Study & Evaluation Scheme of

Master of Computer Application

[Applicable for Batch 2022-24]

[As per CBCS guidelines given by UGC]

Approved in BOS	Approved in BOF	Approved in Academic Council
14-05-2022	08-08-2022	20-10-2022 Vide Agenda No. 8.4.1

QUANTUM UNIVERSITY, ROORKEE

22 KM Milestone, Dehradun-Roorkee Highway, Roorkee (Uttarakhand)

Website: www.quantumuniversity.edu.in

Study & Evaluation Scheme
Study Summary

Name of the Faculty	Faculty of Technology
Name of the School	Quantum School of Technology
Name of the Department	Department of Computer Applications
Program Name	Masters of Computer Applications
Duration	2 Years
Medium	English

Evaluation Scheme

Type of Papers	**Internal Evaluation (%)**	**End Semester Evaluation (%)**	**Total (%)**
Theory	40	60	100
Practical/ Dissertations/Project Report/ Viva-Voce	40	60	100
Internal Evaluation Components (Theory Papers)			
Mid semester Examination I	60 Marks		
Assignment –I	30 Marks		
Assignment-II	30 Marks		
Attendance	30 Marks		
Internal Evaluation Components (Practical Papers)			
Quiz One	30 Marks		
Quiz Two	30 Marks		
Quiz Three	30 Marks		
Lab Records/ Mini Project	40Marks		
Attendance	30 Marks		
End Semester Evaluation (Practical Papers)			
ESE Quiz	40 Marks		
ESE Practical Examination	40 Marks		
Viva- Voce	20 Marks		

Structure of Question Paper (ESE Theory Paper)

The question paper will consist of 5 questions, one from each unit. Student has to Attempt all questions. All five questions are compulsory and carry 20 marks each. Internal choice is given in each question. Answer any two parts of each question carrying 10 marks for each part. [20*5 = 100]

Important Note:

1. *The purpose of examination should be to assess the Course Outcomes (CO) that will ultimately lead to attainment of Programme Outcomes (PO). A question paper must assess the following aspects of learning as planned for a specific course i.e Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy). The standard of question paper will be based on mapped BL level complexity of the unit of the syllabus, which is the basis of CO attainment model adopted in the university.*

2. Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.

3. There shall be continuous evaluation of the student and there will be a provision of real time reporting on QUMS. All the assignments will evaluate through module available on ERP for time and access management of the class.

Program Structure –Master of Computer Applications

Introduction

Master of Computer Applications (MCA) is a two-year professional post-graduate programme for candidates wanting to delve deeper into the world of computer application development with the help of learning modern programming language. The programme is a blend of both theoretical and practical knowledge. An MCA degree endows students' an opportunity to work with tools meant to develop better and faster applications.

MCA degree is designed to meet the shortage of qualified professionals in the IT (Information Technology) industry, an MCA degree. MCA degree in India is offered by many colleges and there are various colleges that also offer integrated MCA programmes as well.

CAREER SCOPE OF COMPUTER SCIENCE ENGINEERING

There is no dearth of lucrative job opportunities for MCA graduates. A candidate with a master's degree in computer applications along with the right amount of relevant work experience, skill set and caliber can easily find great job opportunities at leading IT firms (both private and government) across India and abroad

COMPUTER SCIENCE ENGINEERING: ELIGIBILITY CRITERIA

- According to AICTE, to pursue an MCA course candidates must have pursued BCA/ BSc/ BCom/ BA degree with Mathematics as one of the subjects at 10+2 level or at graduation.
- Also, Minimum marks required: 50% to 60% (a CGPA above 6/10 is considered good) in Bachelor's; 55% and above in Class 12th.

Curriculum (2021-23) Version 2021

Quantum School of Technology

Department of Computer Applications

Master of Computer Applications– PC: 01-4-06

BREAKUP OF COURSES

Sr. No	CATEGORY	CREDITS
1	Program Core	46
2	Program Electives	15
3	Projects/Dissertation	16
4	Seminar	3
5	General Proficiency	3
	TOTAL NO. OF CREDITS	83

SEMESTER-WISE BREAKUP OF CREDITS

Sr.No	CATEGORY	SEM 1	SEM 2	SEM 3	SEM 4	TOTAL
1	Program Core	17	13	10	6	46
2	Program Electives	3	6	6		15
5	Projects/Dissertation			4	12	16
6	Seminar	1	1	1		3
7	General Proficiency	1	1	1		3
	TOTAL	**22**	**21**	**22**	**18**	**83**

SEMESTER 1

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CA4101	PC	Artificial Intelligence and Expert Systems	3	1	0	4	1.0	Nil
CA4102	PC	Linux administration and Network Programming	3	1	0	4	1.0	Nil
CA4103	PC	Programming in Java	3	1	0	4	1.0	Nil
CA4104	PC	Software Engineering	3	1	0	3	1.0	Nil
	PE	Program Elective I	3	0	0	3	1.0	Nil
CA4140	PC	Linux administration and Network Programming Lab	0	0	2	1	1.0	Nil
CA4141	PC	Programming in Java lab	0	0	2	1	1.0	Nil
CA4170	FW	Seminar I	0	0	2	1	1.0	Nil
GP4101	GP	General Proficiency	0	0	0	1		
		Total	**15**	**4**	**6**	**22**		

Contact Hrs: 25

SEMESTER 2

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CA4201	PC	Automata Theory	3	1	0	4	1.0	Nil
CA4202	PC	Advanced Java	3	1	0	4	1.0	Nil
CA4203	PC	Python Programming	3	0	0	3	1.0	Nil
	PE	Program Elective II	3	0	0	3	1.0	Nil
	PE	Program Elective III	3	0	0	3	1.0	Nil
CA4240	PC	Advanced Java Lab	0	0	2	1	1.0	Nil
CA4241	PC	Python Programming Lab	0	0	2	1	1.0	Nil
CA4270	FW	Seminar II	0	0	2	1	1.0	Nil
GP4201	GP	General Proficiency	0	0	0	1		
		Total	**15**	**2**	**6**	**21**		

Contact Hrs = 23

SEMESTER 3

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CA4301	PC	Data Visualization and Machine Learning Models	3	1	0	4	1.0	Nil
CA4308	PC	PHP and MYSQL	3	1	0	4	1.0	Nil
---	PE	Program Elective IV	3	0	0	3	1.0	Nil
---	PE	Program Elective V	3	0	0	3	1.0	Nil
CA4350	PC	Data Visualization and Machine Learning Models Lab	0	0	2	1	1.0	Nil
CA4343	PC	PHP and MYSQL Lab	0	0	2	1	1.0	Nil
CA4342	P	Project	4	0	0	4	1.0	Nil
CA4371	FW	Seminar III	0	0	2	1	1.0	Nil
GP4301	GP	General Proficiency	0	0	0	1	1.0	Nil
		Total	**16**	**2**	**6**	**22**		

Contact Hrs: 24

SEMESTER 4

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CA4401	PC	R Programming	3	0	0	3	1.0	Nil
CA4402	PC	Virtual Reality Systems	3	0	0	3	1.0	Nil
CA4471	FW	Dissertation	12*	0	0	12	1.0	Nil
		Total	**6**	**0**	**0**	**18**		

Contact Hrs: 6

Program Electives

Elective	Course Code	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
I	CA4105	Data Base Administration	3	0	0	3	1.0	Nil
	CA4106	Network Security and Cryptography	3	0	0	3	1.0	Nil
II	CA4204	Introduction to Block chain Technology	3	0	0	3	1.0	Nil
	CA4205	Cyber Law and Crimes	3	0	0	3	1.0	Nil
III	CA4206	Digital Image Processing	3	0	0	3	1.0	Nil
	CA4207	Android Application Development	3	0	0	3	1.0	Nil
IV	CA4307	Deep Learning Concepts	3	0	0	3	1.0	Nil
	CA4309	E-Commerce and M-Commerce	3	0	0	3	1.0	Nil
	CA4312	Software Process and Management	3	0	0	3	1.0	Nil
V	CA4311	Neural Network	3	0	0	3	1.0	Nil
	CA4310	Cloud Computing	3	0	0	3	1.0	Nil
	CA4313	Modeling and Simulation	3	0	0	3	1.0	Nil

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our university.

The following is the course module designed for the MCA program:

Core competency: Students will acquire core competency in computer application studies and in allied subject areas.

Program/Discipline Specific Elective Course (DSEC):

Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

Critical thinker and problem solver: The course curriculum also includes components that can be helpful to post graduate students to develop critical thinking ability by way of solving problems/numerical using basic & advance knowledge and concepts of Computer Applications.

Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristic among the students through appropriate questions, planning and reporting experimental investigation.

Skilled project manager: The course curriculum has been designed in such a manner as to enabling a post graduate student to become a skilled project manager by acquiring knowledge about computer application project management, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

Ethical awareness/reasoning: A post graduate student requires understanding and developing ethical awareness/reasoning which the course curriculums adequately provide.

Lifelong learner: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

Value Added Course (VAC): A value added audit course is a non-credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world. There shall be four courses of Aptitude in Semester I, II, III & IV semesters and two courses of Soft Skills in III & IV Semesters and will carry no credit, however, it will be compulsory for every student to pass these courses with minimum

45% marks to be eligible for the certificate. These marks will not be included in the calculation of CGPI. Students have to specifically be registered in the specific course of the respective semesters.

Skill Enhancement Course: This course may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

Generic/Open Elective Course (OEC): Open Elective is an interdisciplinary additional subject that is compulsory in a program. The score of Open Elective is counted in the overall aggregate marks under Choice Based Credit System (CBCS). Each Open Elective paper will be of 3 Credits in III, IV and VI semesters. Each student has to take Open/Generic Electives from department other than the parent department. Core / Discipline Specific Electives will not be offered as Open Electives.

Non-Credit CGPA : This is a compulsory course but audit that does not have any choice and will be of 3 credits. Each student of MCA program has to compulsorily pass the Environmental Studies and Human values & professional Ethics and NSS.

C. Program Outcomes of Master of Computer Applications:

- PO1. **Computational knowledge:** Acquire in-depth computational knowledge and mathematics with an ability to abstract and conceptualize models from defined problems and requirements.
- PO2. **Problem Analysis:** Identify, formulate, conduct literature survey and solve complex computing problems through analysis as well as provide optimal solutions.
- PO3. **Design/ development of solutions:** Design and evaluate solutions for complex problems, components or processes that meet specified needs after considering public health and safety, cultural, societal, and environmental factors.
- PO4. **Conduct investigations of complex problems:** Conduct literature survey to analyze and extract information relevant to unfamiliar problems and synthesize information to provide valid conclusions and interpret data by applying appropriate research methods, tools and design experiments.
- PO5. **Modern tool usage**: Create, select, adapt and apply appropriate techniques, resources and modern IT tools to complex computing system activities, with an understanding of the limitations.
- PO6. **Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.
- PO7. **Life-long Learning:** Engage in lifelong learning independently for continual development to improve knowledge and competence as a computing professional.
- PO8. **Project management and finance:** Demonstrate knowledge and understanding of management principles and apply these to multidisciplinary software development as a team member and manage projects efficiently as a leader considering economical and financial factors.
- PO9 **Communication Efficacy:** Understand and communicate effectively with the computing community and with society at large, regarding complex computing systems activities confidently and effectively by writing effective reports and design documentations by adhering to appropriate standards, make effective presentations and give / receive clear instructions.
- PO10. **Societal and Environmental Concern:** Understand responsibilities and consequences based on societal, environmental, health, safety, legal and cultural issues within local and global contexts relevant to professional computing practices.
- PO11. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO12 **Innovation and Entrepreneurship:** Identify a timely opportunity for entrepreneurship and use innovation to pursue and create value addition for the betterment of the individual and society at large.

D. Program Specific Outcomes:

PSO 1. To Solve real world computing system problems of various industries by understanding and applying the principles of mathematics, computing techniques and business concepts.

PSO 2. To Design, test, develop and maintain desktop, web, mobile and cross platform software applications using modern tools and technologies.

PSO 3. To use the techniques, skills and modern hardware and software tools necessary for innovative software solutions.

PSO 4. Develop ability to use current technologies, skills and models for computing practice.

Program Educational Objectives (PEO's)

PEO1. To be well familiar with the concepts of Computer Applications development for leading a successful career in industry or as entrepreneur or to pursue higher education.

PEO 2. To develop techno-commercial skills for providing effective solutions to complex problems using domain knowledge of Computer Applications.

PEO 3. To instill lifelong learning approach towards constantly evolving technologies with innovative and ethical mindset.

