KANNUR UNIVERSITY

Re-accredited by NAAC with 'B++' Grade

KUFYUGP

BACHELOR OF COMPUTER APPLICATIONS

SECOND YEAR SYLLABUS

Effective from 2024 Admission Onwards

www.kannuruniversity.ac.in

PREFACE

Welcome to the Four-year Integrated UG COMPUTER APPLICATIONS Programme of Kannur University. The Board of Studies of the University has designed this programme on the basis of the National Education Policy 2023 which critically envisions a brand-new holistic education system for the country, hinging on the effective adoption of modern teaching and training methods, application of technology, and imparting practical and contemporary skills, to shape the overall personality of students. Our programme is designed to equip students with a strong foundation in COMPUTER APPLICATIONS principles while also providing specialized training in Artificial Intelligence and Machine Learning. In today's digital age, these technologies are at the forefront of technological advancements, driving innovation across various industries including healthcare, finance, transportation, and entertainment.

The Programme in COMPUTER APPLICATIONS is designed with the objective of equipping the students to cope with the emerging trends and challenges in the field of computers and interrelated disciplines like computer engineering, COMPUTER APPLICATIONS, information systems, information technology, and software engineering. This programme involves various courses such as Value-added courses, Skill enhancement courses, multi-disciplinary courses and ability enhancement courses with an attribution of discipline specific core, discipline specific electives and various scholastic and co scholastic domains. This programme aims at helping the students define and recharge their creative, analytical, problem-solving, and critical thinking abilities, topped by actively pursuing digital literacy.

The BCA COMPUTER APPLICATIONS Honours program emphasizes a strong theoretical foundation complemented by extensive laboratory experience. Students will engage in hands-on experiments that reinforce classroom learning and develop critical technical skills. Through practical work, they will learn to design application programs, software, and analyse data, thus bridging the gap between theory and practice.

For those opting for the BCA COMPUTER APPLICATIONS Honours with Research track, the program offers an enriched experience with a significant focus on independent research. This track is designed for students who wish to delve deeper into specific areas of interest, culminating in a research thesis. Under the mentorship of faculty members, students will undertake original research projects, honing their ability to conduct scientific inquiries,

think critically, and contribute to the body of knowledge in COMPUTER APPLICATIONS. This rigorous training prepares graduates for careers in academia, research institutions, and industry.

The successful revision of this curriculum would not have been possible without the collective efforts and inputs from the BOS members, Ad hoc committee members, COMPUTER APPLICATIONS academic council member, resource persons and the unwavering support of COMPUTER APPLICATIONS faculty members from the affiliated colleges. Their dedication and expertise have played an instrumental role in shaping a curriculum that is relevant, up-to-date, and consistent with international scholarly criteria.

We wish you to have a motivating atmosphere to make use of your extreme potential and caliber to complete this programme and to serve the nation by enriching yourself.

BEST WISHES

(BOS, COMPUTER APPLICATIONS)

INTRODUCTION

Kannur University - Four-Year Undergraduate Programme: Backdrop and Context

The implementation of the Four-Year Undergraduate Programme (FYUGP) has been driven by the pressing need to address contemporary challenges ensuring responsive changes to the evolving needs of students, industry, and society at large. Recognizing the curriculum as the cornerstone of any education system, it requires regular refinement to align with evolving socioeconomic factors. Higher education must provide students with practical and technical skills relevant to their fields of interest, necessitating the development of a job-oriented curriculum. Despite significant increases in access and expansion of higher education over the years, concerns persist regarding the quality and relevance of educational outcomes, particularly in terms of employability skills. As the world becomes increasingly interconnected, our education system must evolve to instill 21st-century skills, enabling students not only to survive but to thrive in this dynamic environment. Moreover, there is a growing need for higher education institutions to embrace social responsibility and contribute to the development of a knowledge society capable of driving sustainable development through innovation. With the central objective of fostering a robust knowledge society to support a knowledge economy, the Government of Kerala has initiated steps to reform higher education. Accordingly, three commissions were established to suggest reforms in higher education policy, legal and regulatory mechanisms, and evaluation and examination systems. It is within this context that a comprehensive reform of the undergraduate curriculum has been proposed, leading to the restructuring of the Four-Year Undergraduate Programme (FYUGP).

VISION AND MISSION OF KANNUR UNIVERSITY

Vision:

To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargod and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission:

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice, and merit in all educational endeavours.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative, and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as nongovernmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

PROGRAMME OUTCOMES

PO1	**Critical Thinking and Problem-Solving-Apply critical thinking skills to analyze information and develop effective problem-solving strategies for tackling complex challenges.**
PO2	**Effective Communication and Social Interaction-Proficiently express ideas and engage in collaborative practices, fostering effective interpersonal connections.**
PO3	**Holistic Understanding-Demonstrate a multidisciplinary approach by integrating knowledge across various domains for a comprehensive understanding of complex issues.**
PO4	**Citizenship and Leadership-Exhibit a sense of responsibility, actively contribute to the community, and showcase leadership qualities to shape a just and inclusive society.**

PO5	**Global Perspective-Develop a broad awareness of global issues and an understanding of diverse perspectives, preparing for active participation in a globalized world.**
PO6	**Ethics, Integrity and Environmental Sustainability-Uphold high ethical standards in academic and professional endeavors, demonstrating integrity and ethical decision-making. Also acquire an understanding of environmental issues and sustainable practices, promoting responsibility towards ecological well-being.**

PROGRAMME SPECIFIC OUTCOMES

PSO1:	**Apply COMPUTER APPLICATIONS knowledge to solve diverse real- world Challenges**
PSO2:	**Design and implement robust software solutions using diverse programming languages and design tools**
PSO3:	**Utilize advanced techniques for data storage, retrieval, and manipulation across varied computing environments**
PSO4:	**Critically evaluate and apply information technology tools and methodologies with ethical consideration**
PSO5:	**Engage in interdisciplinary research to address complex COMPUTER APPLICATIONS challenges**
PSO6:	**Implementation of professional engineering solutions for the betterment of society keeping the environmental context in mind, be aware of professional ethics and be able to communicate effectively.**
PSO7:	**Demonstrate lifelong learning and adapt ability in response to evolving technology trends**

STRUCTURE OF THE PROGRAMME

The Programme of instruction will consist of Lecture courses, Practical courses, comprehensive Viva-voce, Seminar, internship/ industrial visit, and Project work.

1. ***Lecture courses*****:** Courses involving lectures relating to a field or discipline by a faculty member

2. ***Tutorial courses***: Courses involving problem-solving and discussions relating to a field or discipline under the guidance of qualified personnel in a field of learning,

3. ***Laboratory work***: A course requiring students to participate in a project or practical or lab activity that applies previously learned/studied principles/theory related to the chosen field of learning, work/vocation, or professional practice under the supervision of an instructor.

4. **Comprehensive Viva-voce** : This is an essential assessment included in the Programme to evaluate the student's grasp of the subject matter and their ability to apply their knowledge as defined in the course outcomes. It also provides an opportunity for the student to engage in academic discussions and receive valuable feedback from experts in the field.

5. ***Seminar:*** A course requiring students to participate in structured discussion/conversation or debate focused on assigned tasks/readings, current or historical events, or shared experiences guided or led by an expert or qualified personnel in a field of learning

6. ***Internship/ Institutional visit:*** All students shall undergo a Field Trip/Summer Internship/Apprenticeship in a Firm, Industry or Organization; or Training in labs with faculty and researchers or other Higher Education Institutions (HEIs) or research institutions. Departments can actively promote internships that can eventually lead to research project work. Institutional visit Incorporating institutional or industrial visits in the Programme brings immense value to the students, making their learning journey more enriching and preparing them for successful careers in COMPUTER APPLICATIONS-related fields.

7. ***Research Project:*** These students who have opted for the honours with research should complete a research project under the guidance of the mentor and should submit a research report for evaluation. They need to successfully defend the research project to obtain 12 credits under a faculty member of the University/College. The research shall be in the Major discipline

Course and Credit Structure for Different Pathways

Course Distribution for Students in Semesters I – IV

(1) ***Single Major***: The 6 courses together in B and C can be in different disciplines.

(2) Major with Multiple Disciplines: B and C represent two different disciplines**.**

(3) Major with Minor: B and C represent the same Minor discipline**.**

(4) Double major pathway*:* A and B represent the courses offered by the two departments. Students should choose one of the disciplines as their major 1 and the other as major 2

I SEMESTER				
Sl No.	**Course**	**Hours/Week**	**Credits**	**Total Marks**
1	AEC1 (English)	4	3	75
2	AEC2 (Additional Language)	3	3	75
3	MDC A/B	3	3	75
4	DSC A1	5	4	100
5	DSC A2	5	4	100
6	DSC B1	4/5	4	100
Total		**24/25**	**21**	**525**

II SEMESTER				
Sl No.	**Course**	**Hours/Week**	**Credits**	**Total Marks**
1	AEC2 (English)	4	3	75
2	AEC3 (Additional Language)	3	3	75
3	MDC A/B	3	3	75
4	DSC A3	5	4	100
5	DSC B2	4/5	4	100
6	DSC B3	4/5	4	100
Total		**23/25**	**21**	**525**

III SEMESTER				
Sl No.	**Course**	**Hours/Week**	**Credits**	**Total Marks**
1	MDC A/B	3	3	75
2	VAC A/B	3/4	3	75
3	DSC A4	4	4	100
4	DSC A5	5	4	100
5	DSC B4	5	4	100
6	DSC B5	5	4	100
Total		**25/26**	**22**	**550**

IV SEMESTER				
Sl No.	**Course**	**Hours/Week**	**Credits**	**Total Marks**
1	SEC A/B	3/4	3	75
2	VAC A/B	3	3	75
3	VAC A/B	3	3	75
4	DSC A6	4	4	100
5	DSC A7	5	4	100
6	DSC B6	5	4	100
Total		**23/24**	**21**	**550**

