3[25]	GT	CT	1
4.1	PL/SQL: A Programming Language: A Brief history of PL/SQL, Fundamentals of PL/SQL, PL/SQL Block structure, Comments, Data types, Other Data types, Variable declaration, Anchored Declaration	4	4[33]	GD	Qui	1
4.2	Assignment Operation, Bind Variables, Substitution Variables in PL/SQL, Printing in PL/SQL, Arithmetic Operators.	3	4[25]	SI	HrA	1
4.3	More on PL/SQL: Control Structures and Embedded SQL: Control Structures, Nested Blocks, SQL in PL/SQL, Data Manipulation in PL/SQL, Transaction Control Statements.	5	4[42]	CS	SA	1
5.1	PL/SQL Cursors and Exceptions: Cursors, Implicit Cursors, Explicit Cursors, Explicit Cursor Attributes, Implicit Cursor Attributes, Cursor FOR loops, SELECT ... FOR UPDATE Cursor	6	5[50]	Lec	HoA	1
5.2	WHERE CURRENT OF Clause, Cursor with Parameters, Cursor Variables: An Introduction, Exceptions, Types of Exceptions, More Sample Programs.	6	5[50]	Sem	SA	1

Reference Books

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", McGraw Hill Education, Sixth Edition, 2013.
2. Nilesh Shah, "Database Systems using Oracle", PHI Learning Private Limited, Second

- Edition, 2012.
- C.J. Date, A. Kannan, S. Swamynathan, “*Introduction to Database Systems*”, Pearson Education, Eighth Edition, 2006.
 - Ramez Elmasri, “*Fundamentals of Database Systems*”, Pearson Education, Sixth Edition, 2008.

SEMESTER – II

Course Title: Core Course 6 - 2.3 Advanced Machine Learning Using R

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PR23

Pass-Out Policy : Minimum Contact Hours: 36
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %: 50[No Minimum for Internal]

Course Creator

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CLO - No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	remember Artificial Intelligence, understand Machine Learning Algorithms	2(4), 3(3), 4(3), 5(4), 7(4), 10(2)	1, 2, 3, 5, 6, 9	R, U	F, C, M
CLO-2	understand Basic concepts of R and data structures using R	1(7), 3(5), 6(5), 7(3)	1, 2, 3, 4, 5, 8, 10	U	M
CLO-3	understand and Apply Decision Control and looping statements in R, Create File	1(7), 3(4), 5(3), 6(6),	1, 6, 8, 10	U, Ap	M, P
CLO-4	understand working with Data and create programs using various functions in R, Analyze dplyr and tidyr packages	1(3), 2(2), 3(2), 4(2), 5(6), 6(3), 9(2)	1, 2, 3, 5, 6, 8, 9, 10	U, C, An	M, C
CLO-5	create graphs and understand social media mining	1(4), 2(3), 3(3), 4(5), 5(3), 6(2)	1, 2, 3, 5, 6, 8, 9, 10	C, U	C, P, M

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference

1.1	Introduction to Machine Learning: Artificial Intelligence, How does Machine Learning Work?, Data science and Machine learning	1	1[8]	Lec	CA	1
1.2	Data Analytics and Machine Learning, How it Ties to data science, The future of machine learning, Machine Learning Versus Traditional Programming	3	1[25]	GT	HA	1
1.3	Machine Learning Algorithms: Linear Regression, Logistic Regression, k-Nearest Neighbor Algorithm, Decision Trees, Random Forests.	2	1[17]	GD	SA	1
1.4	Machine Learning Algorithms-II: K-means Algorithm, Naïve Bayes Classification Algorithm.	3	1[25]	SI	MCQ	1
1.5	Neural Network, Applications of Neural Networks, Support Vector Machine (SVM)	3	[25]	CS	OBT	1
2.1	Introduction to R: The R Environment, History of R, Features of R, Importance of R, Advantages of R	3	2[25]	Lec	CA	1
2.2	Disadvantages, Conclusion, Future Scope, Applications of R, Installing R and R studio, Printing Hello World Message, The R script File, Data Structures.	3	2[25]	Sem	HA	1
2.3	More on Data Structures: List, Matrices, Data Frames	3	2[25]	OT	CT	1
2.4	Factors, Arrays, Coercion.	3	2[25]	TPS	Qui	1
3.1	Decision Control and Looping Statements: The if Statement, The if...else statement, The if...else ladder, The ifelse() Function, Basic Loop Structures /Iterative Statements, The Break Statement.	2	1[17]	SOC	HrA	1
3.2	Next Statement, Repeat Loop, R Functions The Return Function, Returning Multiple Values, Lazy Evaluation, Built-in Functions, R Programming Environment.	2	1[16]	Lec	SA	1
3.3	Variable Scope and Lifetime, Calling R Functions Defined in Other Scripts, Recursive Functions, Infix Operator, The 'switch, Statement.	2	1[17]	KWL	HA	1
3.4	Generating and Manipulating Data in R: Generating Random Numbers in R, Standardising a Sample, Generating Random Numbers using the Random Package, Reading and Writing Data into Files, Binary Formats in R.	3	3[25]	OO	SA	1
3.5	Working with Files and Directories, Writing Data Frame to a File, Reading Data from Excel (.xls and .xlsx) in R, Reading HTML and XML Files, Saving and Loading an R session, Reading and Writing Data from SQL Tables.	3	3[25]	Lec	Qui	1
4.1	Working with Data: The seq() Function, The sort() Function, The order() Function, The rev() Function, The summary() Function, The abs() Function.	2	4[17]	GT	HrA	1
4.2	Miscellaneous Built-in Functions in R, The cut() Function, The append() Function, The split() and the unsplit() Functions, Regular Expressions, Anonymous Functions.	2	4[17]	GD	CT	1

4.3	Looping Functions, The table() Function, Contingency Tables, Selecting Parts of Data from a Table, Dealing with Date and Time in R.	4	4[33]	SI	CA	1
4.4	Using dplyr and tidyr Packages: The dplyr Package, The tidyr Package.	4	4[3]	CS	HA	1
5.1	Plotting Graphs: Plotting Histogram, Plotting a Bar Graph, Plotting a pie Chart, Plotting a Line Chart, Plotting a Scatter Plot(or X-Y Graph), Plotting Box Plot Graphs Plotting Boxplot Graphs.	4	5[33]	KWL	SA	1
5.2	Density Plots, saving a Plot in R, Customising Text in a Graph, Advanced Plots with Graph, Advanced Plots with ggplot.	3	5[25]	TPS	MCQ	1
5.3	Social Media Mining: Text Mining, Twitter Mining, Facebook Mining, Web Scraping	5	5[42]	RF	OBT	1

Reference Books

1. Reema Thareja, "Data Science and *Machine Learning with R*", McGraw Hill Education (India) Private Limited, First Edition, 2021.
2. Abhijit Ghatak, "*Machine Learning with R*", Springer, 2017.
3. Cory Lesmister, "*Mastering Machine Learning with R*", Packt Publisher, Second edition, 2017.

SEMESTER – II

Course Title: Elective III – 2.4 Cyber Security

Course Type: Theory

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PREH

Pass-Out Policy : Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO - No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	Understand basics of cybercrime, cyber offenses	2(3), 3(2), 5(4), 6(5), 7(2), 10(4)	1, 2, 3, 4, 5, 6, 7, 10	U	M
CLO-2	Understand computer based symmetric key and asymmetric key algorithms	2(3), 3(2), 5(3), 6(4), 7(4), 10(4)	1, 2, 3, 4, 5, 6, 7, 10	U	M

CLO-3	Analyze cybercrimes on mobile and wireless devices	2(2), 3(3), 5(4), 6(4), 7(3), 10(4)	1, 2, 3, 4, 5, 6, 7, 10	An	C
CLO-4	Understand tools and methods used in cybercrimes	2(3), 3(2), 5(4), 6(5), 7(2), 8(4)	1, 2, 3, 4, 5, 6, 9, 10	U	M
CLO-5	Understand the legal perspectives of cybercrimes and cyber security	2(3), 3(2), 5(3), 6(4), 7(4), 10(4)	1, 2, 3, 4, 5, 6, 7, 10	U	M

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Introduction To Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cyber criminals? Classifications of Cybercrimes	3	1[25]	Lec	CA	1
1.2	Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: survival Mantra for the Netizens	3	1[25]	TPS	SA	1
1.3	Cyber Offenses: How Criminals Plan Them: Introduction Categories of Cybercrime, How Criminals Plan the Attacks, Social Engineering, Classification of Social Engineering, Cyberstalking, Cybercafe and Cybercrime, Botnets: the fuel for Cybercrime, Attack Vector, Cloud Computing	6	1[50]	Sem	HrA	1
2.1	Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era	4	3[34]	WSQ	HoA	1
2.2	Security Challenges Posted by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations	4	2[33]	OT	Qui	1
2.3	Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	4	2[33]	PT	Ess	1
3.1	Tools And Methods Used In Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking	3	3[25]	KWL	CT	1
3.2	Keyloggers and Spywares, Viruses and Worms, Trojan Horses and Backdoors, Steganography	5	3[42]	SP	MCQ	1
3.3	DoS and DDoS Attacks, SQL Injection, Buffer overflow, Attacks on Wireless Networks	4	3[33]	PF	CA	1
4.1	Phishing And Identity Theft: Introduction, Phishing	6	4[50]	OO	SA	1
4.2	Identify Theft (ID Theft)	6	4[50]	SI	HrA	1

5.1	Cybercrimes And Cyber security: The Legal Perspectives: Introduction, Cybercrime and the Legal Landscape around the World, Why do We Need Cyberlaws: The Indian Context	4	5[33]	GD	Ess	1
5.2	The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act	4	5[33]	RF	CT	1
5.3	Amendments to the Indian IT Act, Cybercrime and Punishment, Cyberlaws, Technology and Students: Indian Scenario	4	5[34]	Sem	MCQ	1

Reference Books

1. Nina Godbole, Sunit Belapure, “*Cyber Security*”, Wiley India Pvt. Ltd., Third Edition, First Edition, 2020.
2. Donald Short, Charles J. Brooks, Philip Craig, Christopher Grow, “*Cyber Security, Essentials*”, Wiley, Seventh Edition, 2018.
3. Forouzan, “*Cyber security Blue Team Toolkit*”, Wiley, First Edition, Sixth Impression, 2019.

SEMESTER – II

Course Title: Elective III – 2.4 Dot Net Technologies			Course Type: Theory
Total Hours: 60	Hours/Week: 4	Credits: 4	Course Code: 23PREC
Pass-Out Policy: Minimum Contact Hours: 36 Total Score %:100 Internal: 40 External: 60 Minimum Pass %: 50[No Minimum for Internal]			
Course Creator	Expert 1	Expert 2	
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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	Analyze the implementation of the components of a programming language	2(4), 3(4), 4(3), 5(2), 7(3), 10(4)	1, 2, 3, 4, 5, 6, 7, 9	An	C
CLO-2	Create applications using ADO.NET	2(4), 3(4), 4(3), 5(4), 6(3), 7(2)	1, 2, 3, 4, 5, 6, 9, 10	C	P, M
CLO-3	Create applications using C#	2(4), 3(3), 5(3), 6(3), 7(3)	1, 2, 3, 4, 5, 6	C	P, M
CLO-4	Apply and create controls in ASP.NET	1(2), 2(3), 3(2), 4(4), 7(4), 10(3)	1, 2, 3, 4, 5, 9	Ap, C	P, C, M
CLO-5	Apply and create ADO.NET in ASP.NET	2(4), 3(3), 4(4), 5(3), 7(4), 10(2)	1, 2, 3, 4, 5, 6, 7, 8, 9	C	P, C