E. Pedagogy & Unique practices adopted:

"Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will emphasize on experiential learning:

Role Play & Simulation: Role- play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as virtual share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.

Video Based Learning (VBL) & Learning through Movies (LTM): These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.

Field/Live Projects: The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.

Industrial Visits: Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries. Our institute organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

MOOCs: Students may earn credits by passing MOOCs as decided by the college. Graduate level programs may award Honors degree provided students earn pre-requisite credits through MOOCs. University allows students to undertake additional subjects/course(s) (In-house offered by the university through collaborative efforts or courses in the open domain by various internationally recognized universities) and to earn additional credits on successful completion of the same. Each course will be approved in advance by the University following the standard procedure of approval and will be granted credits as per the approval. Keeping this in mind, University proposed and allowed a maximum of two credits to be allocated for each MOOC courses. In the pilot phase it is proposed that a student undertaking and successfully completing a MOOC course through only NPTEL could be given 2 credits for each MOOC course.

For smooth functioning and monitoring of the scheme the following shall be the guidelines for MOOC courses, Add-on courses carried out by the College from time to time.

a) It will necessary for every student to take at least one MOOC Course throughout the programme.

b) There shall be a MOOC co-ordination committee in the College with a faculty at the level of Professor heading the committee and all Heads of the Department being members of the Committee.

c) The Committee will list out courses to be offered during the semester, which could be requested by the department or the students and after deliberating on all courses finalize a list of courses to be offered with 2 credits defined for each course and the mode of credit consideration of the student. The complete process shall be obtained by the College before end of June and end of December for Odd and Even semester respectively of the year in which the course is being offered. In case of MOOC course, the approval will be valid only for the semester on offer.

d) Students will register for the course and the details of the students enrolling under the course along with the approval of the Vice Chancellor will be forwarded to the Examination department within fifteen days of start of the semester by the Coordinator MOOC through the Principal of the College.

e) After completion of MOOC course, Student will submit the photo copy of Completion certificate of MOOC Course to the Examination cell as proof.

f) Marks will be considered which is mentioned on Completion certificate of MOOC Course.

g) College will consider the credits only in case a student fails to secure minimum required credits then the additional subject(s) shall be counted for calculating the minimum credits required for the award of degree.

Special Guest Lectures (SGL) & Extra Mural Lectures (EML): Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.

Student Development Programs (SDP): Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, SAP, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

Industry Focused programmes: Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice-based insight to the students.

Special assistance program for slow learners & fast learners: write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners.

Induction program: Every year 3 weeks induction program is organized for 1st year students and senior students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.

Mentoring scheme: There is Mentor-Mentee system. One mentor lecture is provided per week in a class. Students can discuss their problems with mentor who is necessarily a teaching faculty. In this way, student's problems or issues can be identified and resolved.

Competitive exam preparation: Students are provided with one class in every week for GATE/ Competitive exams preparation.

Extra-curricular Activities: Organizing & participation in extracurricular activities will be mandatory to help students develop confidence & face audience boldly. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.

Career & Personal Counseling: - Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counseling enables the students to focus on behavior and feelings with a goal to facilitate positive change. Its major role lies in giving: Advice, Help, Support, Tips, Assistance, and Guidance.

Participation in Flip Classes, Project based Learning (A2 Assignment), Workshops, Seminars & writing & Presenting Papers: Departments plan to organize the Flip Classes, Project based Learning (A2 Assignment), workshops, Seminars & Guest lecturers time to time on their respective topics as per academic calendar. Students must have to attend these programs. This participation would be count in the marks of general Discipline & General Proficiency which is the part of course scheme as non-credit course.

Formation of Student Clubs, Membership & Organizing & Participating events: Every department has the departmental clubs with the specific club's name. The entire student's activity would be performed by the club. One faculty would be the coordinator of the student clubs & students would be the members with different responsibility.

Capability Enhancement & Development Schemes: The Institute has these schemes to enhance the capability and holistic development of the students. Following measures/ initiatives are taken up from time to time for the same: Career Counseling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counseling

Library Visit & Utilization of QLRC: Students may visit the library from morning 10 AM to evening 8 PM. Library created its resources Database and provided Online Public Access Catalogue (OPAC) through which users can be accessed from any of the computer connected in the LAN can know the status of the book. Now we are in process to move from OPAC to KOHA.

Detailed Syllabus (Semester wise /course wise)

SEMESTER 1 Year -1

CA4101	Title: Artificial Intelligence and Expert Systems	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	1. To impart knowledge on Artificial Knowledge concepts 2. To learn all searching algorithms and Hill-climbing procedures 3. To enable the learners for aspiring careers in the field of Artificial Intelligence	
Expected Outcome	Able to understand the use of AI and the new applications	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to AI & AI Techniques	7
Introduction to types of knowledge - Ai Techniques and Production system - Control strategies - Breadth-First Algorithm - Depth-First Algorithm - Heuristic Search - Problem characteristics and production system characteristics - Best- first Search.		
Unit II	Knowledge Representation Using Predicate Logic	8
Knowledge Representations – Mappings - Approaches to knowledge representations – simple and Inheritable - Approaches to knowledge representations –Inferential & Procedural knowledge - Predicate logics – symbols and rules - Sample examples on predicates logics - Representing simple facts in logic - Representing knowledge using rules – PROLOG - Forward and Backward reasoning - Truth Maintenance System - Statistical reasoning - Bayesian Networks.		
Unit III	Weak – and – Strong Slot Filler Structures	6
Weak – slot – filler structure - Semantic nets – intersection search - Making some important distinctions on semantic nets - Partitioned semantic net - Partitioned semantic net - Creating Frames - Strong-slot-filler structures – conceptual dependencies - Actions and Rules – CD - Scripts introduction and components - Creating a sample script for RESTAURANT - CYC & CYC		
Unit IV	Game Playing & Planning	
Game playing techniques – The Minimax Search Procedure -Iterative deepening - Depth first iterative deepening - How to plan a system –Components of a planning System – Goal Stack Planning -Hierarchical planning - Reactive systems – Understanding		
Unit V	Learning &Expert Systems	8
Types of learning - General learning models - Expert system components and descriptions - Expert system shells - Types Explanation - Knowledge Acquisition – issues		
Text Books	1. Elaine Rich, Kevin Knight, Shivashankar B Nair – Artificial Intelligence – Third Edition-TataMcGraw Hill, New Delhi	
Reference Books	1. Patterson W Dan Introduction to Artificial Intelligence and Expert system – Prentice Hall of India, New Delhi. 2. Peter Jackson Introduction to Expert systems– Addison-Wesley, New York. 3. Craig Larman – Applying UML & Patterns: An Introduction to Objectoriented analysis and design – Addison Wesley Professional,	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studies on	14-05-2022	
Date of Approval by the Academic Council on	20-10-2022	

Course Outcome for CA4101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	understand the concepts of artificial intelligence. Students will also learn the various searching methods.	2	Emp
CO2	understand various types of knowledge representation techniques required in artificial intelligent machines.	2	S
CO3	understand Weak , and , Strong Slot Filler Structures like semantic networks , cd etc	2	S
CO4	understand about the various methods of reducing the search path in game playing.	2	En
CO5	understand about different types of learning methods and will also study about expert system and its working.	1	None

CO-PO Mapping for CA4101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	1	2	2	2	2	2	2	3	2	3	3
CO2	2	3	2	3	1	2	2	2	2	2	2	2	1	3	2	2
CO3	3	2	1	1	3	3	3	3	2	2	2	2	2	2	1	3
CO4	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	3
CO5	2	3	3	2	2	3	2	3	3	3	3	3	3	3	3	2
Avg	2.6	2.6	2.4	2.0	2.2	2.2	2.2	2.4	2.2	2.2	2.2	2.2	2.2	2.4	2.2	2.6

CA4102	Title: Linux Administration and Network Programming	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To provide a background on the UNIX system call interface. To learn Advanced Programming concepts in UNIX Environment. To intoduce network programming under UNIX.	
Expected Outcome	To enable the learner to become Unix System Analyst / Unix Administrator in the IT Industries	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Linux Shell And File Structure	8
Introduction to Linux- Linux distribution-operating systems and Linux-History of Linux and Unix –Linux Overview-Open source software –Linux Software -The shell- The shell Scripts and programming-Shell configuration-Linux files- Directories and archives		
Unit II	Internet And Network Services	7
Managing services - system startup files - starting services - service management - service scripts-FTP server-The FTP user account-Running vsftpd-configuring vsftpd- vsftpd access controls - web servers - apache web server-apache configuration files - apache configuration and directives –apache configuration tools.		
Unit III	Files And Process Creation	7
Study of Open, Close, Read, Write, Lseek, Dup, stat, fstat, and lstat functions-.File Types - File Access Permissions -Study of Access, Link and Unlink Functions- Reading Directories - Time and Date Routines- Setjmp and Longjmp Functions- fork and Vfork –wait-waitpid.		
Unit IV	Signals And Inter Process Communication	7
Signal concepts, signal function -kill and raise – alarm and pause – abort and sleep – Pipes –FIFO-System V IPC – Message Queue- – Example Program - Semaphores - Example Program -Shared Memory- Example Program.		
Unit V	Scocket Programming And Daemon Process	7
Sockets –Elementary TCP Sockets -TCP Echo Client/ Server -Elementary UDP Sockets -UDP Echo Client/ Server-gethostbyname& gethostbyaddr, getservbyname& getservbyport – getaddrinfo- Syslogd Daemon -syslog function - inetd Daemon –Broadcast Addresses – Unicast Versus Broadcast -Multicast Addresses -Multicasting Versus Broadcasting on LAN, Multicasting on WAN .		
Text Books	1. Richard Petersen - Linux : The Complete Reference 2. Richard Stevens .W & Stephen Rago Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education 3. Richard Stevens .W , UNIX Network Programming, Volume II, Prentice Hall, New Delhi	
Reference Books	1. Stephen A.Rago Unix System V Network Programming, Addison Wesley, New York	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board ofStudies on	14-05-2022	
Date of Approval by theAcademic Council on	20-10-2022	

Course Outcome for CA4102

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to make appropriate decisions during the configuration process to create a properly functioning Linux environment.	3	**s**
CO2	Students should be able to Use programs and utilities to administer a Linux machine.	3	**Emp**
CO3	Students should be able to Explain how a Linux server can be integrated within a multi-platform environment.	2	**Emp**
CO4	Students should be able to Analyze the need for security measures for a Linux environment.	2	**Emp**
CO5	Students should be able to Identify the different uses and advantages of Linux in a business environment in order to participate in discussions regarding network servers and services.	2	**Emp**

CO-PO Mapping for CA4102

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	2	2	1	3	2	2	2	2	2	3	3
CO2	2	3	2	3	2	2	3	2	3	3	3	3	2	2	1	3
CO3	3	3	3	3	2	3	3	3	1	3	2	1	3	2	2	2
CO4	2	2	2	2	1	2	2	2	3	2	2	2	2	3	3	3
CO5	3	1	3	1	3	3	3	3	2	3	1	3	3	2	3	1
Avg	2.6	2.4	2.6	2.2	2.2	2.4	2.6	2.2	2.4	2.6	2.0	2.2	2.4	2.2	2.4	2.4

CA4103	Title: Programming In Java	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To understand the principles and concepts of object programming. To learn multithreading concepts.	
Expected Outcome	To enable the learner to pursue careers in Java solution Architect/Java Programmer	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Java	7
The Creation of Java- The Java Buzzwords- An Overview of Java- Data Types,- Variables-Arrays-Operators- Control Statements.		
Unit II	Object Oriented Concepts	7
Introducing Classes- Overloading Methods- Introducing Access Control- Introducing final- Inheritance Basics- Method Overriding- Using Abstract Classes- The String Constructors- Special String Operations-String Comparison- StringBuffer.		
Unit III	Packages Interference Exception Handling and Multithreading	8
Packages – Interfaces - Exception Handling - The Java Thread Model - The Main Thread - Creating a Thread - Thread Priorities – Synchronization - Interthread Communication.		
Unit IV	Applet, AWT and Event Handling	7
Applet Basics - Applet Architecture - An Applet Skeleton - Simple Applet Display Methods - Requesting Repainting - The HTML APPLET Tag - AWT Classes - Window Fundamentals - Working with Graphics - Event Handling - The Delegation Event Model - Event Classes - Event Listener Interfaces.		
Unit V	Java Console Input and Output and File	7
Enumerations - I/O Basics - Reading Console Input - Writing Console Output - The PrintWriter Class - Reading and Writing Files - Collections Overview - The Java I/O Classes and Interfaces – File - The Stream Classes - The Byte Streams - The Character Streams.		
Text Books	1. Herbert Schildt Java: The Complete Reference, The McGraw-Hill, New Delhi.	
Reference Books	1. Horstmann S., Gray Cornell Core Java 2, Fundamentals, Addition Wesley 2. Amold and Gosling, J., The Java Programming Language, Addition Wesley,New Delhi..	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board ofStudies on	14-05-2022	
Date of Approval by theAcademic Council on	20-10-2022	