GENERAL FOUNDATION COURSES							
MULTI DISCIPLINARY COURSES (MDC)							
SEMESTER	**COURSE CODE**	**COURSE NAME**	**CREDITS**			**HOURS PER WEEK**	**MARKS**
			LECTURE/ TUTORIAL	**PRACTICAL**	**TOTAL**		
I	KU1MDCCAP101	Basics of IT for all	3	0	3	3	75
	KU1MDCCAP102	Digital Marketing	3	0	3	3	75
II	KU2MDCCAP103	Python Programming for all	3	0	3	3	75
	KU2MDCCAP104	Introduction to Data Science	3	0	3	3	75
VALUE ADDED COURSES (VAC)							
SEMESTER	**COURSE CODE**	**COURSE NAME**	**CREDITS**			**HOURS PER WEEK**	**MARKS**
			LECTURE/ TUTORIAL	**PRACTICAL**	**TOTAL**		
III	KU3VACCAP101	Hardware and Networking Essentials	2	1	3	4	75
	KU3VACCAP102	Cyber Law and Ethics	3	0	3	3	75
	KU3VACCAP103	Introduction to Data Analytics	3	0	3	3	75
IV	KU4VACCAP104	Basics of Computer Networks	3	0	3	3	75
	KU4VACCAP105	Basics of Internet of Things	3	0	3	3	75
	KU4VACCAP106	R Programming for Data Analytics	2	1	3	4	75

SKILL ENHANCEMENT COURSES (SEC)							
SEMESTER	**COURSE CODE**	**COURSE NAME**	**CREDITS**			**HOURS PER WEEK**	**MARKS**
			LECTURE/ TUTORIAL	**PRACTICAL**	**TOTAL**		
IV	KU4SECCAP101	Software Project Management	3	0	3	3	75
	KU4SECCAP102	Artificial Intelligence (AI) Assisted Tools	2	1	3	4	75
	KU4SECCAP103	Operating System Administration	2	1	3	4	75

DISCIPLINE SPECIFIC COURSES							
SEMESTER	**COURSE CODE**	**COURSE NAME**	**CREDITS**			**HOURS PER WEEK**	**MARKS**
			LECTURE/ TUTORIAL	**PRACTICAL**	**TOTAL**		
I	KU1DSCCAP101	Foundations of Computers and Programming	3	1	4	5	100
	KU1DSCCAP102	Design Thinking	3	1	4	5	100
	KU1DSCCAP103	Essential IT Tools	3	1	4	5	100
	KU1DSCCAP104	Fundamentals of App Development	3	1	4	5	100
	KU1DSCCAP105	Fundamentals of Web Development	3	1	4	5	100
II	KU2DSCCAP106	Programming with C and C++	3	1	4	5	100
	KU2DSCCAP107	Multimedia and Graphic Designing	3	1	4	5	100
	KU2DSCCAP108	Cyber Security and Ethics	4	0	4	4	100
	KU2DSCCAP109	Introduction to Database Management System	3	1	4	5	100
	KU2DSCCAP110	Ethical Hacking	3	1	4	5	100
III	KU3DSCCAP201	Discrete Mathematics	4	0	4	4	100
	KU3DSCCAP202	Object Oriented Programming through Java	3	1	4	5	100
	KU3DSCCAP203	Digital Systems & Introduction to Microprocessors	3	1	4	5	100
	KU3DSCCAP204	Mathematical Foundations of Computing	3	1	4	5	100

	KU3DSCCAP205	Linux System Administration	3	1	4	5	100
	KU3DSCCAP206	Mobile Application Development	3	1	4	5	100
IV	KU4DSCCAP207	Software Engineering	4	0	4	4	100
	KU4DSCCAP208	Database Management System	3	1	4	5	100
	KU4DSCCAP209	Data Structures and Algorithms	3	1	4	5	100

ASSESSMENT AND EVALUATION

- The assessment shall be a combination of Continuous Comprehensive Assessment (CCA) and an End Semester Evaluation (ESE)
- As per the regulation of Kannur University, one credit corresponds to 25 marks. Hence a 3-credit course must be evaluated for 75 marks and 4 credit courses for 100 marks. The ratio of continuous comprehensive assessment (CCA) to End semester examination (ESE) for theory/lecture courses is 30:70 and for the practical courses, it is 40:60.
- The 4-credit courses (Major and Minor courses) and 3 credit (Foundational Courses) are of two types:
    i. courses with only theory
    ii. courses with 3-credit theory and 1-credit practical.
- In 4-credit courses with only theory components, out of the total 5 modules of the syllabus, one teacher specific module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated.
- In 4-credit courses with 3-credit theory and 1-credit practical components, out of the total 5 modules of the syllabus, 4 modules are for theory and the fifth module is for practical.

Course Credit	**Credit**		**Mark**		**L**		**P**		
4	**L**	**P**	**L**	**P**	**CCA (30%)**	**ESE (70%)**	**CCA (40%)**	**ESE (60%)**	**Total marks**
	4	0	100	0	30	70	0	0	100
	3	1	75	25	25	50	10	15	100
3	**L**	**P**	**L**	**P**	**CCA (30%)**	**ESE (70%)**	**CCA (40%)**	**ESE (60%)**	**Total marks**
	3	0	75	0	25	50	0	0	75
	2	1	50	25	15	35	10	15	75

- The 3 credit courses (Foundational Courses) are of two types:
    - i courses with only theory
    - ii courses with 2-credit theory and 1-credit practical.
- In 3-credit courses with only theory components, out of the total 5 modules of the syllabus, one teacher specific module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated.
- In 3-credit courses with 2-credit theory and 1-credit practical components, out of the total 5 modules of the syllabus, 4 modules are for theory and the fifth module is for practical.
- Continuous Evaluation includes assignments, seminars, periodic written examinations, or other measures as proposed in the syllabus and approved by the university.

Practical exams

- There shall be a Continuous Evaluation of practical courses conducted by the Course- In-Charge.
- An observation book should be maintained for the experiments done in the lab and the same should be evaluated during the continuous evaluation.
- The process of continuous evaluation of practical courses shall be completed before 10 days from the commencement of the end-semester examination.
- The end-semester practical examination and viva-voce, and the evaluation of practical records shall be conducted by the course in-charge and an internal examiner appointed by the Department Council. Duration of ESE may be 2 to 2.5 Hrs.
- Those who passed in continuous evaluation alone will be permitted to appear for the end semester examination and viva-voce
- The end semester practical examination will in general have the following components:

Sl No	**Component of Evaluation**	Marks
1	MODIFICATION	2
2	RECORD	2
3	VIVA	3
4	CODE WRITING	3

5	OUTPUT	5
TOTAL		15

KU1DSCCAP101- Foundations of Computers and Programming,**KU1DSCCAP103- Essential IT Tools/ KU2DSCCAP107 - Multimedia and graphic designing** will have the following components as 4 and 5

#For the course **KU2DSCCAP106- Programming With C and C++** Code writing is divided into Part A and Part B each of 1.5 marks and output is divided into Part A and Part B each of 2.5 marks.

KU1DSCCAP101- Foundations of Computers and Programming		
1	CODE WRITING	3
2	ALGORITHM/ FLOWCHART	2
3	OUTPUT	3
KU1DSCCAP103- Essential IT Tools/ KU2DSCCAP107 - Multimedia and graphic designing		
1	PERFECTION OF THE WORK	4
2	COMPLETENESS	4

Mark Distribution for Discipline Specific Courses and Foundation Courses

The detailed mark distribution for 3 credit and 4 credit courses are given below:

L – Lecture/Theory, P – Practical/Practicum components, CCA – Continuous Comprehensive Assessment, ESE – End Semester Evaluation

- **4 Credit Course (Theory only)**

Evaluation Type		**Marks**
ESE		**70**
CCA		**30**
a)	*Test Paper	15
b)	**Assignment/ Book- Article Review	10
c)	Seminar/ Viva -Voce	5
Total		**100**

- **4 Credit Course (3 credit theory + 1 credit practical)**

Evaluation Type			Marks	Evaluation Type			Marks	Total
Lecture			**75**	**Practical**			**25**	**100**
a)	**ESE**		**50**	a)	**ESE**		**15**	
b)	**CCA**		**25**	b)	**CCA**		**10**	
	i	*Test Paper	12		i	Punctuality and Lab Skill	3	
	ii	**Assignment/ Book- Article review	5		ii	Test Papers	5	
	iii	Seminar/ Viva-Voce	8		iii	Observation Book	2	

- **3 Credit Course (Theory only)**

Evaluation Type		Marks
ESE		50
CCA		25
a)	*Test Paper	12
b)	**Assignment/ Book- Article Review	5
c)	Seminar/ Viva -Voce	8
Total		**75**

- **3 Credit Course (2 credit theory + 1 credit practical)**

Evaluation Type			Marks	Evaluation Type			Marks	Total
Lecture			**50**	**Practical**			**25**	**75**
a)	ESE		**35**	a)	ESE		**15**	
b)	CCA		**15**	b)	CCA		**10**	
	i	*Test Paper	8		i	Test Papers	5	
	ii	**Book-Article review/ Assignment	2		ii	Lab Skill and Punctuality	3	
	iii	Seminar/ Viva-Voce	5		iii	Observation Book	2	

* Best out of two test papers

** Or any other evaluation technique like quiz, open book exam, group activity

INTERNSHIP

- All students should undergo Internship of 2-credits during the first six semesters in a firm, industry or organization, or training in labs with faculty and researchers of their own institution or other Higher Educational Institutions (HEIs) or research institutions.
- Internship can be for enhancing the employability of the student or for developing the research aptitude.
- Internship can involve hands-on training on a particular skill/ equipment/ software. It can be a short project on a specific problem or area. Attending seminars or workshops related to an area of learning or skill can be a component of Internship.
- A faculty member/ scientist/ instructor of the respective institution, where the student does the Internship, should be the supervisor of the Internship.