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Introducing .NET Framework 4.5 and Visual Studio 2012: Exploring the Benefits of .NET Framework, Exploring the Versions of .NET Framework	4	1[30]	SI	CA	1
1.2	Exploring New Features of .NET Framework 4.5, Exploring Visual Studio 2012 IDE, Introducing the Key Enhancements in Visual Studio 2012 IDE, Developing Applications in Visual Studio 2012	4	1[35]	WSQ	HRA	1
1.3	Getting Started with C# 2012: Exploring New Features of C# 2012, Introducing keywords and Identifiers, Describing Operators and operator precedence, Exploring data Types in c# 2012, Explaining Data Type Conversion, Describing variables and constants, Working with Arrays, Exploring Control Flow statements.	4	1[35]	GD	HOA	1
2.1	Dynamic Programming: Explaining Dynamic Language Runtime, Working With the Dynamic Type, Creating Objects of the Dynamic Object and Expand Object Classes	4	2[30]	BS	SA	1
2.2	Working with ADO.NET: Introducing SQL, Introducing ADO.NET, Accessing Data in ADO.NET	4	2[35]	OT	ST	1
2.3	Implementing Data Binding: Data Binding in Windows Forms, Data Binding in WPF	4	2[35]	SEM	MCQ	1
3.1	LINQ in C# 2012: Creating a Simple LINQ Query, Working with Standard Query Operators	3	3[25]	OO	SA	1
3.2	Implementing LINQ to ADO.NET, Using Anonymous Types in Queries	3	3[25]	BS	Ess	1
3.3	Using Lambda Expressions in Queries, Exploring PLINQ	3	3[25]	SOC	QUI	1
3.4	Errors and Exceptions Handling: Exploring Types of Errors, Handling Exceptions, Using the User-Defined Exception Class	3	3[25]	RF	Ess	1
4.1	Introduction to ASP.NET 4.5: Exploring ASP.NET 4.5 Web Application, Explaining ASP.NET 4.5 coding Models, Implementing Code Sharing, Compiling an ASP.NET 4.5 Web Application, Understanding Dynamic Compilation in ASP.NET 4.5	3	4[25]	WSQ	HA	1
4.2	Standard Controls Web Control Class: Label, Textbox, Image Button, List Box, Radio Button, Check Box, Table, Wizard, Calendar, Ad Rotator	4	4[33]	KWL	SA	1

4.3	Navigation Controls: Working with the Sitemap Path Control, Working with the Menu Control, Working with the Tree View Control	5	4[42]	TPS	Ess	1
5.1	Validation Controls: Introducing the Base Validator Class, Required Field Validator, Range Validator, Regular Expression Validator, Compare Validator, Custom Validator, Validation Summary	3	5[25]	OO	CT	1
5.2	Login Controls: Creating a User Account in ASP.NET 4.5	3	5[25]	OT	ST	1
5.3	Login Control, Login Name Control, Login View Control, Login Status Control, Password Recovery Control, Configuring the web.config File for Password Recovery.	3	5[25]	OO	CT	1
5.4	Database Controls: Working with ADO.NET, Introducing Data Source Controls, Working with Data-Bound Controls	3	5[25]	OT	CT	1

Reference Books

1. Vikas Gupta, *Comdex.NET 4.5 “Programming Course Kit”*, Dreamtech, First Edition, 2014.
2. Balagurusamy, *“Programming in C# A Primer”*, Tata McGraw Hill, Third Edition, 2011.
3. David S Platt, *“Introducing Microsoft.NET”*, Microsoft Press, Third Edition, 2003.

SEMESTER - II

Course Title: Elective III – 2.4 Block Chain Technologies			Course Type: Theory
Total Hours: 60	Hours/Week: 4	Credits: 4	Course Code: 23PREI
Pass-Out Policy : Minimum Contact Hours: 36 Total Score %:100 Internal: 40 External: 60 Minimum Pass %: 50[No Minimum for Internal]			
Course Creator	Expert 1	Expert 2	
Mrs. P. Ezhil Roja	Dr.B.Shamina Ross	Dr. C. Thinkal Dayana	
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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	Understand, apply and examine the characteristics of block chain, bit coin and consensus algorithm in centralized and decentralized methods.	1(2), 2(2), 3(2), 4(2), 5(2), 6(4), 8(3), 10(2)	1, 2, 5, 8, 9	U, Ap	F, P

CLO-2	Comprehend and demonstrate the application of hashing and public key cryptography in protecting the block	2(4), 3(4), 4(3), 5(2), 6(4), 8(3)	1, 2, 5, 8, 9	R, Ap	T, P
CLO-3	Understand and analyse the elements of trust in a Block chain: validation, verification, and consensus.	1(1), 2(3), 3(2), 4(2), 5(2), 6(5), 8(5)	1, 2, 5, 8, 9	U, An	M, T
CLO-4	Comprehend and evaluate the alternate coin, Ethereum and smart contract.	3(4), 4(4), 5(3), 6(4), 8(3), 10(2)	1, 2, 3, 5, 6, 9	R, E	M, F, C
CLO-5	Grasp and apply the knowledge of Tools and languages for applications	1(1), 2(2), 3(3), 4(3), 5(3), 6(4), 8(4)	1, 2, 5, 8, 9	U, Ap	M, F, C

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Blockchain, Decentralization Blockchain: The Growth of Blockchain Technology, Distributed Systems, The History of Blockchain And Bitcoin	3	1[25]	Lec	CA	1
1.2	Blockchain, Consensus, CAP Theorem And Blockchain	3	1[25]	TPS	SA	1
1.3	Decentralization: Decentralization using Blockchain, Methods of Decentralization, Routes to Decentralization	3	1[25]	SM	HrA	1
1.4	Blockchain and Full Ecosystem Decentralization, Pertinent Terminology, Platforms for Decentralization, Innovative Trends	3	1[25]	WSQ	HoA	1
2.1	Public Key Cryptography, Consensus Algorithms and Smart Contracts Public Key Cryptography: Asymmetric Cryptography, Cryptographic Constructs And Blockchain	3	2[25]	OT	Qui	1
2.2	Consensus Algorithms: Introducing the Consensus Problem, Analysis and Design, Classification, Algorithms, Choosing an Algorithm	3	2[25]	KWL	CT	1
2.3	Smart Contracts: History, Definition, Ricardian Contracts, Smart Contract Templates, Oracles, Deploying Smart Contracts,	6	2[50]	SP	MC Q	1
3.1	Bitcoin: Bitcoin, an Overview, Cryptographic keys, Transactions, Blockchain, Mining	3	3[25]	PF	CA	1
3.2	Bitcoin Network and Payments: The Bitcoin Network, Wallets, Bitcoin Payments, Innovation in Bitcoin, Advanced Protocols, Bitcoin Investment and Buying and Selling Bitcoin	5	3[42]	OO	SA	1
3.3	Bitcoin Clients and APIs: Bitcoin Client Installation, Experimenting Further with Bitcoin-cli, Bitcoin programming	4	3[33]	SI	HrA	1

4.1	Alternative Coins: Theoretical Foundations, Difficulty Adjustment and Retargeting Algorithms, Bitcoin Limitations, Extended Protocols on Top of Bitcoin, Development of Altcoins	4	4[33]	GD	Ess	1
4.2	Ethereum: Ethereum, An Overview, Ethereum Network, Components of the Ethereum ecosystem	3	4[25]	RF	CT	1
4.3	Ethereum Virtual Machine (EVM), Smart Contracts, Blocks and Blockchain, Wallets and Client, Nodes and Miners, APIs, Tools, and DApps, Supporting protocols, Programming Languages	5	4[42]	Se m	MC Q	1
5.1	Development Tools and Frameworks, Use Cases & Security: Development Tools and Frameworks: Languages, Compilers, Tools and libraries, Frameworks, Contract Development and Deployment, Layout of a Solidity Source Code file, Solidity Language	5	5[42]	BS	HrA	1
5.2	Use Cases: IoT, Government, Health, Finance, Media	2	5[16]	CS	HoA	1
5.3	Scalability and Other Challenges: Scalability, Privacy, Security, Other Challenges	5	5[42]	Sem	MC Q	1

Reference Books

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bit coin and Crypto currency Technologies. Princeton University Press, 2016.
2. Andreas Antonopoulos. Mastering Bitcoin: Programming the open block chain. Oreilly Publishers, 2017.
3. E.Golden Julie,J. Jesu Vedha Nayahi, and Noor Zaman Jhanjhi,” *Block chain technology Fundamentals , Applications, and case Studies*, CRC Press, First Edition, 2021.

SEMESTER – II

Course Title: Elective-IV - 2.5 Principles of Management

Course Type: Theory

Total Hours: 90 Hours/Week: 6 Credits: 5

Course Code: 23PAN1

Pass-Out Policy : Minimum Contact Hours: 54
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

Course Creator

Expert 1

Expert 2

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	remember the basics of management and understand planning.	1(4), 2(4), 3(4), 7(4), 9(4)	1, 2, 3, 5, 8	R, U	F

CLO-2	understand, apply and analyze decision making and organization.	2(4), 3(4), 6(5), 7(4), 10(3)	1, 2, 3, 4, 5, 9, 10	U, Ap, An	M, P, C
CLO-3	apply and analyze coordination, staffing, training and development.	1(2), 2(2), 3(3), 6(4), 7(4), 8(3), 10(2)	1, 2, 3, 4, 5, 6, 7, 8	Ap, An	P, C
CLO-4	direction, supervision and communication.	1(2), 2(1), 3(2), 6(2), 7(3), 8(6), 10(4)	1, 2, 3, 4, 5, 6, 7, 8	Ap, An	M, F
CLO-5	analyze leadership and managerial control.	1(2), 2(1), 3(2), 6(3), 7(4), 8(4), 10(4)	1, 2, 3, 4, 5, 6, 7, 8	An	C, M

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Nature and Functions of Management: Importance of Management, Definition of Management, Management Functions or the Process of Management, Levels of Management, Organizational or Business Functions, Roles of a Senior Manager, Managerial Skills, Managerial Effectiveness, Management and Administration, Management, A Science or an Art?, Management, A Profession?, Professional Management vs Family Management, Management of International Business	7	1[39]	Lec	CA	1
1.2	Development of Management Thought: Early Classical Approaches, Neo-Classical Approaches	4	1[22]	SI	HrA	1
1.3	Planning: Nature of Planning, Importance of Planning, Types of Plans, Difference between strategic Planning and factorial Planning. Steps in Planning, Strategic Planning Process, Limitations of Planning, Making Planning Effective, Planning Skills, Strategic Planning in the Indian Industry	7	1[39]	GD	Ess	1
2.1	Decision-Making: Meaning of a Decision, Types of Decisions, , Rationality in Decision-Making, Environment of Decision-Making, Common Difficulties in Decision-Making	6	2[33]	RF	CT	1
2.2	Organization: What is an “Organisation”, Process of Organising, Principles of	6	2[33]	Sem	MCQ	1
	Organizing, Span of Management, Departmentalisation, or the superstructure of a organization, Process Departmentalisation, Purpose Departmentalisation					

2.3	Organisation Structure, What Type of Structure is Best?, Emerging Organisation Structures, Committees, Teams, International Organisation Structures	6	2[34]	BS	HrA	1
3.1	Coordination: Distinction Between Coordination and Cooperation, Distinction Between Coordination and Control, Need for Coordination, Requisites for Excellent Coordination, Types of Coordination, Techniques of Coordination, Difficulty of Coordination, Coordinating Global Operations	7	3[39]	CS	HoA	1
3.2	Staffing: Importance and Need for Proper Staffing, Manpower Planning, Recruitment, Selection, Placement Transfer, Induction, Manpower Planning in India, Staffing from a Global Perspective	4	3[22]	Sem	MCQ	1
3.3	Training Mentoring and Learning: Difference between Training, Education and Development, Advantages of Training, Steps in Setting up a Training and Development Programme, Design and Development of the Training Programme, Evaluation of Training, Executive Training Practices in India, Mentoring, Organisational Learning , Learning Organization.	7	3[39]	TPS	SA	1
4.1	Direction and Supervision: Requirements of Effective Direction, Giving Orders, Motivation, Job Satisfaction, Organisational Commitment, Morale, First-level or Front-line Supervision	6	4[33]	SM	HrA	1
4.2	Communication: Importance of Communication, Purpose of Communication, Formal Communication, Forms of Communication, Informal Communication,	6	4[33]	WSQ	HoA	1
4.3	The Communication Process, Barriers to Communication, Principles of Effective Communication, Communication Channels and Networks, Checks on in-plant Communication, Communication in Indian Industries	6	5[34]	OT	Qui	1
5.1	Leadership: Difference between a Leader and a Manager, Characteristics of Leadership, Functions of a Leader, Executive Traditional Approaches to Leadership, Leadership Effectiveness,	6	5[33]	KWL	CT	1
5.2	New Approaches top Leadership, Leadership Assessment, Leadership Style in Indian Organizations, Worker Participation in Management in India	6	5[33]	SP	MCQ	1
5.2	Managerial Control: Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in a Control Process, Problems of the Control System, Control Techniques	6	5[34]	PF	CA	1

Reference Books

1. P.C. Tripathi & P N Reddy, “Principles of Management”, Tata McGraw-Hill Publishing

- Company Limited, Sixth Edition, 2019.
2. Heins Weihrich & Harold Koontz, “*Management a Global Perspective*”, McGraw Hill, International Edition, 2000.
 3. Koonts & O’Donnel, “*Principles of Management*”, McGraw Hill, International Edition, 2001.
 4. L.M Prasad, “*Principles and Practice of Management*”, Sultan Chand & Sons, Ninenth Edition, 2020.