Course Outcome for CA4103

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to understand the use of OOPs concepts.	2	**s**
CO2	Students should be able to solve real world problems using OOP techniques.	3	**Emp**
CO3	Students should be able to develop and understand exception handling, multithreaded applications with synchronization.	3	**Emp**
CO4	Students should be able to design GUI based applications	3	**Emp**
CO5	Students should be able to understand the use of File I/O.	3	**Emp**

CO-PO Mapping for CA4103

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	3	2	3	3	3	3	3	2	2	3	3
CO2	1	2	3	2	3	2	2	1	2	2	2	2	3	2	2	1
CO3	2	2	2	2	2	3	3	3	1	3	2	2	2	2	2	2
CO4	2	3	2	2	2	3	3	2	2	1	2	1	2	3	2	2
CO5	3	3	3	3	2	2	2	2	3	2	2	2	3	2	1	3
Avg	2.2	2.4	2.4	2.2	2.4	2.6	2.4	2.2	2.2	2.2	2.2	2.0	2.4	2.2	2.0	2.2

CA4104	Title: Software Engineering	L T P C 3 1 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To gain knowledge about various Software Engineering Paradigms. To carry out testing at various levels by applying the Testing Tactics.	
Expected Outcome	To enable the learner to aim careers in Software Engineering related Fields	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Software Engineering	7
Characteristics of software -The Changing Nature of software – Legacy Software and Software myths – A Generic view of process – Software Engineering: A layered Technology and A process framework - Capability Maturity Model Integration -Process Models – Prescriptive models -Specialized Process Models and The Unified Process -An agile view of Process.		
Unit II	Requirements Analysis and Design	8
System Engineering - Requirements Engineering – Requirements Engineering Tasks - Initiating the Requirements Engineering Process-Eliciting Requirements – Building the Analysis Model - Analysis Modeling Approaches – Data Modeling Concepts and Scenario based Modeling and Flow Oriented Modeling– Design Engineering - Software Design Concepts- The Design Model		
Unit III	Testing Strategies and Tactics	6
Introduction to Testing - Definition of Testing Terminologies-Testing Strategies for Conventional Software-Validation Testing - System Testing - Debugging Process- Testing Tactics – White Box Testing - Black Box Testing - Testing for Specialized Environments		
Unit IV	Project Management, Estimation and Scheduling	7
Project Management Spectrum - The People and the Product- The Process and the Project -Metrics for Process and Projects-Estimation - The Project Planning Process – Resources - Decomposition Techniques - Empirical Estimation Models - Project Scheduling Concepts – Timeline charts and Tracking the Scheduling		
Unit V	Quality, Change and Risk Management	8
Reactive and Proactive Risk Strategies – Software Risks –Risk Identification and Risk Projection – Risk refinement and Risk Mitigation, Monitoring and Management -Quality Concepts -Software Quality Assurance -Software Reviews and Formal Technical Reviews -Statistical Quality Assurance -The Software Configuration Management and the SCM Repository -Business Process Reengineering - Reverse Engineering		
Text Books	1 Roger, S. Pressman , Software Engineering: A Practitioner Approach, McGraw Hill International Edition, New Delhi	
Reference Books	1. Waman, S Jawadekar , Software Engineering: Principles and Practice, McGraw Hill Education Pvt. Limited, New Delhi. 2. Rohit Khurana Software Engineering-Principles and Practices, Vikas Publishing House Pvt. Ltd.,, New Delhi.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board ofStudies on	14-05-2022	
Date of Approval by theAcademic Council on	20-10-2022	

Course Outcome for CA4104

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Student should be able to understand the basic concepts of Software Engineering.	2	s
CO2	Student should be able to understand the requirements analysis and design	2	S
CO3	Student should be able to understand software testing strategies and tactics	2	Emp
CO4	Student should be able to understand about software project management, estimation and scheduling	3	Emp
CO5	Student should be able to understand about software quality, change and risk management	3	Emp

CO-PO Mapping for CA4104

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	3	2	3	3	3	3	3	2	2	3	3
CO2	1	2	2	3	1	1	3	2	2	3	1	2	2	2	2	2
CO3	3	2	2	3	2	2	2	1	3	2	3	3	3	2	1	2
CO4	2	3	3	1	2	3	1	2	2	2	2	2	1	3	2	2
CO5	2	2	1	3	2	2	2	3	2	3	3	1	2	2	2	2
Avg	2.2	2.4	2.2	2.4	2.0	2.2	2.0	2.2	2.4	2.6	2.4	2.2	2.0	2.2	2.0	2.2

CA4140	Title: **Linux Administration and Network Programming Lab**	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The purpose of this course is to introduce to students to the field of programming using C language. The students will be able to enhance their analyzing and problem solving skills and usethe same for writing programs in C.	
Expected Outcome	After Completion of the course student should able to Know concepts in problem solving, To do programming in C language, To write diversified solutions using C language	

List of Experiments

1. Understanding and using of commands like ifconfig,netstat, ping, arp, telnet, ftp, finger, traceroute, whois
2. Socket Programming: Implementation of Connection-Oriented Service using standard ports..
3. Implementation of Connection-Less Service using standard ports.
4. Study of Linux general purpose utility command list man,who,cat, cd, cp, ps, ls, mv
5. Study of Linux general purpose utility command list rm, mkdir, rmdir, echo, more, date, time, kill
6. Study of Linux general purpose utility command list history, chmod, chown, finger, pwd, cal, logout, shutdown

Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022
Date of Approval by the Academic Council on	20-10-2022

Course Outcome for CA4140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Make appropriate decisions during the configuration process to create a properly functioning Linux environment	2	S
CO2	Students should be able to Analyze the need for security measures for a Linux environment.	3	Emp
CO3	Students should be able to Demonstrate the role and responsibilities of a Linux system administrator.	3	Emp

CO-PO Mapping for CA4140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	1	1	3	1	3	3	3	1	2	3	3
CO2	2	3	2	3	2	2	2	2	3	3	2	3	3	3	2	2
CO3	1	2	2	2	2	3	3	2	3	2	1	2	2	2	2	1
Avg	2.0	2.3	2.3	2.3	2.3	2.0	2.0	2.3	2.3	2.7	2.0	2.7	2.0	2.3	2.3	2.0

CA4141	Title: Programming in Java Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To teach the students basics of JAVA programs and its execution. To teachthe student, to develop java programs using interfaces.	
Expected Outcome	To Understand OOP concepts and basics of Java programming. To createJava programs using inheritance and polymorphism. To build files and establish database connection.	

List of Experiments

1. Use eclipse or Netbean platform and acquaint with the various menus, create a test project, add a test class and run it see how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java program that uses both recursive and non-recursive functions to print the nth value of the Fibonacci sequence?
3. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons forthe digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.
4. Develop an applet that displays a simple message.
5. Develop an Applet that receives an integer in one text field & compute its factorial value & returns it in another text filed when the button “Compute” is clicked.
6. Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.
7. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computesthe square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
8. Write a java program that connects to a database using JDBC and does add, deletes, modify and retrieve operations.
9. Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially thereis no message shown.
10. Write a java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.

Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022
Date of Approval by the Academic Council on	20-10-2022

Course Outcome for CA4141

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to use Object Oriented Programming concepts for problem solving.	3	Emp
CO2	Students should be able to Apply JDBC to provide a program level interface for communicating with database using java programming	3	Emp
CO3	Students should be able to Apply the garbage collection for saving the resources automatically	3	Emp

CO-PO Mapping for CA4141

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO2	1	3	2	2	1	3	2	2	3	1	3	3	2	1	2	2
CO3	2	2	1	3	2	2	2	3	2	3	2	2	2	2	2	2
Avg	2.0	2.3	2.0	2.7	2.0	2.3	2.3	2.7	2.3	2.0	2.3	2.7	2.3	2.0	2.3	2.3

SEMESTER 2

CA4201	Title: Automata Theory	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims to introduce the concept of languages, grammars,different types of automata and various types of undecidable problems	
Expected Outcome	Computational and complexity-theoretic aspects of learning. Investigation of formal models of learning. Other learning paradigms. Neural networks and learning. Complexity approach to learning todesign of learning system.	
Unit No.	Unit Title	No. of Hrs(Per Unit)
Unit 1	Introduction Of Automata Theory	6
Alphabets, Strings and Languages; Automata and Grammars, Finite automata: Moore/Mealy machine,Equivalence of Moore & Mealy Machines, NFA/DFA: Definition, Language, Notation, State transition graph, Transition table, NFA with epsilon transition, Equivalence of NFA and DFA, Myhill-Nerode Theorem, Minimization of Finite Automata		
Unit 2	Regular Expression Finite Automata	5
Definition, Algebraic Laws for RE, Kleen's Theorem, Arden Theorem, RE to FA, FA to RE, Non Regular Languages, Pumping Lemma for regular Languages and its Applications Closure properties of Regular Languages, Decision properties of Regular Language		
Unit 3	Context Free Grammars & Pda	5
Definition, Derivation trees, Ambiguity, Simplification of CFG, Normal forms for CFG, Closure & Decision Properties of CFL, Emptiness Testing, and Pumping Lemma. PUSH DOWN AUTOMATA: Language, definition, Instantaneous Description and Acceptance of PDA, Equivalence and Conversion of PDA andCFG.		
Unit 4	Turing Machines	4
Definition, Language acceptance by TM, Deterministic TM, NDTM, Turing Machine as Computer ofInteger functions, Variants of Turing Machine, Universal Turing Machine, Turing Church Thesis, Recursive and recursively enumerable languages		
Unit 5	Decidability & Compuation Models	4
Undecidable problems, Halting problem of TM, PCP, Introduction to recursive function theory, NP Completeness, P, NP and NP Hard problems, Time and Space Complexity, Recent trends and applications of Automation, New Models of Computation.		
Text Books	Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Nerosa Publishing House, 3rd Edition Linz, Peter. An introduction to formal languages and automata, 5thedition K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science(Automata, Languages and Computation)", PHI, 3rd Edition	
Reference Books	1. Martin J. C., "Introduction to Languages and Theory of Computations", TMH 2. Papadimitrou, C. and Lewis, C.L., "Elements of theory of Computations", PHI 3. Kumar Rajendra, "Theory of Automata (Languages and Computation)", PPM	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board ofStudies on	14-05-2022	
Date of Approval by theAcademic Council	20-10-2022	

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Course Outcome for CA4201

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Student should be able to explain basic models of computation, Introduce concepts in automata theory and theory of computation.	3	s
CO2	Student should be able to Identify different formal language classes and their relationships, to design grammars and automata (recognizers) for different language classes	3	S
CO3	Student should be able to Synthesize finite and pushdown automata with specific properties, Prove particular problems cannot be solved by finite or pushdown automata using the Pumping Lemma or the closure properties of regular and/or context-free languages	3	Emp
CO4	"Student should be able to design deterministic Turing machine for all inputs and all outputs, subdivide problem space based on input subdivision using constraints	2	Emp
CO5	Student should be able to Determine the decidability and intractability of computational problems, a fundamental understanding of core concepts relating to the theory of computation and computational models including decidability and intractability	2	Emp

CO-PO Mapping for CA4201

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	3	3	3	2	3	2	3	3	3	3	3	2
CO2	1	1	2	1	2	2	3	2	2	1	3	1	2	2	1	1
CO3	2	2	2	2	2	2	1	1	3	2	1	2	3	1	3	2
CO4	3	3	3	2	2	3	2	2	3	3	1	3	2	2	2	3
CO5	3	3	3	3	2	2	2	3	1	3	2	3	2	2	2	3
Avg	2.2	2.4	2.4	2.2	2.2	2.4	2.2	2.0	2.4	2.2	2.0	2.4	2.4	2.0	2.2	2.2