NB: Guidelines and Evaluation criteria for internship will be published as per AICTE norms

PROJECT IN HONOURS PROGRAMME

- In Honours programme, the student has the option to do a Project of 12-credits in Major instead of three major Courses or Project of 8-credits in Major and one major course in semester 8.
- The Project can be done in the same institution/ any other higher educational institution (HEI) / research centre/ training centre.
- The Project in Honours programme can be a short research work or an extended internship or a skill-based training programme.
- A faculty member of the respective institution, where the student does the Project, should be the supervisor of the Project.

PROJECT IN HONOURS WITH RESEARCH PROGRAMME

- Students who secure 75% marks and above (equivalently, CGPA 7.5 and above) cumulatively in the first six semesters are eligible to get selected to Honours with Research stream in the fourth year.
- In Honours with Research programme, the student has to do a mandatory Research Project of 12-credits instead of three Core Courses in Major in semester 8.
- The number of seats for the Honors with research shall be determined as per the availability of eligible faculty.
- The selection criteria for Honors with research stream shall be in accordance with the guidelines of UGC or as approved by Kannur University.
- Students who have chosen the honours with research stream shall be mentored by a faculty with a PhD.
- The mentor shall prescribe suitable advanced-level courses for a minimum of 20 credits to be taken within the institutions along with the papers on research methodology, research ethics, and research topic-specific courses for a minimum of 12 credits which may be obtained either within the institution or from other recognized institutions, including online and blended modes.

- These students who have opted for the honours with research should complete a research project under the guidance of the mentor and should submit a research report for evaluation. They need to successfully defend the research project to obtain 12 credits under a faculty member of the University/College within the University.
- The research outcomes of their project work may be published in peer-reviewed journals or presented at conferences or seminars or patented.

NB: Guidelines and Evaluation criteria for project evaluation will be published as per AICTE norms

EXTERNAL EVALUATION

- Examinations will be conducted at the end of each semester. The students can write the external examinations in COMPUTER APPLICATIONS in both English and Malayalam languages.
- Individual questions are evaluated in marks and the total marks are converted into grades by the University based on a 10-point grading system.

Letter Grade	**Grade Point (P)**
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

- A minimum of grade point 4 (Grade P) is needed for the successful completion of a Course.

- A student who has failed in a Course can reappear for the End Semester Examination of the same Course along with the next batch without taking readmission or choose another Course in the subsequent Semesters of the same programme to acquire the minimum credits needed for the completion of the Programme.
- There shall not be provision for improvement of CE and ESE.
- A student who has successfully completed the CE requirements in a subsequent semester can also appear for the ESE subject to the maximum duration permitted.

Computation of SGPA and CGPA

The following method is recommended to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

- The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e. **SGPA** (Si) = Σ(Ci x Gi) / ΣCi Where Ci is the number of credits of the course and Gi is the grade point scored by the student in the course.

Example:

Semester	**Course**	**Credit**	**Letter Grade**	**Grade point**	**Credit Point** (Credit x Grade)
I	Course 1	3	A	8	3 X 8 = 24
I	Course 2	4	B+	7	4 X 7 = 28
I	Course 3	3	B	6	3 X 6 = 18
I	Course 4	3	O	10	3 X 10 = 30
I	Course 5	3	C	5	3 X 5 = 15
I	Course 6	4	B	6	4 X 6 = 24
		20			139
SGPA					139/20=**6.95**

- The Cumulative Grade Point Average (CGPA) is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e. CGPA = Σ(Ci x Si) / Σ Ci Where Si is the SGPA of the semester and Ci is the total number of credits in that semester.
- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. Transcript (Format): Based on the above recommendations on Letter grades, grade points and SGPA and CGPA, the HEIs may issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

Example:

Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI
Credit: 21 SGPA: 6.9	Credit: 21 SGPA: 7.8	Credit: 22 SGPA: 5.6	Credit: 24 SGPA: 6.0	Credit: 23 SGPA: 6.3	Credit: 22 SGPA: 8.0
CGPA= (21 x 6.9 + 21 x 7.8 + 22 x 5.6 + 24 x 6.0 + 23 x 6.3 + 22 x 8.0) / 133 = 6.74					

- The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e. **SGPA** (Si) = Σ(Ci x Gi) / ΣCi Where Ci is the number of credits of the course and Gi is the grade point scored by the student in the course.

CGPA	Overall letter Grade
9.5 and above	**O**
8.5 and above but less than 9.5	A+
7.5 and above but less than 8.5	A
6.5 and above but less than 7.5	B+
5.5 and above but less than 6.5	B
4.5 and above but less than 5.5	C
4.0 and above but less than 4.5	D
Less than 4.0	F

Appearance for Continuous Evaluation (CE) and End Semester Examination (ESE) are compulsory, and no Grade shall be awarded to a candidate if the candidate is absent for CE or ESE or both.

VALUE ADDED COURSES (VAC)

KU3VACCAP101: HARDWARE AND NETWORKING ESSENTIALS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	VAC	100 - 199	KU3VACCAP101	3 (2T+ 1P)	4

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	2	-	25	50	75	1.5 hrs.

Course Description:

This value-added course is designed to provide learners with foundational knowledge of computer systems and networking, essential for any modern technical or non-technical profession. The course introduces students to different types of computers and microcomputers, their hardware and software components, and the basic structure of computer programming languages. It also offers an in-depth understanding of the internal architecture of systems, including CPUs, memory units, motherboards, and I/O devices. Moving beyond standalone systems, the course covers core concepts in computer networking such as network types (LAN, WAN), topologies, protocols (TCP/IP, HTTP, FTP), and the OSI model.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Identify various types of computers, microcomputers, and their software components.	R
2	Explain the function of hardware components such as CPU, memory, motherboard, and I/O devices.	U

3	Compare different computer languages and operating systems (e.g., Windows vs. Linux).	An
4	Describe basic networking concepts, types of networks, OSI model, and network devices.	U
5	Configure simple network setups using IPv4/IPv6 in both peer-to-peer and client-server models.	A
6	Differentiate between network protocols and topologies and interpret how they affect network design.	An

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	**2**						**2**
CO 2				**2**			
CO 3	**2**	**2**					
CO 4	**2**	**2**		**2**			
CO 5		**2**		**2**		**6**	
CO6	**2**			**2**			**2**

COURSE CONTENTS

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction to Computers and Software**		**14**
	1 2 3 4	Types of Computers: Desktop, Laptop, Tablet, and Microcomputers Software Components: Operating System (OS), Driver Software, Application Software, Utility Software Features of Operating Systems: Key Differences between Windows and LinuxComputer Languages: High-Level, Low-Level, and Machine Language, Assembler, Compiler, Linker, Loader	

2	**Hardware Components and Microprocessor Basics**		**12**
	1	Hardware Components: CPU, Input Devices, Output Devices	
	2	Motherboard: Internal and External Connectors, Chipset, Platform Controller Hub (PCH), Clock Generator, BIOS, CMOS	
	3	Microprocessor: Execution Unit, Control Unit, Cache Memory	
	4	Memory: Introduction to Primary and Secondary Memory, DRAM vs. SRAM, ROM and its types, Role of ROM in a computer	
	5	I/O Devices: Keyboard, Monitor, Printer, Mouse, Touchscreen	
3	**Computer Networking Fundamentals**		**12**
	1	Introduction to Computer Networking: Benefits and Importance of Networking, Types of Networks: PAN, LAN, MAN, WAN	
	2	Network Packet Structure: Packet, Segment, and Frame, Contents of a Packet Header	
	3	OSI Model (7 Layers): Application, Presentation, Session, Transport, Network, Data Link, Physical	
4	**Network Protocols, Addressing, and Configuration**		**10**
	1	Network Protocols: TCP/IP, IP, HTTP, HTTPS, FTP, SMTP	
	2	Network Topologies: Bus, Star, Ring, Mesh.	
	3	Devices: Hub, Switch, Router, Bridge, Repeater, Gateway, Modem	
	4	Network Addressing: Logical Address, Physical Address, Port Address, Specific Address	
	5	Cables and Connectors: Twisted Pair, Coaxial, Fiber Optic	
	6	Network Configuration: Peer-to-Peer (IPv4/IPv6) – Windows, Client–Server Configuration (IPv4), Internet Café Setup (IPv4), Domain-Based Network System	

5	**Teacher Specific Module**	**12**
	Directions	

Essential Readings:

1."Computer Fundamentals" *Author:* P.K. Sinha & Priti Sinha *Publisher:* BPB Publications
2.“Introduction to Computers” Author: Peter Norton Publisher: McGraw-Hill Education
3."Data Communications and Networking" Author: Behrouz A. Forouzan Publisher: McGraw-Hill
4."Fundamentals of Computer Networks" Author: D. Black Publisher: Pearson
5."Operating Systems: Internals and Design Principles" Author: William Stallings.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Theory		**35**
Practical		**15**
CCA		**25**
Continuous Evaluation (Theory)		**15**
a)	Test Papers	8
b)	Assignment	2
c)	Viva/Seminar	5
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test Papers	5
Total		**75**

KU3VACCAP102: CYBER LAW AND ETHICS

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
3	VAC	100 - 199	KU3VACCAP102		3 (3T+ 0P)	3
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	-	-	25	50	75	1.5 Hrs