SEMESTER - II

Course Title: Elective IV - 2.5 Management Information Systems

Course Type: Theory

Total Hours: 90 Hours/Week: 6 Credits: 5

Course Code: 23PRN1

Pass-Out Policy: Minimum Contact Hours: 54
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %: 50[No Minimum for Internal]

Course Creator

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand the fundamentals of information systems in business.	1(4), 2(4), 3(4), 7(4), 9(4)	1, 2, 3, 5, 8	U	F, M
CLO-2	understand what challenges do information system technologies pose for business professionals.	2(4), 3(4), 6(4), 7(4), 8(2), 10(2)	1, 2, 3, 4, 5, 9, 10	U	F, M
CLO-3	analyze how business applications of information systems are accomplished in today’s networked enterprises.	2(3), 3(3), 6(4), 7(3), 8(4), 10(3)	1, 2, 3, 4, 5, 9, 10	An	C, F
CLO-4	analyze and create how can business professionals plan, develop and implement strategies and solutions that use information technologies help to meet the challenges and opportunities faced in today’s business environment.	2(1), 3(2), 4(5), 6(4), 7(3), 9(2), 10(3)	1, 2, 6, 7, 8, 9, 10	An, C	C, F
CLO-5	analyze what managerial challenges do information systems pose for today’s business enterprises.	1(2), 2(2), 3(3), 6(2), 7(4), 8(4), 10(4)	1, 2, 3, 5, 8, 9	An	C, M

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Foundations of Information Systems in Business: Information System in Business, The Components of Information Systems	9	1[50]	Lec	CA	1
1.2	Competing with Information Technology: Fundamentals of Strategic Advantage, Using Information Technology for Strategic Advantage	9	1[50]	SI	HrA	1
2.1	Data Resource Management: Managing Data Resources, Technical Foundations of Database Management	9	2[50]	GD	Ess	1
2.2	Telecommunications Networks: The Networked Enterprise, Telecommunications Network Alternatives.	9	2[50]	RF	CT	1
3.1	Electronic Commerce Systems: Electronic Commerce Fundamentals, Electronic e-Commerce Applications and Issues	9	3[50]	Sem	MCQ	1
3.2	Decision Support Systems: Decision Support in Business, Artificial Intelligence, Technologies in Business	9	3[50]	WSQ	HoA	1
4.1	Developing Business/IT Strategies: Planning Fundamentals, Implementation Challenges.	9	4[50]	OT	Qui	1
4.2	Developing Business/IT Solutions: Developing Business Systems, Implementing Business Systems	9	4[50]	KWL	CT	1
5.1	Security and Ethical Challenges: Security, Ethical and Social Challenges of IT, Security Management of Information Technology	9	5[50]	SP	MCQ	1
5.2	Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT	9	5[50]	PF	CA	1

Reference Books

1. James A O Brien, George M Marakas, "Management Information Systems", McGraw-Hill Companies, Seventh Edition, 2009.
2. Edward W. Cundiff, Richard Ralph Still, Norman A. P. Govoni, "Fundamentals of Modern Marketing", Prentice Hall of India, Third Edition, 1980.
3. Kenneth C. Laudon, Jane P. Laudon, "Management Information System", Pearson, Fifteenth Edition, 2018.

SEMESTER – II

Course Title: Elective IV - 2.5 E-Commerce & Web Applications

Course Type: Theory

Total Hours: 90 Hours/Week: 6 Credits: 5

Course Code: 23PREJ

Pass-Out Policy: Minimum Contact Hours: 54
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

Course Creator

Expert 1

Expert 2

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand the basic concepts of e-commerce.	1(2), 2(3), 3(5), 7(4), 8(2), 9(4)	1, 2, 3, 5, 8, 9	U	M, C
CLO-2	apply and analyze the business strategy in e-commerce.	2(2), 3(4), 6(3), 7(5), 8(4), 10(2)	1, 2, 3, 4, 5, 8, 9	Ap, An	P, C
CLO-3	analyze electronic data interchange.	2(1), 3(2), 4(5), 6(4), 7(3), 9(2), 10(3)	1, 2, 3, 4, 5, 6, 7, 9	An	C, M
CLO-4	apply consumer trade transaction using web page.	2(1), 3(2), 4(7), 6(3), 7(2), 9(2), 10(3)	1, 2, 3, 4, 5, 6, 7, 9	Ap	P, M
CLO-5	apply and create e-business using the elements of e-commerce advertising and marketing on the internet.	1(2), 2(2), 3(3), 6(2), 7(3), 8(4), 10(4)	1, 2, 3, 4, 5, 9, 10	Ap, C	P, C, M

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Electronic Commerce: The Scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade Cycle, Electronic Markets, Electronic Data Interchange, Internet Commerce, e-Commerce in Perspective	6	1[33]	Lec	CA	1
1.2	The Value Chain: Supply Chains, Porter's Value Chain Model, Inter Organisational Value Chains	6	1[33]	SI	HrA	1

1.3	Competitive Advantage: Competitive Strategy, Porter's Model, First Mover Advantage, Sustainable Competitive Advantage, Competitive Advantage using e-Commerce	6	1[34]	GD	Ess	1
2.1	Business Strategy: Introduction to Business Strategy, Strategic Implications of IT, Technology, Business Environment, Business Capability, Existing Business Strategy, Strategy Formulation and Implementation Planning, e-Commerce Implementation, e-Commerce Evaluation	5	2[27]	RF	CT	1
2.2	Case Study: e-Commerce in Passenger Air Transport: Choices, Airline Booking Systems, Competition and Customer Loyalty, Web Booking Systems, Competitive Outcomes	4	2[25]	Sem	MCQ	1
2.3	Inter-organisational Transactions: Inter-organisational Transactions, The Credit Transaction Trade Cycle, A Variety of Transactions, Pens and Things	4	2[23]	WSQ	HoA	1
2.4	Electronic Markets: Markets, Electronic Markets, Usage of Electronic Markets, Advantages and Disadvantages of Electronic Markets, Future of Electronic Markets	5	2[27]	RF	CT	1
3.1	Electronic Data Interchange(EDI): Introduction to EDI, EDI Definition, The Benefits of EDI, EDI Example	3	3[17]	Sem	MCQ	1
3.2	EDI: the Nuts and Bolts: EDI Technology, EDI Standards, EDI Communications, EDI Implementation, EDI Agreements, EDI Security, Nuts, Bolts and the Tool Kit	3	3[17]	WSQ	HoA	1
3.3	EDI and Business: Organisations that use EDI, EDI Trading Patterns, EDI Transactions, EDI Adoption and EDI Maturity, IOS, EDI and Internet e-Commerce	6	3[33]	OT	Qui	1
3.4	Inter-organisational e-Commerce: Inter-Organisational Transactions, Purchasing Online, After-Sales Online, e-Commerce in Desk-Top Facilities Management, Pens and Things and the Web	6	3[33]	KWL	CT	1
4.1	Consumer Trade Transactions: What you want, when you want it, Internet e-Commerce, The e-Shop, Internet Shopping and the Trade Cycle, Other e-Commerce Technologies, Advantages and Disadvantages of Consumer e-Commerce, consumer e-Commerce at Pens and Things	6	4[33]	SP	MCQ	1
4.2	The Internet: The Internet, The Development of the Internet, TCP/IP, Internet Components, Uses of the Internet, Internet Age Systems	6	4[33]	PF	CA	1
4.3	A Page on the Web: HTML, the Basics, Introduction to HTML, Further HTML, Client Side Scripting, Server Side Scripting, HTML Editors and Editing	6	4[34]	SI	HrA	1
5.1	The Elements of e-Commerce: Elements, e-Visibility, The e-Shop, Online Payments, Delivering the Goods, After-Sales Service, Internet e-Commerce security, A Web Site Evaluation Model	6	5[33]	GD	Ess	1

5.2	e-Business: Introduction, Internet Bookshops, Grocery Supplies, Software Supplies and Support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the Net, e-Diversity	6	5[34]	RF	CT	1
5.3	Electronic Commerce: Let a Thousand Flowers Bloom: The Full Set, Technology Adoption, Integrating the Supply Chain, e-Choice	6	5[34]	PF	CA	1

Reference Books

1. David Whiteley, “*e-commerce-Strategy, Technology and Applications*”, Tata McGraw-Hill Publishing Company Limited, First Edition, Reprint 2007.
2. P.T. Joseph. S.J., “*e-commerce, An Indian Perspective*”, PHI Learning Private Limited, Fourth Edition, 2019.
3. Henry Chan, Raymond L. Tharam Dillon, Elizabeth Chang, “*E-Commerce Fundamentals and Applications*”, John Wiley, First Edition, 2007.

SEMESTER - II

Course Title: Core Practical 2 - 2.6 Data Structures and Algorithms Lab	Course Type: Practical
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Total Hours: 30	Hours/Week: 2	Credits: 1	Course Code: 23PRP3
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Pass-Out Policy: Minimum Contact Hours: 18 Total Score %:100 Internal: 40 External: 60 Minimum Pass %: 50[No Minimum for Internal]
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Course Creator	Expert 1	Expert 2
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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	implement the basic concepts of arrays	2(4), 3(7), 4(5), 6(4)	1, 2, 3, 5, 9, 10	Ap	P
CLO-2	apply stack, queues & linked lists structures to data & analyze the representations	2(5), 4(5), 5(5), 7(5)	1, 3, 4, 5, 6, 7	Ap	P
CLO-3	apply binary tree structure to data, evaluate the time & space	2(2), 3(4), 4(4), 5(5), 7(5)	1, 3, 4, 5, 6, 7	Ap	P
CLO-4	Apply graph structures	2(4), 3(7), 4(5), 6(4)	1, 2, 3, 5, 9, 10	Ap	P
CLO-5	Apply sorting techniques	1(3), 2(2), 3(2), 4(5), 5(4), 6(4)	1, 3, 5, 6, 9, 10	Ap	P

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Sparse Matrix	6	1[100]	SP	ST	1
2	Adding Polynomials - Array/Linked List			SP	ST	1
3	Evaluation of Expressions – Infix, Prefix, Postfix			SP	ST	1
4	Singly Linked List Operations	6	2[100]	SP	ST	1
5	Doubly Linked List Operations			SP	ST	1
6	Stack Operations			SP	ST	1
7	Queue Operations			SP	ST	1
8	Binary tree traversals	6	3[100]	SP	ST	1
9	Binary tree operations			SP	ST	1
10	Minimum Cost Spanning Tree: Kruskal's Algorithm, Prim's Algorithm, Sollin's Algorithm	6	4[100]	SP	ST	1
11	Shortest Path: Bellman and Ford algorithm			SP	ST	1
12	Sorting Techniques	6	5[100]	SP	ST	1
13	Searching Techniques			SP	ST	1
14	Depth First search			SP	ST	1
15	Breadth First Search			SP	ST	1

Reference Books

1. Ellis Horowitz, Sahni, Dinesh Mehta, “*Fundamentals of Data Structures in C++*”, Universities Press, Second Edition, 2008.
2. Gilberge Forouzan, “*Data Structures A Pseudocode Approach with C++*”, TataMcGraw Hill, Fifth Edition, 2004.
3. Alfred Aho, John E. Hopcroft, Jeffrey D. Ullman,” “*Data Structures & Algorithms*”, Pearson Education India, First Edition, 2002.