CA4202	Title: Advanced Java	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	1. To import the knowledge on the advanced concept of Java Programming skills. 2. To provide a basic understanding and knowledge of the latest java programming concept. 3. To equip the students in programming skills used to relate with the IT industry.	
Expected Outcome	To enable the learner for aiming careers such as programmers (Java), Developers and Program analysts.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Components of Swing	7
The Origins of Swing - Components and Containers - Exploring Swing - JLabel and ImageIcon – JtextField - The Swing Buttons – JtabbedPane – JscrollPane – Jlist – JcomboBox – Trees – Jtable.		
Unit II	Rmi & Bean	8
Remote Method Invocation (RMI) - A Simple Client/Server Application Using RMI - Java Beans - What is a Java Bean? - Advantages of Java Beans – Introspection - Bound and Constrained Properties – Persistence - Customizers - The Java Beans API - A Bean Example		
Unit III	Servlets	6
Servlets – Background - The Life Cycle of a Servlet - Using Tomcat for Servlet Development - A Simple Servlet - The Servlet API - The javax.servlet Package - Reading Servlet Parameters - The javax.servlet.http Package - Handling HTTP Requests and Responses - Using Cookies - Session Tracking.		
Unit IV	JDBC Concepts	7
JDBC Objects – JDBC Driver Types – JDBC Packages – A Brief Overview of the JDBC Process – Database Connection – Associating the JDBC/ODBC Bridge with the Database – Statement Objects - .ResultSet – Model Programs – Tables – Inserting Data into Table		
Unit V	JSP & EJB	8
Java Server Pages – JSP – JSP Tags – Tomcat – Request String - Enterprise JavaBeans – Deployment Descriptors – Session Java Bean – Entity Java Bean – Message-Driven Bean – The JAR File.		
Text Books	1. Herbert Schildt JAVA The Complete Reference – McGraw-Hill, 2. Jim Keogh J2EE The Complete Reference, Tata McGraw-HillEdition, New Delhi	
Reference Books	1. Horstmann S, Gary Cornell Core Java 2 volume 2 - Advanced Features- PRENTICE HALL, , New Delhi. 2.Hans Bergsten JavaServer Pages, – O'Reilly	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studies on	14-05-2022	
Date of Approval by the Academic Council on	20-10-2022	

Course Outcome for CA4202

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs	2	s
CO2	Students should be able to Build client-server applications and TCP/IP socket programs	2	Emp
CO3	Students should be able to Describe the working of string methods	2	Emp
CO4	Students should be able to Illustrate database access and details for managing information using the JDBC API	3	Emp
CO5	Students should be able to Describe how servlets fit into Java-based web application architecture	3	Emp

CO-PO Mapping for CA4202

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2	3	3	3	2	3	2	2	2	2	2	2	2
CO2	2	3	3	3	1	2	2	2	3	3	2	2	3	2	3	2
CO3	3	3	2	3	2	2	3	2	2	3	3	1	3	1	3	3
CO4	3	2	3	2	3	1	3	1	3	3	2	3	2	2	1	3
CO5	3	2	1	3	2	2	2	3	2	2	3	2	2	3	3	3
Avg	2.6	2.4	2.4	2.6	2.2	2.0	2.6	2.0	2.6	2.6	2.4	2.0	2.4	2.0	2.4	2.6

CA4203	Title: Python Programming	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide a strong foundation Python Syntax and Libraries	
Expected Outcome	Apply the fundamentals of Python in Machine Learning algorithms	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Setting up the Python environment	8
Installing Python, Anaconda, Jupyter Notebook, Spyder, Introduction to Python, Components, Versions and Distributions, Difference between Python 2 and Python 3, Compiler vs Interpreter, Statically vs dynamically typed languages		
Unit II	Programming with Python-1	8
Python REPL, variables, control structures, functions, objects, First-class functions, Immutable data, Strict and non-strict evaluation, Recursion instead of an explicit loop state, Functions, Iterators, and Generators, Writing pure functions, Functions as first-class objects, Using strings, tuples and named tuples		
Unit III	Programming with Python-2	9
Using lists, dicts, and sets, The Itertools Module, Best Practices, Clean coding, Reading data files into Python, manipulating rows and columns in files, writing files, Introduction to python libraries		
Unit IV	Data Preprocessing	7
Data validation and matching, Methods for detecting outliers, Outlier treatment, Creating derived variables and feature engineering, Basic exploratory data analysis		
Unit V	Statistical modeling	4
Curve fitting		
Text Books	1.Core Python Programming,Dr.R. Nageshwara Rao,Dreamtech Press	
Reference Books	1.Complete Reference Python,Martin C Brown,McgrawHills	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studies on	14-05-2022	
Date of Approval by theAcademic Council on	20-10-2022	

Course Outcome for CA4203

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Setting up the Python environment	2	S
CO2	Students should be able to understand the concept of Functions	3	S
CO3	Students should be able to understand the concepts of lists, dicts, sets and files	3	Emp
CO4	Students should be able to understand the concept of Data Preprocessing	2	Emp
CO5	Students should be able to understand the concept of Statistical modeling	3	Emp

CO-PO Mapping for CA4203

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	2	3	2	3	2	2	1	2	2	3	3	3
CO2	2	1	2	1	2	1	3	1	2	2	2	2	3	2	2	2
CO3	1	2	3	3	2	3	2	1	2	2	2	2	2	2	1	2
CO4	2	2	2	2	3	2	2	3	2	2	2	2	1	3	2	3
CO5	3	3	3	2	1	2	3	2	3	3	3	3	3	2	3	3
Avg	2.0	2.2	2.6	2.2	2.0	2.2	2.4	2.0	2.2	2.2	2.0	2.2	2.2	2.4	2.2	2.6

CA4240	Title: Advanced Java Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Design and develop Web applications,Designing Enterprise based applications by encapsulating an application's business logic.	
Expected Outcome	1. learn the Internet Programming, using Java Applets, create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit(AWT) & Swings.	

List of Experiments

1. WAP to swap two numbers without using third variable.
2. WAP to check whether a number is Armstrong or not.
3. WAP to implement the Concept of Function Overloading.
4. WAP to implement the Concept of Function Overriding.
5. WAP to implement the Exceptional Handling.
6. WAP of an applet that receives two numerical values as the input from user and displays the sum of these two numbers.
7. WAP for displaying product list along with their prices and then allow user to buy any1 item from them with required quantity.
8. WAP to implement multithreading(three threads using single run method).
9. WAP to implement the calculator.
10. WAP to implement the URL.
11. WAP to implement Single Client-Server Communication.
12. WAP to implement the Login_Id Form using JDBC.

Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022
Date of Approval by the Academic Council on	20-10-2022

Course Outcome for CA4240

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Explore Exception Handling	3	S
CO2	Manipulate Window Interfaces Using Swing Objects	3	S
CO3	write Programs with Graphics Objects	3	Emp

CO-PO Mapping for CA4240

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2	2	2	2	3	1	3	2	2	3	3	3	3
CO2	2	3	3	3	3	3	2	1	3	2	3	2	3	1	1	1
CO3	3	1	2	2	3	2	3	3	2	2	2	2	1	2	3	2
Avg	2.3	2.0	2.7	2.3	2.7	2.3	2.3	2.3	2.0	2.3	2.3	2.0	2.3	2.0	2.3	2.0

CA4241	Title: Python Programming Lab	L 0	T 0	P 2	C 1
Version No.	1.0				
Course Prerequisites	Nil				
Objectives	Basics of Python programming. Decision Making and Functions in Python. Object Oriented Programming using Python. Searching Algorithms in python.				
Expected Outcome	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python. Express different Decision Making statements and Functions. Interpret Object oriented programming in Python				

List of Experiments

1) Write a Python program to find GCD of two numbers.
2) Write a Python Program to find the square root of a number by Newton's Method.
3) Write a Python program to find the exponentiation of a number.
4) Write a Python Program to find the maximum from a list of numbers.
5) Write a Python Program to perform Linear Search.
6) Write a Python Program to perform Binary Search
7) Write a Python Program to perform selection sort.
8) Write a Python Program to perform insertion sort.
9) Write a Python Program to perform Merge sort.
10) Write a Python program to find first n prime numbers.

Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022
Date of Approval by theAcademic Council on	20-10-2022

Course Outcome for CA4241

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to To acquire programming skills in core Python. To acquire Object Oriented Skills in Python	2	Emp
CO2	Students should be able to To develop the skill of designing Graphical user Interfaces in Python	2	Emp
CO3	Students should be able to To develop the ability to write database applications in Python	2	Emp

CO-PO Mapping for CA4241

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3	3	1	2	3	3	3	3	3	2	3	3	2
CO2	3	3	3	2	2	2	2	1	3	1	1	3	2	3	2	3
CO3	3	2	2	2	2	3	2	2	2	3	2	2	2	2	2	3
Avg	2.7	2.3	2.7	2.3	2.3	2.0	2.0	2.0	2.7	2.3	2.0	2.7	2.0	2.7	2.3	2.7

SEMESTER 3

CA4301	Title: Data Visualization and Machine Learning Models	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Should have knowledge of one Programming Language (preferable Python)	
Objective	Acquire advanced Data Analysis skills., Stay Industry relevant and grow your career. Create AI/ML solutions for various business problems., Build deploy production grade AI/ML applications., Apply AI/ML metho techniques and tools immediately.	
Expected Outcome	• To Design and create data visualizations • To Conduct exploratory data analysis using visualization • To Craft visual presentations of data for effective comm. • To Apply data transformations such as aggregation • To understand the role of Machine Learning in data science	
Unit No.	Title	No. of Hrs (Per Unit)
Unit 1	Introduction to Data Visualization	8
Introduction to data visualization, Data for data graphics, Design principles, Categorical, time series, and statistical data graphics		
Unit II	Introduction to Data Visualization Tools	7
Introduction to Matplotlib, Basic Plotting with Matplotlib, Area Plots, Histograms, Bar Charts, Pie Charts, Box Plots, Scatter Plots		
Unit III	Introduction to Machine Learning	7
Introduction: what is ML; Problems, data, and tools; Visualization; Matlab, Python, Linear regression; SSE; gradient descent, Overfitting and complexity; training, validation, test data		
Unit IV	Introduction to Supervised Machine Learning	7
Classification problems; decision boundaries; nearest neighbor methods,Linear classifiers,Ensemble methods: random forests, SVM, Neural Network		
Unit V	Introduction to Unsupervised Machine Learning	7
Introduction to Unsupervised classifiers: K-mean clustering, Fuzzy C-means, Gaussian etc.		
Text Books	1. Ethem Alpaydin, Introduction to Machine Learning, Second Edition 2. Stephen Marsland, Machine Learning: An Algorithmic Perspective.	
Reference Books	1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning,. 2. Christopher Bishop.Pattern Recognition and Machine Learning. 2e. 3. Christopher M. Bishop, Pattern Recognition and Machine Learning. 4. Tom Mitchell, Machine Learning	
Mode of Evaluation	Internal and External Examination	
Recommended by Board ofStudies on	14-05-2022	
Date of Approval by theAcademic Council on	20-10-2022	

Course Outcome for CA4301

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Design and create data visualizations	3	Emp
CO2	Students should be able to Conduct exploratory data analysis using visualization	3	Emp
CO3	Students should be able to Craft visual presentations of data for effective comm.	3	Emp
CO4	Students should be able to Apply data transformations such as aggregation and	3	Emp
CO5	Students should be able to understand the role of Machine Learning in data science	3	Emp

CO-PO Mapping for CA4301

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	3	2	2	2	1	2	3	2	3	2	3
CO2	2	2	2	2	1	1	3	2	3	3	2	2	2	2	2	2
CO3	2	2	2	2	3	2	3	2	2	2	2	2	3	2	3	2
CO4	1	1	2	3	2	2	2	2	3	2	2	2	2	2	2	1
CO5	3	3	3	3	2	2	3	2	3	3	3	3	2	3	3	3
Avg	2.2	2.0	2.2	2.4	2.2	2.0	2.6	2.0	2.6	2.2	2.2	2.4	2.2	2.4	2.4	2.2