Course Description: This value-added course provides a foundational understanding of the digital world's legal, ethical, and security aspects. It is designed to enhance the digital literacy and legal awareness of students from all disciplines by introducing key concepts in cybersecurity, cybercrimes, IT laws, digital rights, and ethical responsibilities in cyberspace. Through real-world case studies, discussions, and interactive sessions, learners will gain insights into the evolving challenges in the cyber domain and be empowered to act as responsible digital citizens. The course aims to bridge the gap between technology use and legal-ethical awareness in today's increasingly connected world.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Explain the fundamental concepts of cybersecurity and various types of cybercrimes.	U
2	Identify and describe the key provisions of the IT Act and its relevance in cyberspace.	R,U
3	Analyze legal frameworks and compare national and international cyber laws.	U,An
4	Evaluate the ethical dimensions of online behavior and digital responsibility.	R, E

5	Apply ethical and legal principles in hypothetical cybercrime scenarios or case studies.	R,U,A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	2			2			
CO 2	2			3			2
CO 3				3			2
CO 4	2			2			
CO 5	2			2			2

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Cyber Security and Crimes**		**14**
	1	Introduction to Cyber Security	
	2	Cyber Threat Landscape: Viruses, Worms, Ransomware, Phishing, Social Engineering	
	3	Classification of Cyber Crimes:	
	4	Cyber Terrorism and National Security Threats	
	5	Investigation and Reporting of Cyber Crimes	
	6	Tools and Techniques for Cyber Security	
2	**Cyber Law and IT ACT**		**12**
	1	Cyberspace, Cyber Jurisprudence, Jurisprudence and Law	
	2		
	3	Genesis and Need for Cyber Law	
	4	Overview of the Information Technology Act, 2000	
	5	Amendments to the IT Act (2008 and beyond)	
	6	Legal Recognition of Electronic Documents and Digital Signatures	
	7	Certifying Authorities and Digital Certificates	
	8	Penalties and Adjudication under the IT Act	
		Role of CERT-In and other regulatory bodies	
3	**Cyber Law and Legislation**		**12**
	1	International Laws and Treaties Related to Cyber Space (Budapest Convention, GDPR)	
	2	Comparative Study of Cyber Laws: India vs. US/EU	

	3	Jurisdiction and Sovereignty in Cyber Space	
	4	Intellectual Property Rights in the Digital Environment	
	5	Data Protection and Privacy Laws (India's DPDP Act)	
	6	Role of the Judiciary in Cyber Law Interpretation Case Studies: Landmark Judgments	
4	**Cyber Ethics**		**10**
	1	Definition and Importance of Cyber Ethics	
	2	Ethics vs. Law in Cyberspace	
	3	Common Unethical Practices: Plagiarism, Piracy, Hacking, Cyber-Bullying	
	4	Digital Citizenship and Responsible Internet Use	
	5	Social Media Ethics and Digital Footprint	
	6	Ethics in Artificial Intelligence and Data Analytics	
	7	Ethical Frameworks and Decision Making in IT	
5	**Teacher Specific Module**		**12**
	Directions		
	Space to fill the selected area/ activity		

Essential Readings:

1. "Cyber Law: Simplified" by Vivek Sood
- **Publisher**: Tata McGraw-Hill
- Covers cyber crimes, the IT Act, legal issues in e-commerce, and case law

2. "Cyber Law & Cyber Crimes" by Barkha & U. Rama Mohan
- **Publisher**: Asia Law House
- Detailed analysis of IT Act, cyber crimes, cyber forensics, and case studies.

3. "Information Technology Law and Practice" by Vakul Sharma
- **Publisher**: Universal Law Publishing
- Authoritative text on Indian cyber law with detailed references to IT Act, rules, and court decisions.

4. "Cyber Laws" by Krishna Kumar Yadav
- **Publisher**: Allahabad Law Agency
- Focuses on legal frameworks, cyber crimes, e-governance, and digital signatures.

5. "Cyber Ethics: Morality and Law in Cyberspace" by Richard Spinello
- **Publisher**: Jones & Bartlett Learning (International Edition)
- Covers ethical issues in internet use, privacy, piracy, AI, and social media ethics.

Supplementary Readings / References:

- **The Information Technology Act, 2000 (with amendments)** – Government of India
- **Budapest Convention on Cybercrime** – Council of Europe (for international context)
- **Digital Personal Data Protection Act, 2023** – (India's data protection framework)

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		25
a)	Test Paper	12
b)	Assignment	5
c)	Seminar/Viva- Voce	8
Total		75

KU3VACCAP103: INTRODUCTION TO DATA ANALYTICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	VAC	100-199	KU3VACCAP103	3(3T+0P)	3

Learning Approach (Hours/ Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	1.5 Hrs
3	-	-	25	50	75	

Course Description: Data analytics is a multidisciplinary field that employs various analysis techniques, including math, statistics, and computer science, to draw insights from data sets. Since Data is endless and huge, data has become the most important entity for all sectors such as Banking, Education, Health sector and Government etc.,The course includes everything from simply analyzing data to theorizing ways of collecting data and creating the frameworks needed to store it.

Course Prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domain
1	Familiarize fundamental concepts of data science and analytics	R
2	Identify various sources of data and explain methods for data collection, validation, and cleaning	U
3	Apply basic statistical methods and analyze simple business scenarios using data analytics techniques	A, An
4	Demonstrate an understanding of how data analytics supports decision-making in various industries	A

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	2						
CO2	2		2	2			
CO3							
CO4	2			3		2	

COURSE CONTENTS

MODULE	UNIT	DESCRIPTION	HOURS
I	MODULE TITLE : **Introduction to Data Science and Analytics**		
	1	Data Science - Overview of Data Analytics: Types and Lifecycle	14
	2	Importance and Applications of Data Analytics in Industries (Healthcare, Retail, Finance, Manufacturing, etc.)	
	3	Role of a Data Analyst vs. Data Scientist. Ethical Considerations and Data Privacy	
	4	Types of Data: Structured vs. Unstructured. Sources of Data: Surveys, Sensors, Social Media, Databases, Web, Introduction to Big Data	
II	MODULE TITLE: **Data Collection and Cleaning**		
	1	Data Collection Methods (Manual, Online Forms, APIs, Public Datasets)	12
	2	Common Data Quality Issues	
	3	Techniques for Data Cleaning: Removing Duplicates, Handling Missing Values, Data Transformation	
	4	Introduction to Data Validation. Formatting and Organizing Data (Using Excel/Google Sheets)	
III	MODULE TITLE : **Introduction to Statistics for Data Analysis**		
	1	Basics of Statistics: Mean, Median, Mode, Variance, Standard Deviation	14
	2	Introduction to Probability. Correlation and Causation	

	3	Sampling Techniques and Data Distribution	
	4	Descriptive Statistics. Hypothesis Testing AB Testing	
IV	MODULE TITLE: **Real-world Applications and Case Studies**		
	1	Descriptive Analytics: Summarizing Data and Predictive Analytics: Forecasting Trends (Conceptual Overview)	12
	2	Business Use Cases in Different Industries	
	3	How Companies Use Data to Drive Decisions	
	4	Case Studies in Marketing, Healthcare, Finance, etc.	
V	MODULE TITLE: **TEACHER SPECIFIC MODULE**		
			5

Essential Readings (Books, Journals, E-sources Websites/ weblinks)

1. Data Analytics by V. Rajaraman & C.S. Ananda, PHI Learning
2. Fundamentals of Data Science by S. K. Gupta, Khanna Publishing
3. Data Science and Analytics by V.K. Jain. Khanna Publishing
4. Business Analytics by U. Dinesh Kumar, Wiley India

Assessment Rubrics:

Evaluation Type	Marks
End Semester Evaluation (ESE) Total	50
a) Theory	50
CCA Total	25
a) Test Papers	12
b) Assignment	5
c) Viva/Seminar	8
TOTAL	75

KU4VACCAP104: BASICS OF COMPUTER NETWORKS

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
4	VAC	100-199	KU4VACCAP104		3(3T+0P)	3
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	--	--	25	50	75	1.5hrs

Course Description: This value-added course introduces the foundational concepts of computer networks in a simplified and practical manner, suitable for students from any academic background. The course covers the basics of how computers communicate, the role of networking devices, transmission media, common internet protocols, and practical tools used in daily networking tasks. The hands-on component is designed to build familiarity with real-world networking tools and applications, empowering students with essential digital skills applicable in various career paths.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Recall basic concepts and terminology related to computer networks	**R**
2	Explain different types of networks, transmission media, and networking devices	**R, U**
3	Identify and describe the functions of common networking protocols and applications	**U**
4	Use basic networking commands and tools to check connectivity and configurations	**R, A**
5	Set up a simple peer-to-peer network and perform basic troubleshooting	**A, E, C**

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	2			2			
CO 2	2			3			2
CO 3	2			2			
CO 4	2					2	
CO 5	2	2				2	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction to Networking**		**12**
	1	Definition and importance of computer networks	
	2	Types of networks: LAN, MAN, WAN, PAN	
	3	Network topologies: Star, Bus, Ring, Mesh, Hybrid	
	4	Client-server vs. peer-to-peer models	
	5	Basic concepts of IP addressing and DNS	
2	**Transmission Media and Network Devices**		**10**
	1	Transmission Media Guided media: Twisted pair, Coaxial cable, Optical fiber	
	2	Unguided media: Radio waves, Microwaves, Infrared Network Devices	
	3	NIC, Hub, Switch, Router, Modem, Access Point	
	4	Firewall and Gateway (basic concepts) Wired vs Wireless networks (basic comparison)	
3	**Common Protocols and Applications**		**12**
	1	Common networking protocols:	
	2	TCP/IP, UDP, HTTP, HTTPS, FTP, SMTP, POP3, IMAP, DNS, DHCP	

	3 4 5	Concept of Ports and Sockets Introduction to Internet and Intranet Web browsing, Email communication File transfer and remote login basics (FTP, SSH)	
4	**Networking Tools and Hands-on Lab**		**14**
	1 2 3 4 5 6	Basic Networking Commands: ping, ipconfig / ifconfig, tracert / traceroute, netstat, nslookup Wireshark (basic packet capture and analysis) Introduction to Packet Tracer or similar simulators LAN setup basics using switches and routers **Activities:** Set up a simple peer-to-peer network using two computers and file sharing Use ping, tracert, ipconfig, and nslookup commands to troubleshoot network issues. Simulate a network topology in Cisco Packet Tracer (e.g., star network with 3 clients)	
5	**Teacher Specific Module**		**12**
	Directions Space to fill the selected area/ activity		