SEMESTER – II

Course Title: Core Practical 3 – 2.7 Database Systems - Lab

Course Type: Practical

Total Hours: 30 Hours/Week:2 Credits: 1

Course Code: 23PRP4

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	implement the basic concepts of database management system	2(7), 3(7), 5(6)	1, 2, 3, 5, 6	C	P
CLO-2	apply advanced SQL functions	2(4), 3(4), 4(4), 5(6), 7(2)	1, 2, 3, 5, 6, 7	Ap	P
CLO-3	create normalized database, store, and retrieve and manipulate the stored data	1(2), 2(3), 3(5), 4(3), 5(5), 7(2)	1, 2, 3, 5, 6, 7, 8	C	P
CLO-4	apply indexing and hashing functions	1(2), 2(3), 3(5), 4(3), 5(5), 7(2)	1, 2, 3, 5, 6, 7, 8	Ap	P
CLO-5	apply GUI based database application	2(4), 3(5), 4(3), 5(5), 7(3)	1, 2, 3, 5, 6, 7	Ap	P

Sl. No.	List of Programs	Hours	% of CLO mapping Module	Learning Activities	Assessment Tasks	Reference
1	Create set of tables, add foreign key constraints and incorporate referential integrity	2	1[100]	SP	ST	1
2	aggregate functions	2		SP	ST	1
3	SQL DDL and DML commands	2		SP	ST	1
4	Explore sub queries and simple join operations	2	2[100]	SP	ST	1
5	complex transactions	2		SP	ST	1
6	explore natural, equi and outer joins	3		SP	ST	1

7	View and index for database tables with large number of records	2	3[100]	SP	ST	1
8	Aggregate functions	2		SP	ST	1
9	SQL Triggers	2		SP	ST	1
10	simple GUI based database application	3	4[100]	SP	ST	1
11	Exception handling	2		SP	ST	1
12	Cursors	2	5[100]	SP	ST	1
13	Functions of PL/ SQL	2		SP	ST	1
14	Subprograms-procedure PL/ SQL	2		SP	ST	1

Reference Books

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “*Database System Concepts*”, McGraw Hill Education, Sixth Edition, 2013.
2. Nilesh Shah, “*Database Systems using Oracle*”, PHI Learning Private Limited, Second Edition, 2012.
3. C. J. Date, A. Kannan, S. Swamynathan, “*Introduction to Database Systems*”, Pearson Education, Eighth Edition, 2006.
4. Ramez Elmasri, “*Fundamentals of Database Systems*”, Pearson Education, Sixth Edition, 2008.

SEMESTER - II

Course Title: Core Practical 4 – 2.8 Advanced Machine Learning Using R Lab

Course Type: Practical

Total Hours: 30 Hours/Week: 2 Credits:1

Course Code: 23PRP5

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	remember Artificial Intelligence, understand Machine Learning Algorithms	2(4), 3(3), 4(3), 5(4), 7(4), 10(2)	1, 2, 3, 5, 6, 9	R, U	F, C, M
CLO-2	understand Basic concepts of R and data structures using R	1(7), 3(5), 6(5), 7(3)	1, 2, 3, 4, 5, 8, 10	U	M

CLO-3	understand and Apply Decision Control and looping statements in R, Create File	1(7), 3(4), 5(3), 6(6),	1, 6, 8, 10	U, Ap	M, P
CLO-4	understand working with Data and create programs using various functions in R, Analyze dplyr and tidyr packages	1(3), 2(2), 3(2), 4(2), 5(6), 6(3), 9(2)	1, 2, 3, 5, 6, 8, 9, 10	U, C, An	M, C
CLO-5	create graphs and understand social media mining	1(4), 2(3), 3(3), 4(5), 5(3), 6(2)	1, 2, 3, 5, 6, 8, 9, 10	C, U	C, P, M

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Compute the Central Tendency Measures	2	1[100]	SP	ST	1
2	Linear Regression and Multiple Linear Regression with a Real Dataset	2		SP	ST	1
3	Basic Calculator Using R	2		SP	ST	1
4	Measuring the growth of population	2	2[100]	SP	ST	1
5	Logistic Regression using sklearn	2		SP	ST	1
6	binary classification model	3	3[100]	SP	ST	1
7	Nearest Neighbours and NavieBaye Algorithm	2		SP	ST	1
8	Decision tree for classification using sklearn and its parameter tuning	2		SP	ST	1
9	k-means algorithm	2	4[100]	SP	ST	1
10	Image Classifier using CNN in TensorFlow/Keras	3		SP	ST	1
11	Pie charts and bar charts using R	2	5[100]	SP	ST	1
12	Correlation and Covariance	2		SP	ST	1
13	Classification model using KNN algorithm	2		SP	ST	1
14	String Manipulation functions in R	2		SP	ST	1

Reference Books

1. Brett Lantz, "Machine Learning with R", Addison-Wesley Packt Publishing, 2013.
2. Taweh Beysolow, "Introduction to Deep Learning Using R: A Step-by-Step Guide to Learning and Implementing Deep Learning Models Using R", San Francisco, California, USA, 2017.

SEMESTER – II

Course Title: Elective Lab II – 2.9 Cyber Security - Lab

Course Type: Practical

Total Hours: 30 Hours/Week: 2 Credits: 1

Course Code: 23PRP9

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand basics of cybercrime, cyber offenses	2(3), 3(2), 5(4), 6(5), 7(2), 10(4)	1, 2, 3, 5, 6, 9	U	M
CLO-2	understand computer based symmetric key and asymmetric key algorithms	2(3), 3(2), 5(3), 6(4), 7(4), 10(4)	1, 2, 3, 4, 5, 8, 10	U	M
CLO-3	analyze cybercrimes on mobile and wireless devices	2(2), 3(3), 5(4), 6(4), 7(3), 10(4)	1, 6, 8,10	An	C
CLO-4	understand tools and methods used in cybercrimes	2(3), 3(2), 5(4), 6(5), 7(2), 8(4)	1, 2, 3, 5, 6, 8, 9, 10	U	M
CLO-5	understand the legal perspectives of cybercrimes and cyber security	2(3), 3(2), 5(3), 6(4), 7(4), 10(4)	1, 2, 3, 5, 6, 8, 9, 10	U	M

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Install virtual box	2	1[100]	SP	ST	1
2	secure password using keepass	2		SP	ST	1
3	Wireless device mode as monitor mode	2	2[100]	SP	ST	1
4	Open vulnerabilities of system using metasploit	2		SP	ST	1
5	Multiple vulnerabilities webserver using nikto tool	2		SP	ST	1
6	Open ports in the network using nmap tools	2	3[100]	SP	ST	1

7	Information about the networks	2	4[100]	SP	ST	1
8	Packet sent over HTTP requests	2		SP	ST	1
9	Internet resources using Who is Lookup tool	2		SP	ST	1
10	Sub domains of webpage using knock tool	2		SP	ST	1
11	Implement the Signature Scheme - Digital Signature Standard	2		SP	ST	1
12	Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures	2	5[100]	SP	ST	1
13	Implementation of Rail Fence – Row & Column	2		SP	ST	1
14	Implementation of MD5	2		SP	ST	1

Reference Books

1. Dr. Jeetendra Pande, "Introduction to Cyber Security" Published by Uttarakhand Open University, 2017.
2. Anthony Reyes, Kevin o'shea, Jim steele, Jon R. Hansen, Captain Benjamin R. Jean Thomas Ralph, "Cyber-crime investigations" - bridging the gaps between security professionals, law enforcement, and prosecutors, 2007.

SEMESTER - II

Course Title: Elective Lab II – 2.9 Dot Net Technologies lab

Course Type: Practical

Total Hours: 30 Hours/Week: 2 Credits: 1

Course Code: 23PRP6

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %: 100 Internal: 40 External: 60
Minimum Pass %: 50 [No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	Analyze the implementation of the components of a programming language	2(4), 3(4), 4(3), 5(2), 7(3), 10(4)	1, 2, 3, 4, 5, 6, 7, 8, 9	An	C
CLO-2	Create applications using ADO.NET	2(4), 3(4), 4(3), 5(4), 6(3), 7(2)	1, 2, 3, 4, 5, 6, 9, 10	C	P, M
CLO-3	Create applications using C#	2(4), 3(3), 5(3), 6(3), 7(3)	1, 2, 3, 4, 5, 6	C	P, M

CLO-4	Apply and create controls in ASP.NET	1(2), 2(3), 3(2), 4(4), 7(4), 10(3)	1, 2, 3, 4, 5, 9	Ap, C	P, C, M
CLO-5	Apply and create ADO.NET in ASP.NET	2(4), 3(3), 4(4), 5(3), 7(4), 10(2)	1, 2, 3, 4, 5, 6, 7, 8, 9	C	P, C

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Standard Controls	2	1[100]	SP	ST	1
2	Navigation Controls	2		SP	ST	1
3	Validation Controls	2		SP	ST	1
4	Login Controls	2	2[100]	SP	ST	1
5	Database Controls	2		SP	ST	1
6	Tree Structure	2	3[100]	SP	ST	1
7	Data Binding – Asp.Net XML	3		SP	ST	1
8	Data Binding-Asp.Net Access	2		SP	ST	1
9	Access Data in Ado.Net	2	4[100]	SP	ST	1
10	Master Pages and Themes	2		SP	ST	1
11	LinQ	2	5[100]	SP	ST	1
12	Lambda Expressions	2		SP	ST	1
13	Retrieving data from a SQL database	3		SP	ST	1
14	working with forms using ASP.NET	2		SP	ST	1

Reference Books

1. Vikas Gupta, *Comdex.NET 4.5 “Programming Course Kit”*, Dreamtech, First Edition, 2014.
2. Balagurusamy, *“Programming in C# A Primer”*, Tata McGraw Hill, Third Edition, 2011.
3. David S Platt, *“Introducing Microsoft.NET”*, Microsoft Press, Third Edition, 2003.

SEMESTER - II

Course Title: Elective Lab II – 2.9 Block Chain Technologies Lab

Course Type: Practical

Total Hours: 30 Hours/Week: 2 Credits: 1

Course Code: 23PRP10

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %: 100 Internal: 40 External: 60
Minimum Pass %: 50 [No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand, apply and examine the characteristics of block chain, bit coin and consensus algorithm in centralized and decentralized methods.	1(2), 2(2), 3(2), 4(2), 5(2), 6(4), 8(3), 10(2)	1, 2, 5, 8, 9	U, Ap	F, P
CLO-2	comprehend and demonstrate the application of hashing and public key cryptography in protecting the block chain.	2(4), 3(4), 4(3), 5(2), 6(4), 8(3)	1, 2, 5, 8, 9	R, Ap	T, P
CLO-3	understand and analyse the elements of trust in a Block chain: validation, verification, and consensus.	1(1), 2(3), 3(2), 4(2), 5(2), 6(5), 8(5)	1, 2, 5, 9, 8	U, An	M, T
CLO-4	comprehend and evaluate the alternate coin, Ethereum and smart contract.	3(4), 4(4), 5(3), 6(4), 8(3), 10(2)	1, 2, 3, 5, 6, 9	R, E	M, F, C
CLO-5	grasp and apply the knowledge of Tools and languages for applications	1(1), 2(2), 3(3), 4(3), 5(3), 6(4), 8(4)	1, 2, 5, 8, 9	U, Ap	M, F, C

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Public Ledger and Private Ledger with the various attributes	2	1[100]	SP	ST	1
2	MultiChain private Blockchain	2		SP	ST	1
3	Higher programming language	2		SP	ST	1
4	Naive block chain	2	2[100]	SP	ST	1
5	Deploy method	2		SP	ST	1
6	Regtest environment	3	3[100]	SP	ST	1
7	Payment request URI	2		SP	ST	1
8	Hashcash implementation	2		SP	ST	1

9	Toy application using Blockchain	2	4[100]	SP	ST	1
10	Wallet transaction	3		SP	ST	1
11	Blockchain implementation	2		SP	ST	1
12	Blockchain implementation using Merkle Trees	2	5[100]	SP	ST	1
13	Peer-to-Peer implementation using Blockchain	2		SP	ST	1
14	Creating Crypto-currency Wallet	2		SP	ST	1

Reference Books

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Crypto currency Technologies. Princeton University Press, 2016.
2. Andreas Antonopoulos, Mastering Bitcoin: Programming the open block chain, Oreilly Publishers, 2017

SEMESTER - III

Course Title: Core Course 7 – 3.1 Cryptography and Network Security

Course Type: Theory

Total Hours: 30

Hours/Week: 2

Credits: 2

Course Code: 23PR31

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand concepts of security	2(8), 3(12)	1, 2, 3, 5	U	M
CLO-2	analyze and apply the concepts of cryptography techniques	2(4), 3(7), 4(5), 6(4)	1, 2, 3, 5, 9, 10	An, Ap	C, P
CLO-3	create computer based symmetric key algorithms	2(2), 3(8), 4(7), 6(3)	1, 2, 3, 5, 9, 10	C	P
CLO-4	apply and create computer based	2(2), 3(8), 4(7), 6(3)	1, 2, 3, 5, 9, 10	Ap, C	C, P
CLO-5	analyze public key infrastructure	2(3), 3(9), 4(6), 6(2)	1, 2, 3, 5, 9, 10	An	C, F