CA4308	Title: PHP and MYSQL	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	By the completion of the Web Development with PHP/MySQL course you should be able to Understand the usage of PHP and MySQL in dynamic web development.	
Expected Outcome	• Students should be able to understand the concept of PHD, Decisions and Loop. • Students should be able to understand and implement the function from various perspective in PHP. • Students should be able to understand the array and its implementation in PHP. • Students should be able to understand the concept of session, cookies and HTML forms and file directories. • Students should be able to understand the database connectivity.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to PHP, Decisions and loop	7
Evaluation of PHP, Basic Syntax, Defining variable and constant, PHP Data type, Operator and Expression, Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html.		
Unit II	Function	7
What is a function, Define a function, Call by value and Call by reference, Recursive function, String Creating and accessing, String Searching & Replacing String, Formatting String, String Related Library function.		
Unit III	Array and OOPS	7
Anatomy of an Array, Creating index based and Associative array Accessing array, Element Looping with array, Oops in PHP Object,Oriented Programming in PHP,Classes and Objects,Method Overriding,Encapsulation,Inheritance, Polymorphism.		
Unit IV	Session, Cookies and HTML Forms, File Directories	8
Introduction to Session Control, Session Functionality What is a Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session, Capturing Form, Data Dealing with Multi-value filed, and Generating File uploaded form, redirecting a form after submission, Understanding file& directory, Opening and closing, a file, Coping, renaming and deleting a file, working with directories, Creating and deleting folder, File Uploading & Downloading.		
Unit V	Database Connectivity with MySql and Exception Handling	7
Introduction to RDBMS, Connection with MySQL Database, Performing basic database operation (DML) (Insert, Delete, Update, Select), Setting query parameter, Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.) Understanding Exception and error, Try, catch, throw. Error tracking and debugging.		
Text Books	1"Expert PHP and MySQL" by Andrew Curioso, Ronald Bradford 2"Web Programming with PHP and MySQL" by Max Bramer	

Reference Books	1. PHP and MySQL Web Development by Luke Welling, Laura Thomson 2. The Complete Reference 1st Edition
Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022
Date of Approval by theAcademic Council on	20-10-2022

Course Outcome for CA4308

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understanding the basic concepts of PHP and its applications	2	s
CO2	Students should be able to Demonstrate various MySQL database queries.	3	s
CO3	Students should be able to Demonstrate backup and restore a MySQL database.	3	Emp
CO4	"Students should be able to Demonstrate the concepts of server-side webapplications.	3	Emp
CO5	Students should be able to Demonstrate the implementation of PHP into current HTML basedwebsites	3	Emp

CO-PO Mapping for CA4508

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	3	2	3	3	2	2	2	1	1	1	3	2	3
CO 2	2	2	2	2	2	2	1	2	3	2	2	1	2	2	2	2
CO 3	2	1	2	3	2	2	2	2	1	3	3	3	3	2	2	2
CO 4	3	3	2	2	2	3	3	2	3	2	2	2	2	3	3	3
CO 5	3	2	3	3	2	2	2	2	3	2	2	3	3	2	2	3
Avg	2.6	2.0	2.4	2.6	2.0	2.4	2.2	2.0	2.4	2.2	2.0	2.0	2.2	2.4	2.2	2.6

CA4350	Title: Data Visualization and Machine Learning Models Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and to allow the viewer to quickly and easily pull out the most important information from the data and use machine learning models.	
Expected Outcome	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution. Understand principle, concept, working and application of new technology and comparison of different application	

List of Experiments

1. To study about Basic Plotting with Matplotlib, Area Plots, Histograms, Bar Charts, Pie Charts, Box Plots, Scatter Plots
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
4. Apply EMP algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML library API in the program.
5. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.
6. Write a program to implement Fuzzy C-means to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.
7. Write a program to implement Gaussian to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.
8. Implement the non-parametric Linear Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studies on	14-05-2022
Date of Approval by theAcademic Council on	20-10-2022

Course Outcome for CA4350

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to apply Decision tree, Neural Networks and Bayesian classifier for determining accuracy using appropriate data sets.	3	Emp
CO2	Students should be able to implement k-nearest neighbor, Regression algorithm and SVM's using real life examples.	3	Emp
CO3	Students should be able to demonstrate working of Random Forest algorithm using suitable training and testing datasets.	3	Emp

CO-PO Mapping for CA4350

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	3	2	1	3	2	2	2	3	3	3	3
CO2	2	1	3	3	2	1	3	2	2	2	3	2	1	1	3	2
CO3	2	3	2	1	2	2	2	3	2	3	1	3	2	3	2	2
Avg	2.3	2.0	2.3	2.0	2.3	2.0	2.3	2.0	2.3	2.3	2.0	2.3	2.0	2.3	2.7	2.3

CA4343	Title: PHP and MYSQL Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	By the completion of the Web Development with PHP/MySQL course you should be able to Understand the usage of PHP and MySQL in dynamic web development.	
Expected Outcome	- Student should be able to understand of HTML, CSS & JavaScript. Also able to create website using HTML and CSS & JavaScript. - Students should be able to change content of web page using Ajax. - Students should be able to connect to database and insert data in database.	

List of Experiments

1. Write a program to create menu using HTML and CSS.
2. Build PHP MySQL 5 Star rating System using AJAX.
3. Write a program to sort an array of associative arrays by value of a given key in PHP.
4. Create a Sign Up form using server side form validation in PHP.
5. Exercise on to implement File System functions.
6. How create CAPTCHA in PHP contact form.
7. Write a program to upload multiple files/images in MySQL database.
8. Create CRUD Operations with MySQL in PHP.
9. Build a Login and User authentication system in PHP.
10. Write a program to manage session in PHP.

Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studies on	14-05-2022
Date of Approval by theAcademic Council on	20-10-2022

Course Outcome for CA4343

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Learn how to take a static website and turn it into a dynamic website run from a database using PHP and MySQL.	3	Emp
CO2	Students should be able to Analyze the basic structure of a PHP web application and be able to install and maintain the web server, compile, and run a simple web application	3	Emp
CO3	Students should be able to List the major elements of the PHP & MySQL work and explain why PHP is good for web development	3	Emp

CO-PO Mapping for CA4343

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	3	2	2	3	3	3	3	3	2	3	2
CO2	2	2	3	3	3	2	3	2	2	2	3	2	2	2	2	2
CO3	3	3	2	3	2	2	1	3	2	1	1	3	2	3	2	3
Avg	2.7	2.3	2.3	2.7	2.0	2.3	2.0	2.3	2.3	2.0	2.3	2.7	2.3	2.3	2.3	2.3

SEMESTER 4

CA4401	Title: R Programming	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	In this course you will learn how to program in R and how to use R for effective data analysis.	
Expected Outcome	• To understand the basics of R programming. • To gain the knowledge of Data structure in R Programming. • To understand the functions and loops in the R programming. • To understand about the working with data in R programming • To Gain the knowledge about the string and dates in R programming.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Basics of R Programming	8
Data types, operators, Math, Variables, and Strings, Vectors and Factors, Vector operations		
Unit II	Data Structures in R	7
Arrays & Matrices, Lists, Data frames, filering & subsetting data, aggregate function		
Unit III	Loops and Functions	7
Conditions and loops, Functions in R, Objects and Classes, Debugging		
Unit IV	Working with Data in R	7
Reading CSV and Excel Files, Reading text files, Writing and saving data objects to file in R, charts & graphs		
Unit V	Strings and Dates in R	7
String operations in R, Regular Expressions, Dates and Times in R, Date conversion, handling date & time		
Text Books	1. An introduction to R,W. N. Venables	
Reference Books	1. R for Data Science,Hadley Wickham, Garrett Grolemund	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board ofStudies on	14-05-2022	
Date of Approval by theAcademic Council on	20-10-2022	

Course Outcome for CA4401

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to understand the basics of R programming.	2	S
CO2	Students should be able to gain the knowledge of Data structure in R Programming.	2	S
CO3	Students should be able to understand the functions and loops in the R programming.	2	Emp
CO4	Students should be able to understand about the working with data in R programming	2	Emp

CO5	Students should be able to Gain the knowledge about the string and dates in R programming.	2	Emp

CO-PO Mapping for CA4401

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3	3	2	3	2	2	2	2	2	2	3	2	2
CO2	2	2	2	2	1	2	2	1	2	2	2	2	2	2	3	2
CO3	3	3	3	3	3	2	2	3	3	2	2	3	2	3	2	3
CO4	2	1	2	2	2	3	2	1	3	3	3	3	2	1	1	2
CO5	3	3	2	1	3	2	1	3	3	3	3	3	3	2	2	3
Avg	2.4	2.2	2.4	2.2	2.4	2.2	2.0	2.0	2.6	2.4	2.4	2.6	2.2	2.2	2.0	2.4

CA4402	Title: Virtual Reality System	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	Understand the underlying enabling technologies of VR systems, Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR experiences2.	
Expected Outcome	• To understand the concept of Virtual Reality environment • To understand the use of Hardware technologies for 3rd user interfaces. • To explain various software technologies used in virtual reality • To explain various 3D interaction techniques used in virtual reality • To understand Advances in 3D user interfaces in virtual reality	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Virtual Reality and Virtual Environments	8
The historical development of VR: The benefits of Virtual Reality, Generic Virtual Reality Systems, Real-time computer graphics, Virtual environments, Requirements for VR, Virtual Reality Applications, Types of VR technology, VR design		
Unit II	Hardware Technologies For 3d User Interfaces	7
Computers: Graphics and workstation architectures, Choosing Output Devices for 3D User Interfaces: 3D Sound, Graphics; Haptic Displays, Force feedback Transducers, HMD, Input device characteristics, Choosing Input Devices for 3D Interfaces : Sensors and transducers, Gloves, Navigation and Gesture Interfaces, Tracking Devices, 3D Mice, Direct Human Input, Home - Brewed Input Devices, Visual representation in VR, aural representation in VR		
Unit III	Software Technologies	7
Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment, Computer Vision for augumented reality and AR software		
Unit IV	3D Interaction Techniques	7
3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design, AR techniques, marker based and marker less tracking		
Unit V	Advances In 3D User Interfaces	7
3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces, Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, Questions of 3D UI Technology, 3D Interaction Techniques, 3D UI Design and Development, 3D UI Evaluation and Other Issues.		
Text Books	1. Gerard Jounghyun Kim, Designing Virtual Reality Systems, the Structured Approach, Springer London 2. Grigore C Burdea abd Philippe Coiffet, Virtual Reality Technology, 2nd Eds., Wiley Interscienc 3. John Vince, Introduction in Virtual Reality, Springer,	
Reference Books	1. Virtual Reality Application Centre, Iowa State University, http://www.vrac.iastate.edu/	
Mode of Evaluation	Internal and External Examinations	

Recommended by Board ofStudies on	14-05-2022
Date of Approval by theAcademic Council on	20-10-2022

Course Outcome for CA4402

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to understand the concept of Virtual Reality environment	2	s
CO2	student should be able to understand the use of Hardware technologies for 3rd user interfaces.	2	s
CO3	Student should be able to explain various software technologies used in virtual reality	3	Emp
CO4	Student should be able to explain various 3D interaction techniques used in virtual reality	3	Emp
CO5	Student should be able to understand Advances in 3D user interfaces in virtual reality	3	Emp

CO-PO Mapping for CA4402

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	3	3	3	2	2	2	2	2	2	3	2	2
CO2	1	2	2	2	3	2	2	1	2	2	2	2	2	2	3	2
CO3	3	2	3	3	1	2	2	3	3	2	2	3	2	3	2	3
CO4	3	1	2	2	2	3	2	1	3	3	3	3	2	1	1	2
CO5	3	2	2	1	3	3	3	3	3	3	3	3	3	2	2	3
Avg	2.4	2.0	2.4	2.0	2.4	2.6	2.4	2.0	2.6	2.4	2.4	2.6	2.2	2.2	2.0	2.4

Program Electives

CA4105	Title: Database Administration	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To provide a reliable, consistent, secure, and available corporate-wide data. To distinguish database administration and data administration.	
Expected Outcome	• To Describe the fundamental organization of a computer system. • To Explain addressing modes, instruction formats and program control statements. • To understand the architecture and functionality of central processing unit. • To Simplify in a better way the Input- Output organization. • To understand the various types of knowledge representation in data administration.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Basics of the Oracle Database Architecture	5
Oracle Server Architecture - Connect Users to Servers and Processing queries, changes and commits - Oracle Universal Installer - Setting up OS and Password File Authentication Oracle Enterprise Manager Components - Creating Parameter File - Starting and Shutting an Instance - Opening and Closing a Database - Getting and Setting Parameter Values -Managing Sessions - Monitoring ALERT and Trace Files - Creating an Oracle Database		
Unit II	Managing the Physical Database Structure	5
Managing Control Files - Maintaining Redo Log Files – Planning - Troubleshooting and Archive Redo Log Files - Logical Structure of the Database - Creating and Changing Tablespace - Temporary Segments - Changing and Relocating Tablespaces - Storage Structures and Relationships - Obtaining Storage Structures Information		
Unit III	Managing Database Objects	4
Planning and Creating Rollback Segments - Maintaining Rollback Segments - Managing Tables - Oracle Data types Creating and Controlling Tables - Analyzing and Retrieving Information about Tables - Creating Different Indexes - Reorganizing Indexes - Dropping Indexes of database directory - Integrity Constraints and Triggers - Implementing Integrity Constraints and Triggers - Maintaining Integrity Constraints and Triggers		
Unit IV	Managing Database Use	5
Creating Database Users - Altering and Monitoring Existing Users - Administering Profiles -Controlling Resource Use and Administering Passwords - System Privileges - Object Privileges - Granting and Revoking Privileges - Controlling OS and Auditing		
Unit V	Overview of Backup and Recovery	5
Backup Considerations – Recovery Considerations - Components for Backup and Recovery -Redo Logs - Checkpoints and Achieves - Multiplexing Control Files & Redo Logs - Types of Failures - Configuring Redo Log Archiving - Multiplexing and Archiving Redo Log Files - Recovery Implications and Performing Offline, Online Backups		
Text Books	1. Jason Couchman and Ulrike Schwinn , DBA Certification Exam Guide, Osborne/McGraw-Hill, New York	
Reference Books	1. Donald K.Burleson Oracle Tuning The Definitive Reference, Rampant Tech. Press, North Carolina. 2. Craig S.Mullin Database Administration: The Complete Guide to DBA Practices and Procedures, Addison Wesley New York.	
Mode of Evaluation	Internal and External Examinations	