Essential Readings:

1. **"Computer Networking: A Top-Down Approach"**
   - **Authors**: James F. Kurose, Keith W. Ross
   - **Edition**: 8th Edition (latest available)
   - **Publisher**: Pearson
2. **"Data Communications and Networking"**
   - **Author**: Behrouz A. Forouzan
   - **Edition**: 5th Edition
   - **Publisher**: McGraw Hill
3. **"Computer Networks"**

- **Author**: Andrew S. Tanenbaum, David J. Wetherall
- **Edition**: 5th Edition
- **Publisher**: Pearson

4. **"Networking All-in-One For Dummies"**
   - **Author**: Doug Lowe
   - **Edition**: Updated regularly (check for latest)
   - **Publisher**: Wiley

Supplementary Reading (for lab and practical focus):

1. **"Introduction to Networking Basics"**
   - **Author**: Patrick Ciccarelli, Christina Faulkner
   - **Publisher**: Wiley
   - **Focus**: Basic concepts + hands-on exercises
2. **Cisco Networking Academy Lab Manuals**
   - Can be used if you're using **Packet Tracer** in your lab sessions
   - Available for free with Cisco Networking Academy account

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Seminar/Viva- Voce	8
Total		**75**

KU4VACCAP105: BASICS OF INTERNET OF THINGS (IoT)

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	VAC	100 - 199	KU4VACCAP105	3 (3T+0P)	3

Learning Approach (Hours/ Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	-	-	25	50	75	1.5 hrs

Course Description: This value-added course provides a foundational understanding of the Internet of Things (IoT), a transformative technology driving innovation across industries. The course is designed to equip students with essential knowledge and practical skills in IoT systems, covering key components such as sensors, actuators, microcontrollers, communication protocols, cloud platforms, and security practices. Emphasis is also placed on real-world applications in smart homes, healthcare, and industrial automation, along with discussions on ethical considerations and security challenges in connected environments.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Define the fundamental concepts, evolution, and applications of IoT.	R
2	Explain the roles of key components in IoT systems such as sensors, actuators, and connectivity tools.	U
3	Demonstrate using microcontrollers like Arduino and Raspberry Pi in building simple IoT projects.	A
4	Analyze different IoT communication protocols and architectures (Edge vs. Cloud computing).	An

5	Evaluate security risks in IoT systems and recommend mitigation strategies.	E
6	Design a basic IoT prototype integrating sensors, connectivity, and data visualization tool.	C

Remember , Understand (U), Apply (A), Analyse (An), Evaluate , Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	2						
CO 2	2						
CO 3			2				
CO 4	2			3			
CO 5	2						2
CO 6	2	3				2	

COURSE CONTENTS

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction to IoT**		**14**
	1 2 3 4	**Introduction:** Definition and basic concepts of IoT, Historical development of IoT, Benefits and challenges of IoT **Key Components of IoT:** Sensors and actuators, Gateways and cloud platforms, Connectivity technologies: Wi-Fi, Bluetooth, Zigbee, etc., IoT platforms. **IoT Architecture:** Edge computing vs. cloud computing, Communication protocols: MQTT, CoAP, HTTP. **Applications of IoT :** Smart homes, Industrial IoT (IIoT), Healthcare applications	
2	**IoT Devices and Sensors**		

	1 2 3	**Types of IoT Devices:** Wearables, Smart appliances, Embedded systems **Sensors and Actuators:** Types of sensors: temperature, humidity, motion, etc., Interfacing sensors with microcontrollers **IoT Prototyping:** Basics of Arduino and Raspberry Pi, Building simple IoT projects	
3	**Communication and Networking**		
	1 2	**Wireless Communication Protocols for IoT:** Wi-Fi, Bluetooth, Zigbee, LoRaWAN, Suitability of protocols for various scenarios **Cloud Platforms for IoT:** Introduction to AWS IoT Core, Microsoft Azure IoT Hub, Google Cloud IoT Core, Uploading and visualizing sensor data	12
4	**Security in IoT**		
	1 2 3	**Vulnerabilities and Threats in IoT Systems:** Data breaches, Hacking, Privacy concerns **Security Strategies:** Encryption, Authentication, Access Control **Ethical Considerations:** Data privacy, Bias in IoT systems, Responsible technology use	**10**
5	**Teacher Specific Module**		**5**
	Directions		

Essential Readings:

1. Internet of Things: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti.
2. Building the Internet of Things by Maciej Kranz.
3. Getting Started with Raspberry Pi by Matt Richardson and Shawn Wallace.
4. IoT Projects with Arduino by Emily Friedel and Terry Martin.
5. Fundamentals of IoT Communication Technologies by Rolando Herrero.
6. Designing Connected Products by Claire Rowland.
7. Practical Internet of Things Security By Brian Russell and Drew Van Duren.

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper	12
b)	Assignment	5
c)	Seminar/Viva- Voce	8
Total		**75**

KU4VACCAP106: R PROGRAMMING FOR DATA ANALYTICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	VAC	100-199	KU4VACCAP106	3 (2T+ 1 P)	4

Learning Approach (Hours/ Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	2	-	25	50	75	1.5 Hrs

Course Description: This value-added course is designed to introduce students to the fundamentals of R programming and its powerful capabilities in data analytics. R is a widely-used, open-source programming language specially tailored for statistical computing and data visualization. Through a hands-on approach, students will gain practical experience in data import, cleaning, manipulation, visualization, and performing basic statistical analysis. This course is ideal for beginners, it lays the foundation for advanced learning in areas like machine learning, data science, and business analytics

Course Prerequisite: Introduction to Data Analytics and Basic Programming Skill

Course Outcomes:

CO No.	Expected Outcome	Learning Domain
1	Apply basic R programming skills to load, explore, and manipulate datasets for data analysis tasks.	A
2	Use R packages to clean, transform, and manage data efficiently.	A,An
3	Create a variety of data visualizations (e.g., bar charts, histograms, scatter plots)	A, An, C
4	Perform basic statistical analysis and interpret results	U

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

Mapping of Course Outcomes to PSO

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	2		2				
CO2	2		2	2			
CO3		2					2
CO4	2	2				2	

COURSE CONTENTS

MODULE	UNIT	DESCRIPTION	HOURS
I	MODULE TITLE : **Introduction to R and RStudio**		
	1	Overview of R and its applications in data analytics	14
	2	Installing R and Rstudio and Understanding the RStudio interface	
	3	Writing and running basic R scripts	
	4	Data types, variables, and basic operations	
II	MODULE TITLE : **Data Handling and Manipulation**		
	1	Importing data (CSV, Excel, etc.)	12
	2	Data frames, vectors, lists, and matrices	
	3	Data cleaning: handling missing values, renaming columns, Subsetting and filtering data	
	4	Introduction to the dplyr package for data manipulation	
III	MODULE TITLE: **Data Visualization in R**		
	1	Basic plotting with plot (), barplot(), hist()	14
	2	Introduction to the ggplot2 package	
	3	Creating bar charts, histograms, line charts, and scatter plots. Customizing plots (labels, colors, themes)	
	4	Exporting and saving graphs	
IV	MODULE TITLE: **Basic Statistical Analysis**		
	1	Descriptive statistics: mean, median, mode, standard deviation	12
	2	Data summarization with summary () and aggregate()	
	3	Correlation and simple linear regression, Basic hypothesis testing (t-test, chi-square test)	
	4	Introduction to the caret package for basic modeling	
V	**LAB EXPERIMENTS**		

	1. Write a script to assign values to two variables and print the results of arithmetic operations of these two variables. 2. Create variables of different data types and check the data types using the **class() f**unction 3. Write a script to import a csv and excel file(using readxl library) and print the data 4. Create and explore vectors, lists, matrices, and data frames. 5. A R script to handle missing values, rename columns, and filter data. 6. Use dplyr for summarizing data. 7. Use plot(), barplot(), and hist() to create simple visualizations. 8. Create a basic ggplot2 plot using a sample dataset and customize plot elements like colors, labels, themes, and points. Save plots as image files (e.g., PNG, PDF). 9. Compute basic statistics: **mean**, **median**, **mode**, **standard deviation**. Summarize datasets using built-in functions. 10. Explore relationships between variables using correlation and regression. Perform **t-test** and **chi-square test**.	12

Essential Readings (Books, Journals, E-sources Websites/ weblinks)

1. Available Online: https://r4ds.had.co.nz (Free and official online version)
2. *"Data Analytics Using R" by* Seema Acharya, McGraw Hill Education

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Theory		**35**
Practical		**15**
CCA		**25**
Continuous Evaluation (Theory)		**15**
a)	Test Papers	8
b)	Assignment	2
c)	Viva/Seminar	5
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test Papers	5
Total		**75**

SKILL ENHANCEMENT COURSES (SEC)

KU4SECCAP101: SOFTWARE PROJECT MANAGEMENT

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
4	SEC	100-199	KU4SECCAP101		3(3T+0P)	3
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0	0	25	50	75	1.5 Hrs

Course Description: This course introduces students to the principles, methods, and best practices of software project management. It emphasizes the application of project management processes in the context of software development. Students will learn to plan, schedule, budget, and monitor software projects, along with managing risks, quality, and team dynamics. The course integrates both traditional and modern methodologies, including Agile, to prepare students for real-world software project challenges. Tools like Gantt charts, PERT, and project tracking software are introduced.