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Introduction to the Concepts of Security: Introduction, The Need for Security	2	1[33]	Lec	HrA	1
1.2	Principles of Security, Types of Attacks	4	1[67]	BS	Qui	1
2.1	Cryptography Techniques: Introduction, Plain Text and Cipher Text, Substitution Techniques	2	2[33]	OT	CA	1
2.2	Transposition Techniques, Encryption and Decryption Symmetric and Asymmetric Key Cryptography	2	2[33]	Sem	SA	1
2.3	Steganography, Key Range and Key Size, Possible Types of Attacks	2	2[34]	SI	HoA	1
3.1	Computer-based Symmetric-Key Cryptographic Algorithms: Introduction, Algorithm Types and modes	1	3[17]	WSQ	CT	1
3.2	An overview of Symmetric Key Cryptography, Data Encryption	2	3[33]	FC	CA	1
3.3	International Data Encryption Algorithm, RC4, RC5, Blowfish, Advanced Encryption Standard	3	3[50]	OO	SA	1
4.1	Computer-based Asymmetric-Key Cryptographic Algorithms: Introduction, Brief History of Asymmetric-Key Cryptography	1	4[17]	TPS	Ess	1
4.2	An Overview of Asymmetric-Key Cryptography, The RSA Algorithm, ElGamal Cryptography, Symmetric and Asymmetric Key Cryptography	2	4[33]	KWL	HA	1
4.3	Digital Signature, Knapsack Algorithm, ElGamal Digital Signature, Attacks on Digital Signatures, Problems with the Public-Key Exchange	3	4[50]	OO	MCQ	1
5.1	Public Key Infrastructure: Introduction, Digital certificates, Private-Key Management	3	5[50]	Soc	CA	1
5.2	The PKIX Model, Public Key Cryptography Standards, XML, PKI and Security	3	5[50]	GT	MCQ	1

Reference Books

1. Atul Kahate, “*Cryptography and Network Security*”, Mc Graw Hill Education, Third Edition, Sixth Impression, 2013.
2. William Stallings, “*Cryptography and Network Security, Principles and Practice*”, Pearson Education, Seventh Edition, 2017.
3. Forouzan, “*Cryptography and Network Security, Principles and Practice*”, Mc Graw Hill Education, Third Edition, Sixth Impression, 2015.

SEMESTER - III

Course Title: Core Course 8 – 3.2 Web Technologies

Course Type: Theory

Total Hours: 30 Hours/Week: 2 Credits: 2

Course Code: 23PR32

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	develop Web pages using HTML, CSS and XML	2(3), 3(3), 4(2), 5(2), 7(3), 6(3), 8(4)	1, 2, 6, 7, 8, 10	C, Ap, U	C, M, P
CLO-2	create web application using PHP and MySQL	2(3), 3(2), 4(3), 5(3), 7(3), 6(3), 8(3)	1, 2, 6, 7, 8, 10	C, Ap, U	C, M, P
CLO-3	to design web pages using PHP	2(3), 3(2), 4(3), 5(3), 7(3), 6(3), 8(3)	1, 2, 6, 7, 8, 10	C, Ap, U	C, M, P
CLO-4	create Database Connection Using PHP and MySQL	2(3), 3(3), 4(2), 5(2), 6(3), 7(3)	1, 2, 6, 7, 8, 10	U, C, Ap	C, M, P
CLO-5	develop interactive web pages using PHP	2(3), 3(2), 4(3), 5(3), 6(3), 7(3), 8(3)	1, 2, 6, 7, 8, 10	U, C, Ap	C, M, P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
	Learning PHP Syntax and Variables: PHP's Syntax, Comments	3	1[50]	Lec	Hr	1
1.2	Variables, Types in PHP, The Simple Types and Output	3	1[50]	TPS	Qui	1
2.1	Learning PHP Control Structures and Functions: Boolean Expressions, Branching	2	2[34]	OT	CA	1
2.2	Looping, Alternate Control Syntaxes, Terminating Execution	2	2[33]	Sem	SA	1
2.3	Using Functions, Function Documentation, Defining Your Own Functions, Functions and Variable Scope, Function Scope	2	2[33]	SI	HoA	1

3.1	Passing Information with PHP: HTTP is Stateless, GET arguments, A Better Use for GET-Style URLs	2	3[33]	WSQ	CT	1
3.2	POST Arguments, Formatting Form Variables, PHP Super global	2	3[33]	TPS	Ess	1
3.3	Learning PHP String Handling: Strings in PHP, String Functions	2	3[34]	KWL	HA	1
4.1	Learning Arrays: The Use of Arrays, What are PHP Arrays? Creating Arrays, Retrieving Values	3	4[50]	OO	MC Q	1
4.2	Multi-Dimensional Arrays, Inspecting Arrays, Deleting from Arrays, Iteration	3	4[50]	Sem	SA	1
5.1	Learning Structured Query Language: Relational Database and SQL, SQL Standards, The Workhorses of SQL, Database Design, Privileges and security	2	5[33]	SI	HoA	1
5.2	Integrating PHP and MySQL: Connecting to MySQL, Making MySQL Queries, Fetching Data Sets, Getting Data about Data	2	5[33]	Soc	CA	1
5.3	Multiple Connections, Building in Error checking, Creating MySQL Database with PHP, MySQL Functions	2	5[34]	GT	MC Q	1

Reference Books

1. TeodoruGugoiu, “*HTML, XHTML, CSS and XML by EXAMPLE A Practical Guide*”, Laxmi Publications Pvt. Ltd., New Delhi, First Edition, Reprint, 2016.
2. Steve Suehring, Tim Converse, Joyce Park, “*PHP6 and MySQL Bible*”, WILEY, First Edition, Reprint 2016.
3. Steven Holzner, “*The Complete reference PHP*”, Tata Mc-Graw Hill, Fifth Edition, Reprint 2011.
4. Daniel Gra, “*Web Design Fundamentals Hand Book*”, Climatic Press, First Edition, 2000.
5. Jennifer Niederst, “*Web Design in a NutShell*”, SPD, First Edition, 1999.

SEMESTER - III

Course Title: Core Course 9 – 3.3 Computer Vision		Course Type: Theory
Total Hours: 30	Hours/Week: 2	Credits: 2
Course Code: 23PR33		
Pass-Out Policy : Minimum Contact Hours: 18 Total Score %:100 Internal: 40 External: 60 Minimum Pass %: 50[No Minimum for Internal]		
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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	To understand and recall computer vision and its application areas	2(6), 3(4), 4(4), 5(6)	1, 2, 3, 5, 9	U, Ap	M, F
CLO-2	To develop build a computer vision system	2(5), 4(5), 5(4), 7(6)	1, 2, 5, 9	C, Ap	C, P
CLO-3	To apply and analyze a design range of algorithms for image processing and	2(5), 4(5), 5(5), 7(5)	1, 2, 5, 9	R, U, Ap	P, C
CLO-4	To develop incorporate machine learning techniques with computer vision system	2(5), 4(4), 5(5), 7(4), 8(2)	1, 2, 5, 9	AP, E, C	P, C
CLO-5	To apply and analyze image segmentation and image registration	2(5), 4(5), 5(4), 8(3)	1, 2, 6, 7	U, C, Ap	M, P, C

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Introduction: What is computer vision?, Image formation: Geometric primitives and transformations	3	1[50]	Lec	CA	1
1.2	Photometric image formation, The digital camera	3	1[50]	GD	MCQ	1
2.1	Image processing: Point operators, Linear filtering, More neighborhood operators	3	2[50]	TPS	HrA	1
2.2	Fourier transforms, Geometric transformations	3	2[50]	OO	SA	1
3.1	Recognition: Instance recognition, Image classification, Feature-based methods, Deep networks, Application: Visual similarity search, Face recognition	3	3[50]	SP	HoA	1
3.2	Object detection, Face detection, Pedestrian detection, General object detection	3	3[50]	SI	CT	1
4.1	Computational photography: Photometric calibration, High dynamic range imaging	3	4[50]	RF	Quiz	1
4.2	Super-resolution, denoising and blur removal, Texture analysis and synthesis	3	4[50]	PT	CA	1
5.1	3D reconstruction: shape from X, 3D scanning, Surface representations, Point-based representations	3	5[50]	Sem	CT	1
5.2	Volumetric representations, Model-based reconstruction, Recovering texture maps and albedos	3	5[50]	OT	SA	1

Reference Books

- 1 Richard Szeliski, "Computer Vision Alogrithm and Applications", Springer Publications, Second Edition, 2022
- 2 Simon J.D Prince," Computer Vision Models, Learning, and Inference", Cambridge

University Press, First Edition, 2012

- 3 Richard Hartley, Andrew Zisserman, "Multiple View Geometry in Computer Vision ", Cambridge University Press, Second Edition, 2004

SEMESTER – III

Course Title: Elective V – 3.4 Internet of Things

Course Type: Theory

Total Hours: 45 Hours/Week: 3 Credits: 3

Course Code: 23PREK

Pass-Out Policy : Minimum Contact Hours: 27
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	Comprehend the IoT evolution with its architecture and sensors	2(4), 4(5), 5(6), 6(5)	1, 2, 3, 5, 9, 10	U, E, C, Ap	F, M
CLO-2	Understand the networking concepts for communication and underlying IoT protocols	1(2), 2(3), 4(3), 5(3), 7(5), 8(2), 10(2)	1, 2, 3, 5, 6, 7	U	M
CLO-3	Assess the embedded technologies and develop prototypes for the IoT products	1(2), 2(2), 3(4), 4(4), 5(5), 7(3)	1, 5, 6, 7, 8	E, C	C, P
CLO-4	Evaluate the use of Application Programming Interface and design an API for IoT in real time	2(2), 3(4), 4(4), 5(5), 7(5)	1, 2, 3, 5, 6	E, C	C, M
CLO-5	Recognize the ethics of business models and perform security analysis	6(2), 7(5), 10(5), 8(2), 4(6)	1, 2, 4, 5, 7, 9	R, Ap	F,P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Fundamentals of Iot: Evolution of Internet of Things, Enabling Technologies, IOT Architectures: oneM2M, IOT World Forum (IOTWF) and Alternative IOT models	3	1[33]	Lec	CA	1

1.2	Simplified IOT Architecture and Core IOT Functional Stack – Fog, Edge and Cloud in IOT	3	1[33]	SP	HoA	1
1.3	Functional blocks of an IOT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects	3	1[34]	SI	CT	1
2.1	Iot Protocols: IOT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks	3	2[33]	RF	Quiz	1
2.2	Optimizing IP for IOT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks	3	2[33]	PT	CA	1
2.3	Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT	3	2[34]	WSQ	HoA	1
3.1	Design and Development: Prototyping Embedded Devices, Electronics, Embedded Computing Basics, Arduino, Raspberry Pi-Beagle Bone Black, Electric Imp	4	3[44]	KWL	CT	1
3.2	Prototyping the Physical Design: Non digital Methods, Laser Cutting, 3D printing, CNC Milling, Repurposing/Recycling	5	3[56]	SP	CA	1
4.1	Prototyping Online Components: Getting started with an API, Writing a New API, Real-Time Reactions, Other Protocols	4	4[44]	TPS	HrA	1
4.2	Techniques for Writing Embedded Code: Memory Management, Performance and Battery Life, Libraries,	5	4[56]	OO	SA	1
5.1	Business Models: History of Business Models, Model, Internet of Starting up, Lean Startups	3	5[34]	Sem	CT	1
5.2	Moving to Manufacture: Designing Kits, Designing Printed circuit boards, Certification, Costs, Scaling Up Software	3	5[33]	OT	SA	1
5.3	Ethics: Privacy, Control, Environment, Solutions	3	5[33]	GD	MC	1

Reference Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017.
2. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014.
3. Mansaf Alam, Kashish Ara Shakil, Samiya Khan,” *Internet of Things Concepts and Applications*” Springer, 2020.