Recommended by Board ofStudies on	14-05-2022
Date of Approval by theAcademic Council on	20-10-2022

Course Outcome for CA4105

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Describe the fundamental organization of a computer system	2	S
CO2	Students should be able to Explain addressing modes, instruction formats and program control statements	3	Emp
CO3	Students should be able to understand the architecture and functionality of central processing unit.	2	s
CO4	Students should be able to Simplify in a better way the Input- Output organization	3	Emp
CO5	student should be able to understand the various types of knowledge representation in data administration.	2	Emp

CO-PO Mapping for CA4105

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2	3	3	2	2	3	3	3	3	3	3	2	2
CO2	3	3	2	2	2	2	2	1	2	2	2	2	2	2	3	3
CO3	2	3	2	3	1	3	3	2	2	2	3	3	2	2	3	2
CO4	3	1	2	2	2	2	3	3	2	2	2	2	2	1	2	3
CO5	3	2	3	3	2	2	1	3	3	3	3	2	2	2	1	3
Avg	2.6	2.2	2.4	2.4	2.0	2.4	2.2	2.2	2.4	2.4	2.6	2.4	2.2	2.0	2.2	2.6

CA4106	Title: Network Security and Cryptography	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To understand the concept of Transport Level Security, Wireless Network Security and Electronic Mail Security	
Expected Outcome	• To understand the concept of Transport Level Security. • To understand the concept of Wireless Network Security. • To understand the concept of Electronic Mail Security. • To be able to secure a message over insecure channel by various means. • To learn about how to maintain the Confidentiality, Integrity and Availability of a data.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Information Security	7
Basics of Network security(CIA Triad),Types of Security attacks, services and mechanism, Introduction to cryptography, Conventional Encryption: Conventional encryption model, Classical encryption techniques - substitution ciphers and transposition ciphers, Steganography - Stream and Block ciphers - Modern Block Ciphers: Block ciphers principals, Data Encryption Standard(DES).		
Unit II	Network Security Arithmetic	7
Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms.		
Unit III	Authentication in Security	8
Principles of public key crypto systems - RSA Algorithm, Key, Diffie-Hellman key exchange algorithm, Message Authentication and Hash Function: Authentication requirements - Authentication functions - Message Authentication Code, MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signature Standards (DSS), Authentication Applications: Kerberos and X.509 - directory authentication service electronic mail security-pretty good privacy (PGP) - S/MIME.		
Unit IV	Electronic Mail Security and IP Security	7
Email Security: Pretty Good Privacy (PGP), S/MIME - S/MIME Functionality and Messages - S/MIME Certificate Processing - - Domain Identified Mail Internet Mail Architecture E-Mail Threats. IP Security: Overview, IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management.		
Unit V	Web and System Security	7
Web Security: Secure Socket Layer (SSL) and Transport Layer Security, HTTP, TCP/IP, Secure Electronic Transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems, Denial of Service attack, Intrusion Detection Systems		
Text Books	1. William Stallings - Cryptography and Network Security - Pearson Education	
Reference Books	1. Behrouz A. Forouzan, Debdeep Mukhopadhyay - Cryptography and Network Security - Tata McGraw-Hill Education Pvt. Ltd. 2. Charles Pfleeger - Security in computing - Prentice Hall of India	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board ofStudies on	14-05-2022	
Date of Approval by theAcademic Council on	20-10-2022	

Course Outcome for CA4106

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	learn about the Cryptography & Network security, along with different IT/cyber laws to combat cyber crime	2	s
CO2	understand and analyze how different cryptographic algorithms and hashing techniques secure data and ensure CIA triad of network security	2	S
CO3	understand about various forms of malicious virus threats over internet.	2	Emp
CO4	learn about firewalls and other intrusion detection techniques.	2	Emp
CO5	learn about Basics, setting of VPN configuration and concepts of exchanging keys, modifying security policy.	2	Emp

CO-PO Mapping for CA4106

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	3	2	2	2	2	2	2	2	1	2	3
CO2	3	3	2	2	3	2	2	1	3	3	3	3	3	2	2	3
CO3	2	2	3	1	3	2	1	3	2	2	2	3	2	2	3	2
CO4	1	3	2	2	2	1	3	2	3	3	3	2	2	3	2	1
CO5	2	2	3	3	3	3	2	3	3	2	2	3	2	2	2	2
Avg	2.2	2.4	2.6	2.0	2.6	2.2	2.0	2.2	2.6	2.4	2.4	2.6	2.2	2.0	2.2	2.2

CA4204	Title: Introduction to Block Chain Technology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Understand how blockchain systems (mainly Bitcoin and Ethereum) work, Integrate ideas from blockchain technology into their own projects.	
Expected Outcome	• To Understand how block chain systems (mainly Bit coin and Ethereum) work. • To understand what Block chain is and why it is used. • To be able to explain the different components involved within Block chain. • To know when and why you may want to use Block chain within your environment. • To master at a high level what crypto currency is.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Basics	7
Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.		
Unit II	Blockchain	7
Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.		
Unit III	Distributed Consensus	8
Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.		
Unit IV	Cryptocurrency	7
History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin		
Unit V	Cryptocurrency Regulation	7
Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.		
Text Books	1.Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).	
Reference Books	1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies 2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board ofStudies on	14-05-2022	
Date of Approval by theAcademic Council on	20-10-2022	

Course Outcome for CA4204

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to understand the concept of Distributed Database, File System, Digital Signature	3	S
CO2	Students should be able to understand the concept of Blockchain Network, Mining Mechanism, Distributed Consensus, Chain Policy	3	Emp
CO3	Students should be able to understand the concept of Nakamoto consensus,, Sybil Attack	3	S
CO4	Students should be able to understand the concept of Distributed Ledger, Bitcoin protocols	3	Emp
CO5	Students should be able to understand the concept of Stakeholders, Domain Name Service and future of Blockchain.	3	Emp

CO-PO Mapping for CA4204

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	2	3	3	2	2	2	2	1	2	2	1
CO2	3	3	2	2	3	2	2	2	3	3	3	3	3	2	3	3
CO3	2	2	3	3	3	2	2	2	2	2	2	3	3	2	1	2
CO4	1	3	2	2	2	3	3	2	3	3	3	2	2	1	2	3
CO5	2	2	3	3	3	2	3	2	3	2	2	3	2	3	2	2
Avg	2.2	2.4	2.6	2.4	2.6	2.2	2.6	2.2	2.6	2.4	2.4	2.6	2.2	2.0	2.0	2.2

CA4205	Title: Cyber Law and Crimes	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To learn the principles of computer investigations and digital evidence. To prepare students for careers in homeland defense, law enforcement, or commercial IT security.	
Expected Outcome	• To learn the principles of computer investigations and digital evidence. • To prepare students for careers in homeland defense, law enforcement, or commercial IT security. • To make Learner Conversant With The Social And Intellectual Property Issues Emerging From 'Cyberspace. • To explore The Legal And Policy Developments In Various Countries To Regulate Cyberspace. • To develop The Understanding Of Relationship Between Commerce And Cyberspace.	

Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Information Age and Cyber Crime	7
Cyber Space - Relationship between Computers Crime and Law - Brief Historical Perspective of Criminal Law - Classification of Crimes - Criminal Responsibility, E – commerce and Laws in India, Theories and objectives of Punishment - The Organized Crime - The "White-Collar" Crime - Cyber Crime - Cyber Crime : Definition of "Computer Crime" - Computer Crime categories - Types of Computer Crimes -Classification of Computer Crime - Crime on Web - Indian Scenario - Cyber Jurisdiction - Definition of Cyber Jurisdiction - Model for Jurisdictional Analysis		
Unit II	Cyber Crime and Criminal Codification in India	8
Indian Penal Code : I to III - Indian Penal Code : IV to VI - Indian Penal Code : VII to IX - Indian Penal Code : X to XII - Indian Penal Code : XIII to XV - Indian Penal Code : XVI to XVIII - Protection of Intellectual Property ,I , Patents - Indian Patent Law - Trade Marks , Agmarks		
Unit III	E-commerce Law	6
Copyrights - Digital Signature - Working of Digital Technology - E – commerce and Laws in India-----(a) Digital / Electronic Signature in Indian Laws (b) E – Commerce; Issues and provisions in Indian Law (c) E – Governance; concept and practicality in India (d) E – Taxation issues in Cyberspace (e) E – Contracts and its validity in India, Cloud Computing & Law and Cryptography Laws.		
Unit IV	Communication Network as Surveillance Tool	7
The Web , Intelligence- Tool , Espionage - The Interlude - Data and Information Processing - The operations - The Tradecraft - The armament - Economic Intelligence and Attacks - Web or Net Crimes - Information Warfare - Hackers Psychology and Laws Related To Hacking - Genesis of the term Hacker - Theories of Delinquency		
Unit V	Identity and Information Theft	8
Identity Theft case Files - Avoid being an Easy Target - Cyber Fraud and Electronic Misuse - Definition of Computer Fraud or cyber Fraud - Characteristics Cyber Fraud Offence - How the Victims and Cyber Fraud are Deceived? - The legal Issues - Fraud-Related Offenses - Protection of Cyber Crimes - Encryption in Crime and Terrorism - Law Enforcement Options - Other Technologies for Hiding Evidence - Concealing Crimes through Anonymity.		

Text Books	1.Prof. Parag Diwan, Dr. Suri R.K and Dr. Sanjay Kaushik , "Cyber Crime(Volume : 11,IT Encyclopaedia.com" , Pentagon Press, New Delhi
Reference Books	1.Johnson, Thomas A., "Forensic Computer Crime Investigation" Boca Raton-Fla: CRC ,Press
Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022

Date of Approval by the Academic Council on	20-10-2022

Course Outcome for CA4205

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	understand about Computer security	2	s
CO2	understand about Cyber Law	2	s
CO3	understand about Cyber Crime	2	Emp
CO4	understand about Investigating Cybercrime	2	Emp
CO5	understand about Organizational and Human Security	2	Emp

CO-PO Mapping for CA4205

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	3	3	2	2	3	2	2	2	2	2	2	1	2
CO2	3	2	2	2	2	3	3	2	3	3	3	3	3	2	2	3
CO3	2	3	3	1	2	2	1	2	2	2	1	3	2	2	2	2
CO4	1	3	2	2	2	3	2	2	2	3	2	3	3	2	3	3
CO5	2	2	3	2	2	2	2	2	3	2	2	2	2	2	3	2
Avg	2.2	2.4	2.2	2.0	2.2	2.4	2.0	2.2	2.4	2.4	2.0	2.6	2.4	2.0	2.2	2.4

CA4206	Title: Digital Image Processing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To know about image fundamentals and mathematical transforms necessary for image processing.To gather knowledge about image enhancement techniques. To know about image restoration procedures.	
Expected Outcome	• To know about image fundamentals and mathematical transforms necessary for image processing. • To gather knowledge about image enhancement techniques • To know about image restoration procedures. • To understand the need for image transforms different types of image transforms and their properties. • To understand the rapid advances in Machine vision	

Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Digital image Fundamentals	7
Overview of Digital Image Processing – Fields that use Digital image processing – Fundamental steps in Digital Image Processing – Components of an Image Processing System – Elements of visual perception – Background on MATLAB and the Image Processing Toolbox - The MATLAB Working Environment.		
Unit II	Image Representation & Transformations	8
Digital Image Representation - Reading Images - Displaying Images - Writing Images –Image Types - Array Indexing - Intensity Transformations and Spatial Filtering - Intensity Transformation Functions - Histogram Processing and Function Plotting - The 2-D Discrete Fourier Transform - Computing and Visualizing the 2-D DFT in MATLAB - Filtering in the Frequency Domain - Properties of 2D Fourier Transform		
Unit III	Image Enhancement	6
Image Enhancement in spatial domain: Histogram Equalization – Enhancement using Arithmetic / Logic Operations – Spatial Filtering – Smoothing & Sharpening Spatial Filters. Image Enhancement in Frequency domain: Filtering in the frequency domain – Smoothing & Sharpening		
Unit IV	Image Compression	7
Fundamentals – Image Compression models – Lossless Compression: Variable Length Coding – LZW Coding – Bit plane Coding – predictive coding –Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression Standards – JPEG standards – MPEG standards		
Unit V	Image Segmentation & Representation	8
Edge Detection – Thresholding – Region based Segmentation – Chain codes – Polynomial approximation – Boundary Segments – Case study using MATLAB.		