Course Prerequisite: C Programming, Java or C++ Programming

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the fundamentals of project management in the context of software development.	U
2	Apply project planning techniques, including WBS, network diagrams, and scheduling.	A
3	Estimate project resources, costs, and timelines using standard models.	A
4	Identify and manage project risks, communication plans, and procurement processes.	U

5	Use tools and techniques to manage project scope, quality, and performance.	A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	2			2			2
CO 2	2			2			
CO 3		2		2			
CO 4	2						
CO 5		2		2			

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**MODULE TITLE -Introduction to Project Management**		
	1	Understanding Projects and Project Management a) What is a Project?, Attributes of a project, Project Constraints b) What is project Management? c) Role of the Project manager,Suggested Skills for Project Managers	4
	2	Project Life Cycle and SDLC a) Project and Product Lifecycles b) The Context of Information Technology Projects c) Recent Trends Affecting Information Technology Project Management	5

	3	Project Management Process Groups a) Five Project Management Process Groups b) Mapping the Process Groups to the Knowledge Areas c) Developing an IT Project Management Methodology	4
2	**MODULE TITLE- Project Scope and Schedule Management**		
	1	Project scope Management a) What is Project Scope Management? b) Planning Scope Management c) Collecting Requirements d) Defining Scope	4
	2	Project scope Management Contd… a) Creating the Work Breakdown Structure b) The WBS Dictionary c) Validating Scope d) Controlling Scope	4
	3	Project Schedule Management a) The Importance of Project Schedules a) Planning Schedule Management b) Defining Activities c) Sequencing Activities	3
	4	Project Schedule Management contd…. a) Estimating Activity Durations b) Developing the Schedule- Gantt Charts, Critical Path Method c) Program Evaluation and Review Technique (PERT) d) Controlling the Schedule	2
3	**MODULE TITLE- The Project Cost and Quality Management**		
	1	Project Cost Management a) The Importance of Project Cost Management b) Basic Principles of Cost Management c) Planning Cost Management d) Estimating Costs e) Determining the Budget f) Controlling Costs	4
	2	Project Quality Management a) What is Project Quality Management?	4

		b) Planning Quality Management c) Managing Quality d) Controlling Quality e) Tools and Techniques for Quality Control f) ISO standards and Six Sigma Basics g) Improving It Project Quality-Maturity Models,CMMI	
4	**MODULE TITLE- Managing Project Changes, Risk, People and Communication**		
	1	*Managing Changes a) Managing changes in Traditional and Agile methods b) Configuration Management	3
	2	*Project Risk Management a) Risk Management Process b) Define Standards, Identify Risks, Some Common Risks in Software Development, Classify Risks c) Risk Management Strategies, Budgeting for Risks d) Risk Monitoring and Control	4
	3	*Managing people and organising communication a) Managing people b) Project Organisation Structures c) Managing Communication	3
	4	Open Source Tools for Managing Projects	2
5	**Teacher Specific Module**		**5**
	Familiarise Tools for Software Project Management		
	Emerging Trends in Software Project management		5

Essential Readings:

1. Kathy Schwalbe, Information Technology Project Management, Cengage Learning, Inc., 9th Edition, Student Edition: ISBN-13: 978-1-337-10135-6.
2. Adolfo Villafiorita, Introduction to Software Project Management, CRC Press Taylor & Francis Group, ISBN-13: 978-1-4665-5954-7 (eBook - PDF) (For topics prefixed with * only)

References:

Books:

1. Bob Hughes, Mike Cotterell and Rajib Mall, Software Project Management, McGraw Hill Education
2. Andrew Stellman , Jennifer Greene, Applied software Project management, O'Reilly Media**Web:**
1. PMI (Project Management Institute)-https://www.pmi.org
2. OpenProject(Free Project Management Tool)-https://www.openproject.org
3. ProjectLibre(Free alternative to MS Project) -https://www.projectlibre.com

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Case study presentation	8
Total		**75**

KU4SECCAP102: ARTIFICIAL INTELLIGENCE (AI) ASSISTED TOOLS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	SEC	100-199	KU4SECCAP102	3(2T+1P)	4

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	2	-	25	50	75	1.5 Hrs

Course Description:

This Skill Enhancement Course introduces learners to the foundational concepts and practical applications of Artificial Intelligence (AI) tools across diverse domains. The course offers a hands-on learning experience with popular AI-powered platforms used for text generation, image design, audio/video creation, and productivity enhancement. Special focus is given to prompt engineering, enabling learners to interact effectively with AI systems to generate accurate and creative outputs.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the fundamentals of AI and categories of AI tools.	U
2	Describe the applications of text-based, image-based, audio, video, and productivity AI tools in real-world contexts.	R,U
3	Demonstrate using popular AI tools for content creation, communication, and task automation.	U, A
4	Analyze the differences between traditional and AI-assisted approaches in content generation and productivity enhancement.	R,An

5	Evaluate the ethical implications and potential limitations of using AI tools in professional and academic settings.	R,An,E
6	Construct effective prompts to optimize outputs from text, image, and multimedia-based AI tools.	R, C

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	2						2
CO 2	2			2			
CO 3	2		2				
CO 4	2				2		2
CO 5	3			2	2		
CO 6	3	2		2			

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction to AI and AI Tools**		**14**
	1	Introduction to Artificial Intelligence.	
	2	History and evolution of AI	
	3	Categories of AI: Narrow AI, General AI, and Super AI	
	4	Overview of AI applications in various sectors	
	5	Types of AI tools: Text, Image, Audio, Video, Productivity, etc.	
	6	Ethical implications and responsible AI usage	
	7	**Activity:** Explore and report on 3 different free AI tools from various categories.	

2	**Exploring Text-Based and Image Design-Based AI Tools**		**12**
	1 2 3 4 5	Text generation tools: ChatGPT, Gemini, Jasper, Writesonic Image generation/design tools: Canva AI, DALL·E, Adobe Firefly, Midjourney Prompting basics for text/image AI tools Comparing traditional vs AI-assisted content creation **Activities:** **Text Tool Task:** Use ChatGPT to write a short article or summary on a given topic. **Image Tool Task:** Design a poster or social media graphic using Canva AI or DALL·E	
3	**Audio, Video, and Productivity Tools**		**12**
	1 2 3 4 5	Audio tools: Descript, Murf.ai, ElevenLabs. Video tools: Pictory, Synthesia, Runway Productivity tools: Notion AI, Grammarly, Otter.ai, Microsoft Copilot Use cases in education, business, and content creation **Activities:** Create Audio/Video: Generate a voiceover or short AI video for a presentation. Productivity Challenge: Use AI tools like Notion AI or Grammarly for document enhancement and planning.	
4	**Introduction to Prompt Engineering**		**10**
	1 2 3 4 5	Introduction to the prompt, Role of prompts in AI tools Anatomy of a good prompt Types of prompts: Instructional, conversational, role-based Prompt tuning: Improving results through iteration Use in text, image, and code generation Activities: Prompt Lab: Experiment with different prompt styles in ChatGPT to produce creative writing or code. Role-based Prompting: Simulate expert roles (e.g., historian, teacher) using prompt scenarios.	
5	**Teacher Specific Module**		**12**
	Sample Lab Exercise: 1. Generate short-form content using an AI text tool on any topic.		

	2. Create visual content using Canva AI or DALL·E for the above topic 3. Generate a voiceover using an AI audio tool, **Murf.ai**, **Descript**, or **ElevenLabs**. 4. Use AI tools to create a simple explainer video using **Pictory, Heygen** or **Synthesia**. 5. Use AI productivity tools to write and organize ideas, using **Notion AI**, **Grammarly**, or **Microsoft Copilot**. 6. Write effective prompts (minimum three different prompts) for AI tools and observe the outputs. Demonstrate for poor and better prompting. Test the three types of prompts: **Instructional, Conversational and Role-Based**	

Essential Readings:

1. Artificial Intelligence Basics

- **Title:** *Artificial Intelligence: A Guide for Thinking Humans*
  Author: Melanie Mitchell
  Publisher: Penguin
  Description: Offers a clear introduction to core AI concepts with real-world implications.
  Level: Beginner to Intermediate
- **Title:** *Artificial Intelligence: A New Synthesis*
  Author: Nils J. Nilsson
  Publisher: Morgan Kaufmann
  Description: A foundational textbook covering traditional and modern AI.
  Level: Intermediate

2. AI Tools and Applications

- **Title:** *The Art of Prompt Engineering with ChatGPT: Crafting Effective Prompts for Work, Creativity, and Learning*
  Author: Nathan Hunter
  Publisher: Independently published
  Description: Focuses on prompt crafting strategies for getting optimal results from text-based AI tools.
  Level: Beginner to Intermediate

3. Multimedia and Productivity Tools

- **Title:** *AI for Creators: A Guide to AI Tools for Content Creation*
  Author: Chris Lu
  Publisher: Self-published
  Description: Hands-on guide to tools like Midjourney, Descript, Synthesia, and

others for creative work.
Level: Beginner

- **Title:** *AI and You: How to Think, Create and Collaborate with AI*
  Author: Dan Fitzpatrick
  Publisher: Routledge
  Description: Includes practical examples and tool-based workflows for content creators and professionals.
  Level: Beginner

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Theory		**35**
Practical		**15**
CCA		**25**
Continuous Evaluation (Theory)		**15**
a)	Test Papers	8
b)	Assignment	2
c)	Viva/Seminar	5
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test Papers	5
Total		**75**

KU4SECCAP103: OPERATING SYSTEM ADMINISTRATION

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	SEC	100-199	KU4SECCAP103	3 (2T+ 1P)	4

Learning Approach (Hours/ Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	1.5 Hrs
2	2	-	25	50	75	

Course Description: This course is designed to provide students with comprehensive, hands-on knowledge of operating system management using two of the most widely used platforms: **Linux** and **Windows**. Students can gain critical skills needed to install, configure, maintain, and troubleshoot both Linux and Windows operating systems in standalone and networked environments. It equips participants with practical expertise and will develop a dual-platform skill for a wide range of roles in IT support, system administration, and technical operations especially for those who pursue a career in system administration.