SEMESTER - III

Course Title: Elective V – 3.4 Social Network

Course Type: Theory

Total Hours: 45 Hours/Week: 3 Credits: 3

Course Code: 23PREL

Pass-Out Policy : Minimum Contact Hours: 27
Total Score %: 100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO - No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	to understand, impart and summarize the concepts of Social media, Social	1(4), 2(6), 4(5), 5(5)	1, 2, 3, 5, 9, 10	U, E, C, Ap	F, M
CLO-2	to comprehend, design and develop a Word Press Powered Website	2(4), 4(3), 5(3), 7(6), 8(2), 10(2)	1, 2, 3, 5, 6, 7	C, Ap	F, C, P
CLO-3	to understand, implement and perform evaluation of Social Networking and Micro-Blogging	2(4), 4(3), 5(3), 7(6), 8(2), 10(2)	1, 5, 6, 7, 8	R, U	M, T, P
CLO-4	to collaborate, implement and analyse the Widgets and Badges in social networking environment	1(2), 2(3), 4(3), 5(3), 7(5), 8(2), 10(2)	1, 2, 3, 5, 6	Ap, E, C	M, T, P
CLO-5	to understand, illustrate and perform evaluation of web optimization for social networks	1(4), 2(3), 4(5), 5(2), 7(3), 8(3)	1, 2, 4, 5, 7, 9	U, C, Ap	M, P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Introduction: Social Media Strategy, Important First Decisions, Websites, Blogs, RSS Feeds Mapping, Preparation, Multimedia Items Gathering Content for Blog Posts RSS Feeds & Blogs, RSS Feeds	3	1[33]	Lec	CA	1
1.2	The Feed Reader, The Feed, Options for Creating an RSS Feed, Planning Feed, Blogs, Options for Starting	3	1[34]	GD	MCQ	1

1.3	Blog and RSS Feed, Feed or Blog Content, Search Engine Optimization (SEO), Feed Burner, RSS Feed and Blog Directories, An Optimization Plan for Blog or RSS Feed	3	1[33]	TPS	HrA	1
2.1	Building a Word Press Powered Website: Word Press as A CMS, Diversity of Word Press Sites, The Anatomy of a Word Press Site, a Brief Look at the Word Press Dashboard Planning, Site Themes Plug-ins setting up Sidebars Building Pages, Posting Blog Entries	5	2[56]	OO	SA	1
2.2	Podcasting, Vidcasting, & Webcasting, Publishing Options for Podcast, Creating and Uploading Podcast Episodes, Publishing Podcast Optimizing Podcast, Webcasting	4	2[44]	SP	HoA	1
3.1	Social Networking & Micro-Blogging: Facebook, The Facebook Profile, Myspace LinkedIn, Twitter, Niche Social Networking Sites, Creating Own Social Network, Promoting Social Networking Presence	3	3[34]	SI	CT	1
3.2	Social Bookmarking & Crowd, Sourcing, Social Bookmarking, A Social Bookmarking Strategy, Crowd, Sourced News Sites, Preparation and Tracking Progress Media Communities	3	3[33]	RF	Quiz	1
3.3	Image Sharing Sites, Image Sharing Strategy, Video Sharing Sites-Video Sharing Strategy, Searching And Search Engine Placement, Connecting With Others	3	3[33]	PT	CA	1
4.1	Widgets & Badges: Highlighting Social Web Presence, Sharing And Syndicating Content Making Site More Interactive, Promoting Products And Making Money, Using Widgets In Word Press, Widget Communities and Directories	4	4[44]	Sem	CT	1
4.2	Working Widgets Into Strategy Social Media Newsrooms, Building Social Media Newsroom, Populating The Newsroom-Social Media News Releases, Social Media Newsroom Examples. More Social Tools, Social Calendars, Social Pages Wikis, Social Search Portals, Virtual Worlds	5	4[56]	OT	SA	1
5.1	Website optimization: A Website Optimization Plan, Streamlining Web Presence, An Integration Plan	3	5[33]	SP	CA	1
5.2	Looking to the Future-Life streaming: The Future of Blogging, Distributed Social Networking-Social Ranking, Relevancy, and Defriending, Web 3.0 or The Semantic Web, Mobile Technology, Measuring Your Success, A Qualitative Framework, A Quantitative Framework, Tools to Help You Measure	6	5[67]	TPS	HrA	1

Reference Books

1. Deltina hay, A Survival Guide To Social Media and Web 2.0 Optimizationl, Dalton Publishing, 2009
2. Miriam Salpeter, Social Networking for Career Success Learning Express, 2011 Miles, Peggy, “Internet world guide to webcasting”, Wiley Publication, 2015
3. Anupam Biswas, Ripon Patgiri, Bhaskar Biswas,” *Principles of Social networking*”, Springer, 2022

SEMESTER - III

Course Title: Elective V – 3.4 Advanced JAVA Programming

Course Type: Theory

Total Hours: 45 Hours/Week: 3 Credits: 3

Course Code: 23PREM

Pass-Out Policy: Minimum Contact Hours: 27
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	Understand and apply AWT applets and handling events	1(7), 3(6), 6(7)	1, 2, 3, 5, 8, 10	U, Ap	M, P
CLO-2	Apply and create applications using swing	1(3), 2(2), 3(2), 4(5), 5(4), 6(4)	1, 2, 5, 8, 9, 10	Ap, C	P, T
CLO-3	Create applications using java beans	5(5), 6(5), 7(3), 4(5), 3(2)	1, 2, 3, 5, 10	C	P, T
CLO-4	Analyze and create JDBC &RMI	5(5), 6(5), 7(3), 4(5), 3(2)	1, 2, 3, 5, 10	An, C	F, C, P
CLO-5	Analyze and create servlet programming	3(2), 4(3), 5(4), 6(5), 7(4)	1, 2, 3, 4, 5, 9, 10	An, C	F, C, P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	AWT-Applets, Applications, and Event Handling: The Abstract Windowing Toolkit	3	1[33]	Lec	CA	1
1.2	Applets, Applications, Handling Events	3	1[34]	KWL	Qui	1
1.3	AWT: Graphics, Image, Text and fonts	3	1[33]	OO	HrA	1
2.1	Swing-Applets, Applications, and Pluggable Look and Feel: The Java Foundation Classes	3	2[33]	OT	Ess	1
2.2	Swing, What's New in javax. Swing Package	3	2[33]	SI	CT	1
2.3	Heavyweight vs Lightweight components, Swing Features	3	2[34]	Sem	ST	1
3.1	Swing: Text Fieldes, Buttons, Toggle Buttons	3	3[30]	TPS	SA	1
3.2	Checkboxes, and Radio Buttons.	3	3[35]	SM	HrA	1
3.3	Working with Java Beans: What is Java Bean? Advantage of Java Beans	3	3[35]	WSQ	HoA	1
4.1	Talking to Database: What does JDBC do?, JDBC vs. ODBC and other APIs	5	4[30]	OT	Qui	1
4.2	Two-tier and Three-tier Models, Introducing SQL	2	4[36]	KWL	CT	1
4.3	Understanding RMI: Remote Method Invocation (RMI), Client/Server Architecture	2	4[34]	SP	MCQ	1
5.1	Servlet Life-Cycle, Servlet Security Features, HTML-Aware Servlets, HTTP- Specific Servlets, Performance Features	4	5[50]	PF	CA	1
5.2	Three-Tier Applications, Web Publishing System	3	5[50]	GD	CT	1

Reference Books

1. KoGENT Solutions INC, *Java 6 Programming, Black Book*, Comprehensive Problem Solver, Dreamtech Press, New Delhi
2. KoGENT Solutions INC, *Java Server Programming, Black Book*, Indispensable Comprehensive Reference, Dreamtech Press, New Delhi
3. Herbert Schildt, *The Complete Reference*, Seventh Edition, Tata McGRAW-Hill Pvt.Lt

SEMESTER - III

Course Title: Elective VI – 3.5 Data Science

Course Type: Theory

Total Hours: 75 Hours/Week: 5 Credits: 4

Course Code: 23PREN

Pass-Out Policy: Minimum Contact Hours: 45
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#PLO	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	Understand the Fundamentals of data science and Data science	2(6), 4(7), 5(6)	1, 2, 9	U	M, F
CLO-2	Understand Machine learning and Handling Large data, Apply general technique to handle large data	2(3), 3(4), 4(3), 5(4), 6(2), 7(4)	1, 2, 3, 5, 9, 10	U, Ap	M, P
CLO-3	Create data Storage, Analyze risk, Understand NoSQL	2(4), 4(5), 5(6), 6(5)	1, 2, 5, 9, 10	C, An, U	P, C, M
CLO-4	Understand the risk graph databases. Neo4j, Text Mining and text analysis	2(3), 4(4), 5(5), 6(6), 7(2)	1, 2, 5, 6, 7	U, F	M, C
CLO-5	Understand Data visualization, Create interactive Dashboard with dc.js	2(6), 3(3), 4(4), 5(7)	1, 2, 3, 5	U, C	M, P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Data Science in a Big world: Benefits and uses of data science and big data, Facets of Data, The data Science Process, The big Data Ecosystem and data science	3	1[19]	SP	CA	1
1.2	The data science process: Overview of the data Science Process, defining Research Goals and Creating, Retrieving Data	4	1[27]	TPS	HrA	1
1.3	Cleansing, Integrating, and Transforming Data, Exploratory Data Analysis	4	1[27]	OO	SA	1
1.4	Build the models, Presenting Findings and Building applications on top of them	4	1[27]	SI	HrA	1
2.1	Machine Learning: What is Machine Learning and why should you care about it? The Modelling Process, Types of Machine Learning	3	2[19]	GD	Ess	1

2.2	Handling Large data on a single computer: The problems you face when handling large data, General techniques for handling large volumes of data, General programming tips for dealing with large data sets	4	2[27]	RF	CT	1
2.3	Case Study1: Predicting malicious URLs	4	2[27]	Sem	MCQ	1
2.4	Case Study2: Building a recommender system inside a database	4	2[27]	WSQ	HoA	1
3.1	First step in big data: Distributing data storage and processing with frameworks	3	3[19]	OT	Qui	1
3.2	Case Study: Assessing risk when loaning money	4	3[27]	KWL	CT	1
3.3	Join the NoSQL movement: Introduction to NoSQL	4	3[27]	SP	MCQ	1
3.4	Case study: What disease is that?	4	3[27]	SP	CA	1
4.1	The rise of graph databases: Introducing Connected data and graph databases	3	4[19]	PF	CA	1
4.2	Introducing Ne04j: A graph database, Connected data example: A recipe recommendation engine	4	4[27]	SI	MCQ	1
4.3	Text Mining and text analysis: Text Mining in the real world, Text Mining Techniques	4	4[27]	Cs	OBT	1
4.4	Case Study: Classifying Reddit posts	4	4[27]	Lec	CA	1
5.1	Data visualization to the end user: Data visualization options, Cross filter, the Java script Map Reduce library	5	5[33]	Sem	HA	1
5.2	Creating an interactive dashboard with dc.js	5	5[33]	OT	CT	1
5.3	Dashboard development tools	5	5[34]	Sem	CA	1

Reference Books

1. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “*Introducing data Science*”, Dreamtech press, Forty Fifth Revised Edition, 2019.
2. Chirag Shah, “*A Hands on Introduction to Data Science*” Cambridge university Press, First Edition, 2020.
3. Joel Grus, “*Data Science fom Scratch*”, O’Really , First Edition, 2015.