Text Books	1. Rafael C Gonzalez, Richard E Woods - Digital Image Processing –Pearson Education 2. Rafael C Gonzalez, Richard E Woods, Steven Eddins ,- Digital Image Processing using MATLAB – Pearson Education
Reference Books	Rafael C Gonzalez, Richard E Woods, - Digital Image Processing – Pearson Education
Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022

Date of Approval by theAcademic Council on	20-10-2022

Course Outcome for CA4206

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Review the fundamental concepts of a digital image processing system.	2	s
CO2	Analyze images in the frequency domain using various transforms.	3	Emp
CO3	Evaluate the techniques for image enhancement and image restoration.	3	Emp
CO4	Categorize various compression techniques.	3	Emp
CO5	Interpret image segmentation and representation techniques.	3	Emp

CO-PO Mapping for CA4206

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	3	3	2	1	3	2	2	2	2	2	2	3	2
CO2	1	2	2	2	2	3	3	2	3	1	3	3	2	1	2	1
CO3	2	3	3	3	2	2	3	1	2	2	2	2	2	3	2	2
CO4	3	3	3	2	2	3	3	2	2	3	2	3	3	2	1	3
CO5	2	2	2	2	2	2	2	3	1	2	2	2	2	2	3	3
Avg	2.0	2.4	2.2	2.4	2.2	2.4	2.4	2.2	2.0	2.0	2.2	2.4	2.2	2.0	2.2	2.2

CA4207	Title: Android Applications Development	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	To understand mobile application development trends and Android platform. To analyze the need of simple applications, game development, Location map				
Expected Outcome	• To understand the basics of Android platform and get to understand the activity and lifecycle. • To design and create Layouts, Views like Button, Toggle Button, Radio Button, Checkbox etc • To understand file handling, managing data using SQLite, Data sharing with query string, projections. • To understand messaging, networking and services. • To understand location based services like Display map, zoom control, view and change, Marking, Geo coding etc.				

Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Android Fundamentals	7
Mobile Application development and trends – Android overview and Versions – Android open stack, features – Setting up Android environment (Eclipse, IntelliJ IDEA, AVD), Anatomy of Android applications – – Activity and Life cycle – Intents, services and Content Providers		
Unit II	Android User Interface	8
Layouts: Linear, Absolute, Table, Relative, Frame, Scrollview, Resize and reposition - Screen orientation – Views: Textview, EditText, Button, ImageButton, Checkbox, ToggleButton, RadioButton, RadioGroup, ProgressBar, AutocompleteText, Picker, Listviews and Webview– Displaying pictures with views: Gallery and ImageView, ImageSwitcher, Gridview – Displaying Menus: Helper methods,Toast.		
Unit III	Data Persistence	6
Shared User preferences – File Handling: File system, System partition, SD card partition, user partition, security, Internal and External Storage – Managing data using SQLite , Connect to firebase.		
Unit IV	Messaging, Networking and Services	7
SMS Messaging: Sending and Receiving – Sending email and networking , Asynchronous threading, communication and binding services, Sending sms with sms api.		
Unit V	Location Access and Publish Android application	8
Location based services: Display map, zoom control, view and change, Geocoding, google map displaying current location, Publish Android applications and Deployment..		

Text Books	WeiMeng Lee “Beginning Android Application Development”, Wrox Publications (John Wiley, New York) (For 1 to 5 units).
Reference Books	1. Ed Burnette “Hello Android: Introducing Google's Mobile Development Platform”, The Pragmatic Publishers, 3rd edition, North Carolina USA 2.Reto Meier “Professional Android 4 Application Development”,Wrox Publications
Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studies on	14-05-2022

Date of Approval by the Academic Council on	20-10-2022

Course Outcome for CA4207

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	understand the basics of Android platform and get to understand the activity and lifecycle.	2	S
CO2	design and create Layouts, Views like-Button, Toggle-Button, Radio-Button, Checkbox etc	2	Emp
CO3	understand file handling, managing data using SQLite, Data sharing with query string, projections.	2	Emp
CO4	understand messaging, networking and services.	2	Emp
CO5	understand location based services like Display map, zoom control, view and change, Marking, Geocoding etc.	2	Emp

CO-PO Mapping for CA4207

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2	3	3	2	3	2	2	2	2	2	3	2	2
CO2	3	2	2	2	1	2	3	2	2	3	3	3	2	2	3	3
CO3	2	3	3	3	2	2	3	2	3	2	2	3	3	2	2	2
CO4	3	3	3	2	3	3	2	2	2	3	2	3	2	2	2	3
CO5	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2
Avg	2.4	2.4	2.2	2.2	2.2	2.4	2.4	2.2	2.2	2.4	2.2	2.6	2.2	2.4	2.2	2.4

CA4307	Title: Deep Learning Concepts	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The concept of objective functions is crucial in Deep Learning as it needs to be optimized in order to get better prediction or a more efficient model	
Expected Outcome	• To Define what is Neural Network and model a Neuron and Express both Artificial Intelligence and Neural Network. • To Analyze ANN learning, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning and Boltzmann learning. • To Implement Simple perception, Perception learning algorithm, Modified Perception learning algorithm, and Adaptive linear combiner, Continuous perception, learning in continuous perception. • To Analyze the limitation of Single layer Perceptron and Develop MLP with two hidden layers, Develop Delta learning rule of the output layer and Multilayer feed forward neural network with continuous perceptions. • To Design of another class of layered networks using deep learning principles.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
Feed forward neural networks. Gradient descent and the back propagation algorithm. Unit saturation, aka the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima. Heuristics for faster training. Nestors accelerated gradient descent. Regularization. Dropout.		
Unit II	Convolution Neural Network	8
Architectures, convolution / pooling layers		
Unit III	Recurrent Neural Networks	6
LSTM, GRU, Encoder Decoder architectures		
Unit IV	Deep Unsupervised Learning	7
Deep Unsupervised Learning: Auto encoders (standard, sparse, denoising, contractive, etc), Variational Auto encoders, Adversarial Generative Networks, Auto encoder and DBM.		
Unit V	Applications of Deep Learning to Computer Vision	8
Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, and video to text with LSTM models. Attention models for computer vision tasks.		
Text Books	WeiMeng Lee “Beginning Android Application Development”, Wrox Publications (John Wiley, New York) (For 1 to 5 units).	
Reference Books	1. Ed Burnette “Hello Android: Introducing Google's Mobile Development Platform”, The Pragmatic Publishers, 3rd edition, North Carolina USA 2.Reto Meier “Professional Android 4 Application Development”,Wrox Publications	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studies on	14-05-2022	
Date of Approval by the Academic	20-10-2022	

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Course Outcome for CA4307

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Define what is Neural Network and model a Neuron and Express both Artificial Intelligence and Neural Network	2	Emp
CO2	Students should be able to Analyze ANN learning, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning and Boltzmann learning	3	Emp
CO3	Students should be able to Implement Simple perception, Perception learning algorithm, Modified Perception learning algorithm, and Adaptive linear combiner, Continuous perception, learning in continuous perception	3	Emp
CO4	Students should be able to Analyze the limitation of Single layer Perceptron and Develop MLP with 2 hidden layers, Develop Delta learning rule of the output layer and Multilayer feed forward neural network with continuous perceptions,	3	Emp
CO5	Students should be able to Design of another class of layered networks using deep learning principles.	3	Emp

CO-PO Mapping for CA4307

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	2	2	3	3	2	2	2	2	2	3	2
CO2	3	2	2	2	2	2	3	2	2	3	3	3	2	3	2	3
CO3	2	3	1	3	2	3	3	2	2	2	3	2	2	3	2	2
CO4	3	3	3	2	3	2	2	2	3	3	2	3	3	2	2	3
CO5	2	2	2	2	2	3	2	2	2	2	3	2	2	2	3	3
Avg	2.4	2.6	2.0	2.4	2.2	2.4	2.4	2.2	2.4	2.4	2.6	2.4	2.2	2.4	2.4	2.6

CA4309	Title: E-Commerce and M-Commerce	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	To gain knowledge about different types of management information system. To carry out the process of developing and implementing information system.				
Expected Outcome	• To gain knowledge about different types of MIS • To Understand the basic concepts and technologies • To Have the knowledge of the different types of MIS • To understand the processes of developing • Be aware of the ethical, social, and security issues of information systems.				
Unit No.	Unit Title	No. of hours (per Unit)			
Unit I	Introduction to E-Commerce, Business of Internet, N/W Security & Firewalls	7			
E-Commerce Framework, E-Commerce and Media Convergence ,Anatomy of E- Commerce Applications - E-Commerce Consumer and Organization Applications - Telco/Cable/Online Companies- National Independent ISPs- Regional-level ISPs - Local level ISPs - Service Providers Abroad- Network Interconnection Points - Internet Connectivity Options - Client-Server Network Security - Emerging Threats, Firewalls and Network Security - Data and Message Security, Challenge, Response Systems, Encrypted Documents and E-Mail.					
Unit II	E-Commerce &WWW, Consumer Oriented E-Com, E-Payment System	8			
EDI Application in Business - EDI: Legal, Security and Pr ivacy Issues - EDI and E-commerce - Standardization and EDI - EDI Software Implementation - EDI Envelope for Message Transport–Value Added Networks - Internet based EDI - The New Age of Information Based Marketing - Advertising on the Internet - Charting the Online Marketing Process - Market Research					
Unit III	Challenges of the Internet Business- Business and Technology, M- Commerce	6			
Challenges of the internet business - Business and technology - Positive and negative effects of the internet - Value chain - Planning and execution - M- commerce-what is m-commerce? - Mobility and m-commerce - Location information: Asset					
Unit IV	Customer Care, Billing and Revenue Assurance, the Internet Business Model: the Future and its Economics	7			
Mobility & customer care - Billing and revenue assurance – OSS - The internet business model: Future and its economics - Public right and regulation - Internet Based model – OP - The next generation internet: Mobile Internet - The Next Generation Internet: Economics					
Unit V	Customer Care, Billing and Revenue Assurance, the Internet Business Model: the Future and Its Economics	8			
Mobility & customer care - Billing and revenue assurance – OSS - The internet business model: Future and its economics - Public right and regulation - Internet Based model – OP - The next generation internet: Mobile Internet - The Next Generation Internet: Economics					
Text Books	1 Kalakota &Whinston , Frontiers of Electronic Commerce – Addison Wesley, New York. 2 Louis(P J), M-Commerce Crash Subject: The Technology And Business Of Next generation – McGraw Hill, New York.				