Course Prerequisite: KU1DSCCAP101

Course Outcomes:

CO No.	Expected Outcome	Learning Domain
1	Demonstrate the ability to install and configure Linux and Windows operating systems	A
2	Effectively manage users, groups, and file permissions	U
3	Monitor and manage system processes, services, and scheduled tasks	A, An
4	Configure network settings and apply basic system security measures,	U

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	2						2
CO2	2						
CO3	2						
CO4	2	2		2			2

COURSE CONTENTS

MODULE	UNIT	DESCRIPTION	HOURS
I	MODULE TITLE: **Operating System Fundamentals and Installation**		
	1	Overview of OS types: Windows vs. Linux	14
	2	Linux : Installing Linux distributions (Ubuntu, CentOS, etc.), Dual boot configuration, Understanding file system hierarchy, Basic shell usage and terminal commands, Configuring system settings (display, power timezone, etc.)	
	3	Windows: Installing Windows OS (Home, Pro, Server editions), Disk partitioning and formatting, Device Manager and driver installation, Configuring Windows settings (Control Panel, System Properties), Introduction to PowerShell	
II	MODULE TITLE : **User and File System Management**		
	1	Linux : Creating and managing user accounts and groups, File and directory permissions (chmod, chown)	12
	2	Linux: Sudoers configuration and access control, Shell environment familiarising	
	3	Windows: Managing user accounts and groups (Local Users and Groups MMC)	
	4	Windows: NTFS permissions and inheritance, User Account Control (UAC), Group Policy basics	
III	MODULE TITLE: **Process, Task, and Service Management**		

	1	Linux: Managing processes (ps,top, kill, nice), Running background and foreground tasks	14
	2	Linux: Managing services with systemd and service, Cron jobs and scheduling tasks	
	3	Windows: Task Manager and Process Explorer, Managing services (services.msc)	
	4	Windows: Task Scheduler, Windows Event Viewer for diagnostics	
IV	MODULE TITLE: **Network Configuration and Security**		
	1	Linux: IP configuration and netplan/nmcli, Firewall configuration using ufw/iptables	12
	2	Linux: SSH setup and remote access, Basic network troubleshooting (ping, netstat, traceroute)	
	3	Windows: IP settings and adapter configuration, Windows Defender Firewall rules	
	4	Windows: Remote Desktop configuration, Network troubleshooting tools (ipconfig, netstat, ping, tracert)	
V	**LAB EXPERIMENTS**		
	1. Install Linux and Windows and implement dual booting. Choose manual partitioning in Linux, configure Disk partitioning (NTFS format) in Windows. 2. Run and observe the output of these commands: **whoami, uname -a, df -h, mkdir sample, touch testfile.txt, mv testfile.txt sample/, rm -r testfolder** 3. Run the following commands and observe the output: **Get-ComputerInfo, Get-Process, Get-Service,Get-Disk** 4. Create a test user in Linux and Windows operating systems and add the user to the admin group and check the privileges. 5. Demonstrate ps and cron commands with various options in Linux and task manager and task scheduler in Windows 6. Configure network in Linux and Windows environments and demonstrate remote access.		12

Essential Readings (Books, Journals, E-sources Websites/ weblinks)

1. Windows Administration Fundamentals by Ravikanth Chaganti
2. Open Source For You -journal

3. Yashavant Kanetkar, UNIX Shell Programming, BPB
4. https://learn.microsoft.com/en-us/windows/win32

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Theory		**35**
Practical		**15**
CCA		**25**
Continuous Evaluation (Theory)		**15**
a)	Test Papers	8
b)	Assignment	2
c)	Viva/Seminar	5
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test Papers	5
Total		**75**

DISCIPLINE SPECIFIC COURSES (DSC)

KU3DSCCAP201: DISCRETE MATHEMATICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCCAP201	4 (4T+0P)	4

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	Nil	-	30	70	100	2 Hrs.

Course Description: : This course introduces mathematical techniques that are foundations for analysing and understanding problems in computer science.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Provide a basic understanding of fundamental mathematical concepts such as sets, functions.	U, A
2	Acquire knowledge in Mathematical Logic	U
3	Acquire knowledge in Predicate Calculus	U, A
4	Awareness about the importance of Graph Theory in Computer Application	U

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1		2			2		3
CO 2		2			2		3
CO 3		2			2		3
CO 4		2			2		3

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**MODULE 1:**		
	1	Set Theory: Basic concepts- Set Operations, Properties of Set operations, Subset Venn diagram- Cartesian product.	15
	2	Mathematical Logic - Propositional Calculus -Statement, Connectives, negation, conjunction, disjunction, conditional, biconditional, statement-- Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF).	
	3	Propositions, logical operations (basic connectives), compound statements, construction of truth table, conditional statements, tautology, contradiction, contingency. Equivalence of formula- Well Formed Formula (WFF)- Tautologies, Normal Forms, Rules of inference.	
	4	Methods of proofs: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Predicate logic, quantifiers (basic introduction)	
	5	Mathematical Induction	

2	**MODULE 2:** Functions and Relations		
	1	Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions. Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.	15
	2	Relations - Relations and Their Properties, Functions as relations, Closure of Relations, Composition of relations, Equivalence Relations and Partitions.	
	3	Partial Ordering, Hasse Diagram. Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem	

3	**MODULE 3: Elementary Graph Theory**		
	1	Basic terminologies of graphs -- connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, bipartite graph- complete bipartite graph- Isomorphic graph	12
	2	Trees: Definition- spanning tree- minimal spanning tree (MST)- DFS- BFS- incidence matrix - Traveling salesman's problem.	

	MODULE 4:		
	1	Planar graph- Shortest Paths in Weighted Graphs- Euler's Paths and Circuits, Hamiltonian Paths and Circuits.	10
4	2	Storage representation and manipulation of graphs. Coloring, chromatic number.	

5	**Teacher Specific Module**	
	Directions	
	Teacher can implement proper methodologies and evaluation metrics related with the topics	

Essential Readings:

1. Discreate Mathematics and Its Applications with Combinatorics and Graph Theory, Kamala Krithivasan, McGraw Hill Education

2. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.

3. Deo Narsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979

Suggested Readings:

1. J. K. Sharma Discrete Mathematics, Macmillan Publishers India Limited

2. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.

3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015

Assessment Rubrics:

End Semester Evaluation		**70**
Theory		**70**
CCA		**30**
Continuous Evaluation (Theory)		**30**
a)	Test Paper-1	15
b)	Assignment	10
c)	Viva/seminar/Case study	5
Total		**100**

KU3DSCCAP202: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCCAP202	4 (3T+1P)	5

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	35	65	100	1.5 Hrs.

Course Description: This course introduces the concepts of object-oriented programming like abstraction, encapsulation, inheritance, polymorphism and applies them in solving problems. The object-oriented concepts are introduced through Java language. The course equips students to setup JDK environment to create, debug and run Java programs

Course Prerequisite: KU1DSCCAP101: Foundations of Computers and Programming KU1DSCCAP106 : Programming with C and C++

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the basic principles of the object-oriented programming	U, A
2	Develop small to medium sized applications using Java	A, C
3	Demonstrate an introductory understanding of graphical user interfaces, multithreaded programming,	U, A, C
4	Develop applications with database connectivity	U, A, C

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2					3
CO 2	3	3	2	2	2		
CO 3	2	2		2			3
CO 4	3	3	2		2		

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**MODULE 1:**		
	1	**Fundamentals of Object-Oriented Programming:** Basic Concepts of Object-Oriented Programming (OOP)--Objects and Classes. Encapsulation, Inheritance, Polymorphism Benefits and Applications of OOP.	15
	2	Java Evolution: Java Features, Difference between Java, C and C++, Java and Internet, Java Environment. Java Tokens and statements, Implementing Java program and JVM, Command Line Arguments	
	3	Overview of Java Language: Introduction to Simple Java Program, Use of Comments and Math function, Java Program Structure	
	4	Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference	

2	**MODULE 2:**		
	1	Inheritance – Inheritance types, super keyword, preventing inheritance: final classes and methods.	15
	2	Polymorphism – method overloading and method overriding, abstract classes and methods	
	3	Interfaces- Interfaces Vs Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface, inner class.	
	4	Packages- Defining, creating and accessing a package, importing packages.	

3	**MODULE 3:**		
	1	Exception handling-Benefits of exception handling, the classification of exceptions - exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception subclasses.	15
	2	Multithreading – Differences between multiple processes and multiple threads, thread life cycle, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication	
	3	GUI Programming with Swing - The AWT class hierarchy, Introduction to Swing, Swing Vs AWT, Hierarchy for Swing components, Overview of some Swing components – Jbutton, JLabel, JTextField, JTextArea, simple Swing applications	
	4	Layout management – Layout manager types – border, grid and flow Event Handling- Events, Event sources, Event classes, Event Listeners, Delegation event model, Examples: Handling Mouse and Key events, Adapter classes	

4	**MODULE 4:**		
	1	Collection Framework in Java – Introduction to java collections, Overview of java collection framework, Commonly used collection classes- Array List, Vector, Hash table, Stack,	12
	2	Connecting to Database – JDBC Type 1 to 4 drivers, connecting to a database, querying a database and processing the results, updating data with JDBC	

5	**LAB EXPERIMENTS**	
	1. Write a program to read two numbers from user and print their product. 2. Write a program to print the square of a number passed through command line arguments. 3. Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student. 4. Write a java program to find the largest number out of n natural numbers. 5. Write a java program to find the Fibonacci series & Factorial of a number using recursive and non-recursive functions. 6. Write a java program to multiply two given matrices. 7. Write a Java program for sorting a given list of names in ascending order.	15