SEMESTER – III

Course Title: Elective VI – 3.5 Big Data Analytics

Course Type: Theory

Total Hours: 75 Hours/Week: 5 Credits: 4

Course Code: 23PREO

Pass-Out Policy : Minimum Contact Hours: 45
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand evolution and basics of Big Data	1(7), 3(6), 6(7)	1, 2, 3, 5, 8, 10	U	M
CLO-2	analyze Big Data Analytics concepts	1(5), 2(6), 3(5), 6(4)	1, 2, 3, 5, 8, 10	An	C, F
CLO-3	analyze and apply Hadoop	1(4), 2(3), 3(4), 4(3), 5(4), 6(2)	1, 2, 3, 5, 8, 10	An, Ap	C, P
CLO-4	analyze and apply Hive	1(4), 2(3), 3(4), 4(3), 5(4), 6(2)	1, 2, 3, 5, 8, 10	An, Ap	C, P, F
CLO-5	analyze and apply Machine Learning and evaluate Big Data trends	1(3), 2(3), 3(4), 4(4), 5(3), 6(3)	1, 2, 3, 5, 8, 10	An, Ap, E	T, P, C

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Introduction to Big Data: Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data	3	1[20]	Lec	HrA	1
1.2	What is Big Data?, Other Characteristics of Data Which are not Definitional Traits of Big Data, Why Big Data?, Are We Just an Information Consumer or Do We also Produce Information?	6	1[40]	BS	Qui	1
1.3	Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment, What is New Today?	6	1[40]	OT	CA	1
2.1	Big Data Analytics: Where do we Begin? What is Big Data Analytics?, What Big Data Analytics Isn't?	3	2[19]	Sem	SA	1
2.2	Why this Sudden Hype Around Big Data Analytics?, Classification of Analytics, Greatest Challenges that Prevent Businesses from Capitalizing on Big Data	4	2[27]	SI	HoA	1
2.3	Top Challenges Facing Big Data, Why is Big Data Analytics Important?, What Kind of Technologies are we Looking Toward to Help Meet the Challenges Posed by Big Data?	4	2[27]	WSQ	CT	1
2.4	Data Science, Data Scientist... Your New Best Friend!!!, Terminologies Used in Big Data Environments, Basically Available Soft State Eventual Consistency (BASE), Few Top Analytics Tools	4	2[27]	FC	CA	1

3.1	Introduction to Hadoop: Introducing Hadoop, Why Hadoop?, Why not RDBMS?	3	3[19]	OO	SA	1
3.2	RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop	4	3[27]	TPS	Ess	1
3.3	Hadoop Overview, Use Case of Hadoop, Hadoop Distributors	4	3[27]	KWL	HA	1
3.4	HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN, Interacting with Hadoop Ecosystem	4	3[27]	OO	MCQ	1
4.1	Introduction to Hive: What is Hive?, Hive Architecture, Hive Data Types	5	4[33]	Soc	CA	1
4.2	Hive File Format, Hive Query Language (HQL), RCFile Implementation	5	4[34]	GT	MCQ	1
4.3	SerDe, User-Defined Function (UDF)	5	4[33]	KWL	HA	1
5.1	Introduction to Machine Learning: Introduction to Machine Learning	5	5[33]	OO	MCQ	1
5.2	Machine Learning Algorithms	5	5[34]	Soc	CA	1
5.3	Big Data Trends in 2019 and Beyond: Streaming the IoT for Machine Learning, Open Source.	5	5[33]	GT	MCQ	1

Reference Books

1. Seema Acharya, Subhasini Chellappan, "*Big Data Analytics*", Wiley, Second Edition, 2015.
2. Tom White "Hadoop: The Definitive Guide", O'reily Media Third Edition, 2012.
3. Bhuvanewari, T. Devi, "*Big Data Analytics*", Scitech Publications Pvt. Ltd, First Edition, 2018.

SEMESTER - III

Course Title: Elective VI – 3.5 Digital Forensics

Course Type: Theory

Total Hours: 60	Hours/Week: 4	Credits: 4
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Course Code: 23PREP

Total Hours: 75	Hours/Week: 5	Credits: 4
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Pass-Out Policy : Minimum Contact Hours: 45 Total Score %:100 Internal: 40 External: 60 Minimum Pass %: 50[No Minimum for Internal]

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CLO - No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand the Digital Forensics Profession and Investigations, Analyse Investigator's Office and Laboratory, Understand and evaluate Data acquisition and Data acquisition tools.	2(3), 3(2), 5(4), 6(5), 7(2), 10(4)	1, 2, 3, 4, 5, 9, 10	U, An, E	T, C, M
CLO-2	understand Processing Crime and Incident Scenes, Evaluate Digital Forensics Tools, Apply Validating and testing Forensics Software.	1(3), 2(3), 3(3), 4(5), 6(4), 7(2)	1, 2, 3, 5, 6, 8, 10	U, E, Ap	M, P, F
CLO-3	understand Recovery of Graphics Files, Analyse unknown file formats, Evaluate digital forensics analysis and validation.	5(5), 6(5), 7(3), 4(5), 3(2)	1, 2, 3, 6, 9, 10	U, An, E	M, F, C
CLO-4	understand virtual Machine forensics live acquisitions and Network forensics, Remember Email and Social Media Investigations, Apply digital Forensics methods to social media communications, Understand Mobile device Forensics and the interest of Anything.	1(4), 2(3), 3(3), 4(5), 5(3), 6(2)	1, 2, 3, 5, 8, 9, 10	U, R, Ap	M, F P
CLO-5	understand and cloud Forensics, report Writing for high Tech Investigations, create Expert Testimony in digital Investigations.	1(3), 2(2), 3(2), 4(2), 5(6), 6(3) 9(2)	1, 2, 3, 5, 8, 9	U, An, C	N, F, P

Module	Course Description	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1.1	Understanding the Digital Forensics Profession and Investigations: An Overview of Digital Forensics, Preparing for Digital Investigations, Maintaining Professional Conduct, Preparing a Digital Forensics Investigation.	2	1[13]	Lec	CA	1
1.2	Procedures for Private-Sector High-Tech Investigations, Understanding Data Recovery Workstations and Software, Conducting an Investigation	2	1[13]	SI	HrA	1

1.3	The Investigator's Office and Laboratory: Understanding Forensics Lab Accreditation Requirements, Determining the Physical Requirements for a Digital Forensics Lab,	2	1[14]	GD	Ess	1
1.4	Selecting a Basic Forensic Workstation, Building a Business Case for Developing a Forensics Lab	3	1[20]	RF	CT	1
1.5	Data Acquisition: Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions , Using Acquisition Tools.	3	1[20]	Sem	MCQ	1
1.6	Validating Data Acquisitions, Performing RAID Data Acquisitions, Using Remote Network Acquisition Tools, Using Other Forensics Acquisition Tools.	3	1[20]	BS	HrA	1
2.1	Processing Crime and Incident Scenes: Identifying Digital Evidence, Collecting Evidence in Private-Sector Incident Scenes, Processing Law Enforcement Crime Scenes, Preparing for a Search.	3	2[19]	CS	HoA	1
2.2	Securing a Digital Incident or Crime Scene, Seizing Digital Evidence at the Scene, Storing Digital Evidence, Obtaining a Digital Hash, Reviewing a Case.	4	2[27]	Sem	MCQ	1
2.3	Current Digital Forensics Tools: valuating Digital Forensics Tool Needs, Digital Forensics Software Tools.	4	2[27]	TPS	SA	1
2.4	Digital Forensics Hardware Tools, Validating and Testing Forensics Software.	4	2[27]	SM	HrA	1
3.1	Recovering Graphics Files: Recognizing a Graphics File, Understanding Data Compression, Identifying Unknown File Formats, Understanding Copyright Issues with Graphics.	7	3[47]	WSQ	HoA	1
3.2	Digital Forensics Analysis and Validation: Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding Techniques	8	3[53]	OT	Qui	1
4.1	Virtual Machine Forensics, Live Acquisitions, and Network Forensics, An Overview of Virtual Machine Forensics, Performing Live Acquisitions, Network Forensics Overview.	3	4[19]	KWL	CT	1
4.2	E-mail and Social Media Investigations: Exploring the Role of E-mail in Investigations, Exploring the Roles of the Client and Server in E-mail, Investigating E-mail Crimes and Violations	4	4[27]	SP	MCQ	1
4.3	Understanding E-mail Servers, Using Specialized E-mail Forensics Tools, Applying Digital Forensics Methods to Social Media Communications .	4	4[27]	PF	CA	1
4.4	Mobile Device Forensics and the Internet of Anything: Understanding Mobile Device Forensics, Understanding Acquisition Procedures for Mobile Devices, Understanding Forensics in the Internet of Anything	3	4[27]	SI	MCQ	1

5.1	Cloud Forensics: An Overview of Cloud Computing, Legal Challenges in Cloud Forensics, Technical Challenges in Cloud Forensics.	3	5[20]	Cs	OBT	1
5.2	Acquisitions in the Cloud, Conducting a Cloud Investigation, Tools for Cloud Forensics	3	5[20]	Lec	CA	1
5.3	Report Writing for High-Tech Investigations: Understanding the Importance of Reports, Guidelines for writing reports, Generating Report Findings with Forensics Software Tools.	4	5[27]	Sem	HA	1
5.4	Expert Testimony in Digital Investigations: Preparing for Testimony, Testifying in Court, preparing for a Deposition or Hearing, Preparing Forensics Evidence for Testimony.	5	5[53]	OT	CT	1

Reference Books

1. Bil Nelson, Amelia Philios, Chris Steuart, “*Guide To Computer Forencies and Investgations*”, Processing Digital Evidence, Sixth Edition, 2018.
2. Thomos J.Holt, Adam M. Bossler, Kathryn C. Sagfried”, *Cybercrime and Digital Forensics*” Routledge, 2022.
3. Joakim kavrestad, “*Fundamentals of Digital Forensics*”, Springer, Second Edition, 2020.

SEMESTER - III

Course Title: Core Practical 6 - Cryptography and Network Security – Lab
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Course Type: Practical

Total Hours: 60	Hours/Week: 4	Credits: 2
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Course Code: 23PRP11

Pass-Out Policy: Minimum Contact Hours: 36 Total Score %:100 Internal: 40 External: 60 Minimum Pass %: 50[No Minimum for Internal]
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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand concepts of security	2(8), 3(12)	1, 2, 3, 5	U	M
CLO-2	analyze and apply the concepts of cryptography techniques	2(4), 3(7), 4(5), 6(4)	1, 2, 3, 5, 9, 10	An, Ap	C, P
CLO-3	create computer based symmetric key algorithms	2(2), 3(8), 4(7), 6(3)	1, 2, 3, 5, 9, 10	C	P
CLO-4	apply and create computer based asymmetric key	2(2), 3(8), 4(7), 6(3)	1, 2, 3, 5, 9, 10	Ap, C	C, P
CLO-5	analyze public key infrastructure	2(3), 3(9), 4(6), 6(2)	1, 2, 3, 5, 9, 10	An	C, F

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	String	5	1[100]	SP	ST	1
2	Ceaser Cipher	4		SP	ST	1
3	Hill Cipher	4	2[100]	SP	ST	1
4	Substitution Cipher	4		SP	ST	1
5	Data Encryption Standard	4		SP	ST	1
6	DES Algorithm	5	3[100]	SP	ST	1
7	Blowfish Algorithm	4		SP	ST	1
8	RSA Algorithm	4		SP	ST	1
9	Knapsack Algorithm	5	4[100]	SP	ST	1
10	Port Security	4		SP	ST	1
11	Building Trojans and Rootkit hunter	5		SP	ST	1
12	Digital Signature Standard	4	5[100]	SP	ST	1
13	Wireshark	4		SP	ST	1
14	Man-in-the-middle attack and Session hijacking	4		SP	ST	1

Reference Books

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education/PHI, Seventh Edition.
2. Behrouz A Forouzan, Debdeep Mukhopadhyay, “Cryptography and Network Security”, McGraw Hill Education, Third Edition.

SEMESTER - III

Course Title: Core Practical 7 – Web Technologies - Lab

Course Type: Practical

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PRP12

Pass-Out Policy: Minimum Contact Hours: 36
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	develop Web pages using HTML, CSS and XML	2(3), 3(3), 4(2), 5(2), 7(3), 6(3), 8(4)	1, 2, 6, 7, 8, 10	C, Ap, U	C, M, P
CLO-2	create web application using PHP and MySQL	2(3), 3(2), 4(3), 5(3), 7(3), 6(3), 8(3)	1, 2, 6, 7, 8, 10	C, Ap, U	C, M, P
CLO-3	to design web pages using PHP	2(3), 3(2), 4(3), 5(3), 7(3), 6(3), 8(3)	1, 2, 6, 7, 8, 10	C, Ap, U	C, M, P
CLO-4	create Database Connection Using PHP and MySQL	2(3), 3(3), 4(2), 5(2), 6(3), 7(3)	1, 2, 6, 7, 8, 10	U, C, Ap	C, M, P
CLO-5	develop interactive web pages using PHP	2(3), 3(2), 4(3), 5(3), 6(3), 7(3), 8(3)	1, 2, 6, 7, 8, 10	U, C, Ap	C, M, P

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Education details in a tabular format	4	1[100]	SP	ST	1
2	CV on a web page	5		SP	ST	1
3	Homepage having three links	4		SP	ST	1
4	Cascade Style Sheet	4	2[100]	SP	ST	1
5	Style sheet in CSS	5		SP	ST	1
6	Image maps	4	3[100]	SP	ST	1
7	Creating Database	5		SP	ST	1
8	Control Structures	4		SP	ST	1
9	Arrays	4	4[100]	SP	ST	1
10	Date Validation	4		SP	ST	1
11	Input validation using Angular Javascript	5		SP	ST	1
12	PHP to fetch details from the database	4	5[100]	SP	ST	1
13	Hide paragraph using JQuery	4		SP	ST	1
14	Handle mouse events and form events	4		SP	ST	1

Reference Books

1. Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015.
2. Dayley Brad, Dayley Brendan ,”AngularJS, JavaScript, and jQuery All in One”, Sams Teach Yourself 1st Edition, Kindle Edition, 2015.