Reference Books	1 Henry chan, Raymond Lee, Tharam Dillon, Elizabeth Change E-Commerce Fundamental and Applications –John Wiley & Sons Ltd., New York. 2 David Whiteley, E- Commerce, Strategy, Technologies and Applications – Tata McGraw hill, New Delhi
Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022
Date of Approval by the Academic Council on	20-10-2022

Course Outcome for CA4309

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	understand about Electronic Commerce	2	s
CO2	understand about Electronic Commerce strategies	2	S
CO3	understand about Reference Models	2	Emp
CO4	understand about Electronic Market	2	Emp
CO5	understand about Electronic Business	2	Emp

CO-PO Mapping for CA4309

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2	3	3	2	3	2	2	2	2	2	2	1	2
CO2	3	2	2	2	2	2	3	2	2	3	3	3	2	3	2	3
CO3	2	3	3	3	2	1	3	3	3	2	3	3	2	2	2	2
CO4	3	2	3	2	3	2	2	2	2	3	2	3	3	2	3	3
CO5	2	3	2	2	2	3	2	2	2	2	2	2	2	3	3	2
Avg	2.4	2.4	2.6	2.2	2.4	2.2	2.4	2.4	2.2	2.4	2.4	2.6	2.2	2.4	2.2	2.4

CA4312	Title: Software Process & Management	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	Identify the different project contexts and suggest an appropriate management strategy. Practice the role of professional ethics in successful software development.				
Expected Outcome	• Identify and describe the key phases of project management. • Determine an appropriate project management approach through an evaluation of the business context and scope of the project.				
Unit No.	**Unit Title**	**No. of hours (per Unit)**			
Unit 1	**Development life cycle processes**	**8**			
Overview of software development life cycle – introduction to processes – Personal Software Process (PSP) – Team software process (TSP) – Unified processes – agile processes – choosing the right process Tutorial: Software development using PSP					
Unit 2	**Requirements management**	**8**			
Functional requirements and quality attributes – elicitation techniques – Quality Attribute Workshops (QAW) – analysis, prioritization, and tradeoff – Architecture Centric Development Method (ACDM) – requirements documentation and specification – change management – traceability of requirements Tutorial: Conduct QAW, elicit, analyze, prioritize, and document requirements using ACDM					
Unit 3	**Estimation, planning, and tracking**	**7**			
Identifying and prioritizing risks – risk mitigation plans – estimation techniques – use case points – function points – COCOMO II – topdown estimation – bottomup estimation – work breakdown structure – macro and micro plans – planning poker – wideband delphi – documenting the plan – tracking the plan – earned value method (EVM) Tutorial: Estimation, planning, and tracking exercises					
Unit 4	**Configuration and quality management**	**7**			
identifying artifacts to be configured – naming conventions and version control – configuration control – quality assurance techniques – peer reviews – Fegan inspection – unit, integration, system, and acceptance testing – test data and test cases – bug tracking – causal analysis Tutorial: version control exercises, development of test cases, causal analysis of defects					
Unit 5	**Software process definition and management**	**6**			
Process elements – process architecture – relationship between elements – process modeling – process definition techniques – ETVX (entrytaskvalidationexit) – process baselining – process assessment and improvement – CMMI – Six Sigma Tutorial: process measurement exercises, process definition using ETVX					
Text Books	1.Pankaj Jalote, "Software Project Management in Practice", Pearson, 2002.				
Reference Books	2.Chris F. Kemerer, "Software Project Management – Readings and Cases", McGraw Hill,1997.				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board of Studied on	14-05-2022				
Date of Approval by the Academic Council on	20-10-2022				

Course Outcome for CA4312

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Appreciate the engineering nature of software development. Describe key activities in software development and the role of modeling.	2	Emp
CO2	Students should be able to Learn how to capture software requirements and handle difficult situations in the course addresses elicitation, specification, and management of software system requirements	2	Emp
CO3	Students should be able to Explain key concepts in software development such as risk and quality; explain the basics of an object-oriented approach to software development. Describe a simple workflow for interacting with the published literature on software development.	2	S
CO4	Students should be able to Apply modern software testing processes in relation to software development and project management,Create test strategies and plans, design test cases, prioritize and execute them.	2	Emp
CO5	Students should be able to Study a body of knowledge relating to Software Engineering, Software reengineering, and maintenance; Understand the principles of large scale software systems, and the processes that are used to build them;	1	Emp

CO-PO Mapping for CA4312

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	3	2	3	2	2	1	3	2	2	2	2	2	3	3
CO 2	2	3	2	3	2	2	3	2	3	3	3	3	2	2	1	3
CO 3	3	3	3	3	2	3	3	3	1	3	2	1	3	2	2	2
CO 4	2	2	2	2	1	2	2	2	3	2	2	2	2	3	3	3
CO 5	3	1	3	1	3	3	3	3	2	3	1	3	3	2	3	1
Avg	2.6	2.4	2.6	2.2	2.2	2.4	2.6	2.2	2.4	2.6	2.0	2.2	2.4	2.2	2.4	2.4

CA4311	Title: Neural Networks	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Design and Implementation of multi-rate and adaptive systems.	
Expected Outcome	• Design and Implementation of multi-rate and adaptive systems. • To know the main types of neural networks. • To apply the methods of training neural networks. • To know the application of artificial neural networks. • To be able to formalize the problem, to solve it by using a neural network.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Cell and Their Structures	7
Action potential, dendrites, synapse and axon Biological Neural Network Vs Artificial Neural Network History and Applications of ANN. Different Architectures of ANN-Different Learning algorithms of ANN-Common activation functions Development process of ANN, Setting of weights, simple OR function simulation McCullosh and Pitts model MP model simulation of OR,AND,NOT functions.		
Unit II	Simple Neural Nets for Pattern Classification	8
Learning algorithms, Supervised and Unsupervised - Hebbian network architecture- Hebbian network algorithm and Application - Perceptron network architecture and its limitations -XOR problem and its solution - Perceptron applications - Adaline architecture and learning -Back propagation network, BP Algorithm Derivation of weight adjustment terms		
Unit III	Pattern Association	6
Pattern Association preliminaries-Pattern associator properties Associative memories and networks -Auto associative net, algorithm and weight setting- Hetero associative net, algorithm and weight setting Problems related to Associative memories -Bidirectional associative memories, weight setting and algorithms -BAM and its various forms -Problems related to BAM.		
Unit IV	Adaptive Resonance Theory and Neocognitron	7
Architecture and Operation -ART-1 algorithm and applications -ART-II architecture and operation-ART-II algorithm and applications -Probabilistic Neural Network,Architecture andalgorithm-Cascade Correlation Network and itsAdvantages -Cascade Correlation learning algorithm -Neocognitron architecture-Neocognitron learning algorithm		
Unit V	Adoptive Resonance Theory	8
Storage Security- Storage security framework, Risk Triad, Storage security domains, security implementations in storage Networking; Managing the Storage Infrastructure - Monitoring the Storage Infrastructure, Storage Management Activities, Storage Infrastructure Management Challenges.		
Text Books	1. Laurene Fausett - Fundamentals Of Neural Networks-Architectures, Algorithms and Applications - Pearson Education, 2.James A.Freeman and David.M.Skapura - Neural Networks Algorithms, Applications and Programming Techniques - Pearson Education	
Reference Books	1. Yegnanarayana B. - Artificial Neural Networks - Prentice - Hall, of India. 2. Simon Haykin- Neural Networks - A Comprehensive Foundation	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studies on	14-05-2022	
Date of Approval by the Academic Council on	20-10-2022	

Course Outcome for CA4311

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Student will be able to remember and understand biological structure of neural networks.	2	S
CO2	Student will be able to understand learning algorithms for pattern classification.	3	Emp
CO3	Student will be able to apply pattern Association preliminaries.	2	Emp
CO4	Student will be able to analyze Adaptive resonance theory and neocognitron.	3	Emp
CO5	Student will be able to understand storage security network.	3	Emp

CO-PO Mapping for CA4311

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	3	3	3	2	3	2	2	2	3	3	2	3
CO2	2	2	2	3	1	2	2	2	2	2	2	3	2	2	3	2
CO3	3	3	2	2	2	2	3	3	2	2	2	3	2	3	2	3
CO4	2	2	3	2	3	3	1	2	1	3	3	2	2	1	3	2
CO5	3	3	2	3	2	2	2	3	3	3	3	3	3	2	2	3
Avg	2.4	2.6	2.4	2.4	2.2	2.4	2.2	2.4	2.2	2.4	2.4	2.6	2.4	2.2	2.4	2.6

CA4310	Title: Cloud Computing	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	To provide students with the fundamentals and essentials of Cloud Computing and also a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.				
Expected Outcome	• To understand the use of Cloud Computing Concepts. • To solve real world application development problems using Google app engine, GKE. • To understand the need of Google cloud storage options. • To understand the use of networking and management tools. • To manage machine learning applications over the cloud.				

Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Cloud computing	4
Origins of Cloud computing – Cloud components ,Cloud vs. Traditional architecture, Essential characteristics – On-demand self service, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing. Services models (IaaS, PaaS, SaaS), The GCP (Google cloud platform) console		
Unit II	Use GCP to Build Your Apps	6
Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing, Computing services in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Exploring PaaS with App Engine, Event driven programs with cloud functions, Containerizing and orchestrating apps with Google Kubernetes Engine.		
Unit III	Structured and Unstructured Storage models	5
Storage options in the cloud, Structured and unstructured storage in the cloud, Unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL		
Unit IV	Cloud APIs and Cloud Security	5
The purpose of APIs, Cloud Endpoints, Using Apigee Edge, Managed message services, Exploring Cloud SQL, Cloud Pub/Sub, Introduction to security in the cloud, The shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM.		
Unit V	Introduction to Cloud Networking and VMWare	6
Introduction to networking in the cloud, Defining a Virtual Private Cloud, Public and private IP address basics, Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine		

Text Books	1. Marinescu D C, Cloud Computing Theory and Practice, Morgan Kaufmann.
Reference Books	1. Erl T, Mahmood Z and Martinez J W, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall. 2. Stallings W, Foundations of Modern Networking, Pearson.
Mode of Evaluation	Internal and External Examinations
Recommended by Board ofStudies on	14-05-2022

Date of Approval by the Academic Council on	20-10-2022

Course Outcome for CA4310

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to understand the use of Cloud Computing Concepts.	2	S
CO2	Students should be able to solve real world application development problems using Google app engine, GKE.	3	Emp
CO3	Students should be able to understand the need of Google cloud storage options.	2	S
CO4	Students should be able to understand the use of networking and management tools.	2	S
CO5	Students should be able to manage machine learning applications over the cloud.	3	Emp

CO-PO Mapping for CA4310

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	2	3	2	2	2	2	3	2	3	2	3
CO2	2	2	2	2	2	2	1	2	3	2	2	1	2	2	2	2
CO3	2	2	2	3	2	2	2	2	3	3	3	3	3	2	2	2
CO4	3	3	3	2	3	3	2	3	2	2	2	2	3	3	3	3
CO5	3	2	3	3	1	2	3	3	3	3	3	3	2	2	2	2
Avg	2.6	2.2	2.6	2.4	2.0	2.2	2.2	2.4	2.6	2.4	2.4	2.4	2.4	2.4	2.2	2.4

CA4313	Title: Modeling and Simulation	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course is designed to provide complete knowledge to estimated costing, behavior and working of any final product.	
Expected Outcome	After the completion of this course, the students will be able to know how any model can behave or act before testing it in real word.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit 1	Introduction	8
Systems, models, discrete event simulation and continuous simulation. Time-advance mechanisms, event modeling of discrete dynamic systems, single-server single queue model, event graphs, Monte Carlo simulation.		
Unit 2	GPSS	7
Model structure, entities and transactions, blocks in GPSS, process oriented programming, user defined functions, SNA, logic switches, save locations, user chains, tabulation of result, programming examples.		
Unit 3	Random Number Generation:	6
Congruence generators, long period generators, uniformity and independence testing		
Unit 4	Random Variate Generation	7
Location, scale and shape parameters, discrete and continuous probability distributions; Inverse transform method, composition and acceptance rejection methods		
Unit 5	Queuing Models	7
Little's theorem, analytical results for M/M/1, M/M/1/N, M/M/c, M/G/1 and other queuing models.		
Text Books	1. Karian, Z.A. and Dudewicz, E.J., "Modern Statistical Systems and GPSS Simulation", CRC Press. 2. Banks, J., Carson, L.S., Nelson, B.L. and Nicol, D.M., "Discrete Event System Simulation", Pearson Education	
Reference Books	1. Law, A.M. and Kelton, W.D., "Simulation, Modeling and Analysis", Tata McGraw-Hill	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	14-05-2022	
Date of Approval by the Academic Council on	20-10-2022	

Course Outcome for CA4313

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students will understand the techniques of modeling in the context of hierarchy of knowledge about a system and	3	S
CO2	Students should be able develop the capability to apply the same to study systems through available software.	3	Emp
CO3	Students will learn different types of simulation techniques	2	S
CO4	Students should be able to understand the use of networking and management tools.	3	S
CO5	Students will learn to simulate the models for the purpose of optimum control by using software.	3	Emp

CO-PO Mapping for CA4313

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related- 0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	3	3	3	2	3	2	3	3	3	3	3	2
CO2	1	1	2	1	2	2	3	2	2	1	3	1	2	2	1	1
CO3	2	2	2	2	2	2	1	1	3	2	1	2	3	1	3	2
CO4	3	3	3	2	2	3	2	2	3	3	1	3	2	2	2	3
CO5	3	3	3	3	2	2	2	3	1	3	2	3	2	2	2	3
Avg	2.2	2.4	2.4	2.2	2.2	2.4	2.2	2.0	2.4	2.2	2.0	2.4	2.4	2.0	2.2	2.2