SEMESTER – III

Course Title: Core Practical 8 – 3.8 Computer Vision - Lab

Course Type: Practical

Total Hours: 60 Hours/Week: 4 Credits: 4

Course Code: 23PRP13

Pass-Out Policy : Minimum Contact Hours: 36
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	To understand and recall computer vision and its application areas	2(6), 3(4), 4(4), 5(6)	1, 2, 3, 5, 9	U, Ap	M, F
CLO-2	To develop build a computer vision system	2(5), 4(5), 5(4), 7(6)	1, 2, 9, 5	C, Ap	C, P
CLO-3	To apply and analyze a design range of algorithms for image processing and computer vision	2(5), 4(5), 5(5), 7(5)	1, 2, 5, 9	R, U, Ap	P, C
CLO-4	To develop incorporate machine learning techniques with computer vision system	2(5), 4(4), 5(5), 7(4), 8(2)	1, 2, 5, 9	AP, E, C	P, C
CLO-5	To apply and analyze image segmentation and image registration	2(5), 4(5), 5(4), 8(3)	1, 2, 6, 7	U, C, Ap	M, P, C

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Image Loading, Exploring, and displaying an Image	4	1[100]	SP	ST	1
2	Access and Manipulate of Image Pixels	5		SP	ST	1
3	Image Transformations	4	2[100]	SP	ST	1

4	Addition operation of Two Images	4	3[100]	SP	ST	1
5	Image filtering operations	5		SP	ST	1
6	Image Binarization	4		SP	ST	1
7	Edge Detection operation	5	4[100]	SP	ST	1
8	Find Grayscale and RGB Histograms	4		SP	ST	1
9	K- Nearest Neighbors-Bayes Classifier	4		SP	ST	1
10	Hierarchical Clustering	4	5[100]	SP	ST	1
11	K-means Clustering algorithm	5		SP	ST	1
12	KNN Classification algorithm	4		SP	ST	1
13	Support Vector Machines	4	5[100]	SP	ST	1
14	Video Tracking	4		SP	ST	1

Reference Books

1. Richard Szeliski, "Computer Vision Algorithm and Applications", Springer Publications, Second Edition, 2022.
2. Simon J.D Prince, "Computer Vision Models, Learning, and Inference", Cambridge University Press, First Edition, 2012.
3. Richard Hartley, Andrew Zisserman, "Multiple View Geometry in Computer Vision ", Cambridge University Press, Second Edition, 2004.

SEMESTER - III

Course Title: Elective Practical – 3.9 Internet of Things - Lab

Course Type: Practical

Total Hours: 30 Hours/Week: 2 Credits: 1

Course Code: 23PRP14

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %: 100 Internal: 40 External: 60
Minimum Pass %: 50 [No Minimum for Internal]

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CLO - No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	comprehend the IoT evolution with its architecture and sensors	2(4), 4(5), 5(6), 6(5)	1, 2, 3, 5, 10	U, E, C, Ap	F, M
CLO-2	understand the networking concepts for communication and underlying IoT protocols	1(2), 2(3), 4(3), 5(3), 7(5), 8(2), 10(2)	1, 2, 3, 5, 6, 7	U	M

CLO-3	assess the embedded technologies and develop prototypes for the IoT products	1(2), 2(2), 3(4), 4(4), 5(5), 7(3)	1, 5, 6, 7, 8	E, C	C, P
CLO-4	evaluate the use of Application Programming Interface and design an API for IoT in real time	2(2), 3(4), 4(4), 5(5), 7(5)	1, 2, 3, 5, 6	E, C	C, M
CLO-5	recognize the ethics of business models and perform security analysis	6(2), 7(5), 8(2), 4(6), 10(5)	1, 2, 4, 5, 7, 9	R, Ap	F,P

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	IoT program to turn ON/OFF LED light	2	1[100]	SP	ST	1
2	IoT program using IR sensor	2		SP	ST	1
3	Humidity and Temperature Monitoring	2	2[100]	SP	ST	1
4	web server program for local hosting	2		SP	ST	1
5	Soil Moisture Sensor	2		SP	ST	1
6	Ultrasonic Sensor	2	3[100]	SP	ST	1
7	Relay Module	2		SP	ST	1
8	Fire Detection	2		SP	ST	1
9	Gas Leakage detection	2	4[100]	SP	ST	1
10	Heartbeat Sensor	2		SP	ST	1
11	Controlling the Light Emitting Diode (LED) with a push button.	2		SP	ST	1
12	Interfacing the RGB LED with the Arduino	2	5[100]	SP	ST	1
13	Controlling the LED blink rate with the potentiometer interfacing with Arduino	2		SP	ST	1
14	Detection of the light using photo resistor	2		SP	ST	1

Reference Books

- David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
- Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014.

SEMESTER - III

Course Title: Elective Practical III – 3.9 Social Network - Lab

Course Type: Practical

Total Hours: 30 Hours/Week: 2 Credits: 1

Course Code: 23PRP15

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %:100 Internal: 40 External: 60
Minimum Pass %: 50[No Minimum for Internal]

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CLO - No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	To understand, impart and summarize the concepts of Social media, Social networking and Webcasts	1(4), 2(6), 4(5), 5(5)	1, 2, 3, 5, 9, 10	U, E, C, Ap	F, M
CLO-2	To comprehend, design and develop a Word Press Powered Website	2(4), 4(3), 5(3), 7(6), 8(2), 10(2)	1, 2, 3, 5, 6, 7	C, Ap	F, C, P
CLO-3	To understand, implement and perform evaluation of Social Networking and Micro-Blogging	2(4), 4(3), 5(3), 7(6), 8(2), 10(2)	1, 5, 6, 7, 8	R, U	M, T, P
CLO-4	To collaborate, implement and analyse the Widgets and Badges in social networking environment	1(2), 2(3), 4(3), 5(3), 7(5), 8(2), 10(2)	1, 2, 3, 5, 6	Ap, E, C	M, T, P
CLO-5	To understand, illustrate and perform evaluation of web optimization for social networks	1(4), 2(3), 4(5), 5(2), 7(3), 8(3)	1, 2, 4, 5, 7, 9	U, C, Ap	M, P

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Twitter's API	2	1[100]	SP	ST	1
2	Tweet entities with frequency analysis	2		SP	ST	1
3	Facebook's Social Graph API	2	2[100]	SP	ST	1
4	Facebook's Social Graph connections	3		SP	ST	1

5	LinkedIn API	2		SP	ST	1
6	LinkedIn connections as a CSV file	2	3[100]	SP	ST	1
7	Google+ API	2		SP	ST	1
8	Human Language Data with TF-IDF	2		SP	ST	1
9	GitHub's API	2	4[100]	SP	ST	1
10	GitHub interest graph	2		SP	ST	1
11	Perform Design modelling, aggregating of semantic web.	2		SP	ST	1
12	Making of network graphs and conducting analysis on the dataset from Kaggle	2	5[100]	SP	ST	1
13	Perform collaborative filtering recommendation on the dataset.	3		SP	ST	1
14	Perform classification and clustering on the dataset	2		SP	ST	1

Reference Books

1. Deltina hay, "A Survival Guide To Social Media and Web 2.0 Optimization", Dalton Publishing, 2009.
2. Miriam Salpeter, "Social Networking for Career Success Learning Express", 2011.
3. Miles, Peggy, "Internet world guide to webcasting", 2008 Professionals, Wiley Publication, 2015.

SEMESTER – III

Course Title: Elective Practical III – 3.9 Advanced Java Programming - Lab

Course Type: Practical

Total Hours: 30 Hours/Week: 2 Credits: 1

Course Code: 23PRP16

Pass-Out Policy: Minimum Contact Hours: 18
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %: 50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	Understand and apply AWT applets and handling events	1(7), 3(6), 6(7)	1, 2, 3, 5, 8, 10	U, Ap	M, P
CLO-2	Apply and create applications using swing	1(3), 2(2), 3(2), 4(5), 5(4), 6(4)	1, 2, 5, 8, 9, 10	Ap, C	P, T
CLO-3	Create applications using java beans	5(5), 6(5), 7(3), 4(5), 3(2)	1, 2, 3, 5, 10	C	P, T

CLO-4	Analyze and create JDBC & RMI	5(5), 6(5), 7(3), 4(5), 3(2)	1, 2, 3, 5, 10	An, C	F, C, P
CLO-5	Analyze and create servlet programming	3(2), 4(3), 5(4), 6(5), 7(4)	1, 2, 3, 4, 5, 9, 10	An, C	F, C, P

Sl. No.	List of Programs	Hours	% of CLO mapping with Module	Learning Activities	Assessment Tasks	Reference
1	Exception handling	2	1[100]	SP	ST	1
2	Swing	2		SP	ST	1
3	Grid Layout	2		SP	ST	1
4	Applet	2	2[100]	SP	ST	1
5	Digital Clock	2		SP	ST	1
6	Menu Creation	2	3[100]	SP	ST	1
7	Servlet from HTML forms	3		SP	ST	1
8	Servlet from Applets	2		SP	ST	1
9	servlet from JSP	2	4[100]	SP	ST	1
10	Java Beans	2		SP	ST	1
11	Connect database using JDBC	2		SP	ST	1
12	Access database from Hard disk using domain server name	3	5[100]	SP	ST	1
13	Network Programming	2		SP	ST	1
14	Remote Method Invocation (RMI)	2		SP	ST	1

Reference Books

1. KoGENT Solutions INC, “*Java6 Programming Black Book*”, Dreamtech Press, New Edition, 2008.
2. KoGENT Solutions INC, “*Java Server Programming Black Book*”, Dreamtech Press, Platinum Edition, 2014.
3. Herbert Schildt, “*The Complete Reference*”, Tata McGraw-Hill, Seventh Edition, 2007.

SEMESTER – III

Course Title: Mini Project

Course Type: Project

Total Hours:30 Hours/week: 2 Credit: 2

Course Code: 23PRD2

Pass-Out Policy: Minimum Contact Hours: 18
Total Score %:100 Internal: 40 External: 60
Minimum Pass %:50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand the problem	2(20)	1, 2	U	F, M
CLO-2	analyze the requirements	1(20)	1, 8	An	C
CLO-3	create a real time system	3(10), 4(10)	1, 2, 9	C	P
CLO-4	apply different types of testing algorithms	5(4), 7(4), 9(2)	1, 5, 6	Ap	P, F
CLO-5	create documentation & implement the system	5(10), 10(10)	2, 3, 5, 7	C	F, M, C, P

SEMESTER – IV

Course Title: Project

Course Type: Project

Total Hours: Full Semester Hours/week:30 Credit: 20

Course Code: 23PRD1

Pass-Out Policy: Minimum Contact Hours: 15
 Total Score %:100 Internal: 40 External: 60
 Minimum Pass %:50[No Minimum for Internal]

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CLO- No.	Course Learning Outcomes <i>Upon completion of this course, students will be able to:</i>	% of PLO Mapping with CLO	CLO & PLO Mapped with GA#	Cognitive Level (CL)	Knowledge Category (KC)
CLO-1	understand the problem	2(20)	1, 2	U	F, M
CLO-2	analyze the requirements	1(20)	1, 8	An	C
CLO-3	create a real time system	3(10), 4(10)	1, 2, 9	C	P
CLO-4	apply different types of testing algorithms	5(8), 7(8), 9(4)	1, 5, 6	Ap	P, F
CLO-5	create documentation & implement the system	5(10), 10(10)	2, 3, 5, 7	C	F, M, C, P