8. Write a Java program that checks whether a given string is a palindrome or not. Ex:MADAM is a palindrome.
9. Write a java program to read n number of values in an array and display it in reverse order.
10. Write a Java program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
11. Create a JAVA class called Student with the following details as variables within it.
    a. USN, NAME, BRANCH, PHONE, PERCENTAGE
    b. Write a JAVA program to create n Student objects and print the USN, Name, Branch, Phone,and percentage of these objects with suitable headings.
12. Write a Java program that displays the number of characters, lines and words in a text.
13. Write a Java program to create a class called Shape with methods called getPerimeter() and getArea(). Create a subclass called Circle that overrides the getPerimeter() and getArea() methods to calculate the area and perimeter of a circle.
14. Write a Java program to create a class Employee with a method called calculateSalary(). Create two subclasses Manager and Programmer. In each subclass, override the calculateSalary() method to calculate and return the salary based on their specific roles.
15. Write a Java program using an interface called ‘Bank’ having function ‘rate_of_interest()’. Implement this interface to create two separate bank classes ‘SBI’ and ‘PNB’ to print different rates of interest. Include additional member variables, constructors also in classes ‘SBI’ and ‘PNB’.
16. Write a Java package program for the class book and then import the data from the package and display the result.
17. Write a Java program for finding the cube of a number using a package for various data types and then import it in another class and display the results.
18. Write a Java program for demonstrating the divide by zero exception handling.
19. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
20. Create an exception subclass UnderAge, which prints “Under Age” along with the age value when an object of

	UnderAge class is printed in the catch statement. Write a class exceptionDemo in which the Method test () throws UnderAge exception if the variable age passed to it 21. Write a Java program to create three threads and to display "Good Morning" for every one second, "hello" for every two seconds and "welcome" for every three seconds by using Thread class 22. Write a Java program that creates three threads. First thread displays" OOP", the second thread displays "Through" and the third thread displays "Java" by using Runnable interface. 23. Implement a Java program for handling mouse events when the mouse entered, exited, clicked, pressed, released, dragged and moved in the client area 24. Implement a Java program for handling key events when the keyboard is pressed, released, typed 25. Write a Java swing program that reads two numbers from two separate text fields and display the sum of two numbers in the third text field when button add is pressed. 26. Write a Java program to design student registration form using Swing controls. The form should have the following fields and a button "Save" ● Name, Register No, Email Id, Gender, Branch, Address 27. Write a Java program to shuffle elements in arraylist 28. Write a Java program to iterate through all elements in a HashMap 29. JDBC program to insert, Delete and Update records into Employee table 30. JDBC program to display database metadata. 31. JDBC program to display Resultset metadata. 32. JDBC program to connect to Student table. Implement the record scrolling functions – first(), last(), next(), previous(), beforeFirst(), afterLast(), absolute() and relative().	

Essential Readings:

1. Understanding object-oriented programming with Java, T.Budd, Pearson Education

2. Java: How to Program , P.J.Deitel and H.M.Deitel,PHI

3. Object Oriented Programming through Java, P.RadhaKrishna,Universities Press.

Suggested Readings:

1. Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson

2. Introduction to Programming and Object–Oriented Design Using Java -- Jaime Niño, Frederick A. Hosch

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**65**
Theory		**50**
Practical		**15**
CCA		**35**
Continuous Evaluation (Theory)		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Viva/Seminar	8
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test	5
Total		**100**

KU3DSCCAP203: DIGITAL SYSTEMS AND INTRODUCTION TO MICROPROCESSORS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCCAP203	4 (3T+ 1 P)	5

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	35	65	100	1.5 Hrs.

Course Description: This course introduces the technical knowledge of digital circuits. Digital systems are at the heart of almost all modern mechatronics and electronics technologies. Describe the architecture & organization of 8086 Microprocessors. Understand and classify the instruction set of the 8086 microprocessor and distinguish the use of different instructions and apply it in assembly language programming. Relate the addressing modes used in the instructions. Realize the Interfacing of memory & various I/O devices with 8086 microprocessors. Interface various peripheral IC's with Intel 8086 microprocessor for its various applications.

Course Prerequisite: KU1DSCCAP101: Foundations of Computers and Programming

Course Outcomes:

CO No.	Expected Outcome	Learning Domain
1	Explain the fundamental principles of Combinational digital circuits	U
2	Compare and describe the fundamental concepts of microprocessor systems.	U, A
3	Describe the architecture & organization of 8086 Microprocessor. Understand and classify the instruction set of 8086 microprocessor and distinguish the use of different instructions and apply it in assembly language programming	A, C
4	Realize the Interfacing of microprocessors with peripheral devices.	U

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3		3				3
CO2	3		3				2
CO3	3		3				2
CO4	3		3	3			2

COURSE CONTENTS

MODULE	UNIT	DESCRIPTION	HOURS
I	MODULE TITLE: **Digital Systems Basics**		
	1	Number Systems and Codes: Binary, Octal and hexadecimal conversions	15
	2	BINARY ARITHMETIC: Addition, Subtraction. Excess -3 code, Gray code, BCD,	
	3	Data Representation: Data types - Complements (1's and 2's)– FixedPoint representation and Floating-Point representation.	
	4	Logic gates-AND, OR, NOT, NAND, NOR, EXOR, EXNOR.	
II	MODULE TITLE: **Building Blocks of Digital Systems**		
	1	Boolean Laws and theorems, Sum of Products method, Product of Sum method	15
	2	Boolean Algebra – DeMorgan's Theorem	
	3	K map representation and simplification (up to four variables)	
	4	Pairs, Quads, Octets, Don't care conditions. Combinational circuits: Adders -Full adder	
III	**MODULE TITLE: Introduction to 8086**		
	1	Introduction to 8086 – Microprocessor architecture	15
	2	Functional Block Diagram	

	3	Register Organization of 8086	
	4	8086 PIN DIAGRAM. Addressing modes	
IV	MODULE TITLE: **Assembly Language Programming**		
	1	Introduction to Assembly language programming Instruction set - Data transfer instructions, Arithmetic and Logic instructions, Branch instructions, Loop instructions	15
	2	String Instructions, Assembler Directives and operators.	
	3	Flag Manipulation instructions, Shift and Rotate instructions, String instructions, Assembler Directives and operators.	
	4	STACK STRUCTURE OF 8086, Modes of data transfer- Programmed I/O, interrupt I/O, DMA.	
V	LIST OF LAB EXPERIMENTS		
		Implement using MASM. 1. Study of Assembler and Debugging commands. 2. A program to add a data byte located at offset 0500H in 2000H segment to another data byte available at 0600H in the same segment and store the result at 0700H in the same segment. 3. 8086 Assembly program that takes two numbers, adds them and displays the result on the screen (in decimal) 4. A program to swap two 8-bit numbers using a temporary variable. 5. A program for BCD addition of two 16 bit numbers. 6. An ALP to find the maximum number from the given array of N numbers. 7. A program to insert a byte into a string. 8. A program to check whether a string is palindrome or not. 9. A program to arrange a given array of N bytes in ascending order. 10. A program for Sum of Array Elements 11. A program to Count Even and Odd Numbers in an Array	15

Essential Readings (Books, Journals, E-sources Websites/ weblinks)

1. K. M. Bhurchandi and A. K. Ray, Advanced Microprocessor and Peripherals, 3rd Ed, TMH
2. Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 6th Ed, Penram International Publishing
3. Thomas L. Floyd, Digital Fundamentals, 11th Ed, Pearson
4. M. Morris Mano, Computer System Architecture, 3rd Ed, Pearson
5. Douglas V. Hall, Microprocessors and Interfacing: Programming and Hardware, 2 nd Ed, McGraw Hill

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**65**
Theory		**50**
Practical		**15**
CCA		**35**
Continuous Evaluation (Theory)		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Viva/Seminar	8
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test	5
Total		**100**

KU3DSCCAP204: MATHEMATICAL FOUNDATIONS OF COMPUTING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200 - 299	KU3DSCCAP204	4 (3T+ 1P)	5

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	35	65	100	1.5 Hrs.

Course Description: This course is intended to prepare students to use mathematical foundations in many areas of computer science like algorithms, computer networks, cryptography, data science, machine learning, artificial intelligence etc. To develop mathematical thinking in solving computer science related problems

Course Prerequisite: Basic Mathematics (Algebra, Arithmetic)

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Visualize vector operations and linear transformations	U, A
2	Apply matrices to real-world computer science problems	A
3	Ability to relate calculus concepts to practical CS applications	A
4	Builds foundational knowledge for cryptography & security.	U, A
5	Understand and apply core statistical and probability principles	U, A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	2	3			2		2
CO 2	2	3	2	2	2	2	2
CO 3	3	3	2	2	2	2	2
CO 4	3	3	2	2	2	2	2
CO 5	3	3	3	2	2	2	2

COURSE CONTENTS

Contents for Classroom Transaction:

NB: Concepts must be delivered by relating it to the scenarios in Computer Application

MODULE	UNIT	DESCRIPTION	HOURS
1	**MODULE TITLE: Linear Algebra & Calculus**		
	1	Vector: Definition of vectors, Real coordinate spaces, Magnitude of a vector	1
	2	Vector operations: addition, scalar multiplication, visualisation	2
	3	Linear Independence, bases, dimension	2
	4	Vector dot products, Interpretation of dot product	1
	5	Orthogonal vectors	1
	6	Matrix, Linear transformations, Eigen value, Eigen Vector (Geometric interpretation of concept)	2
	7	**Differentiation:** Concept, Rate of change, slope of a function, Visualisation	2
	8	**Partial Derivatives**: Concept, Derivatives w.r.t. one variable in multivariable functions, Gradient	2
	9	Maxima and Minima (Optimization), Using first and second derivative	1
	10	**Integration:** concept, Definite Integral, indefinite Integral, Area under curve	1
	11	Examples to illustrate applications in Computer Science	2
2	**MODULE TITLE: Algebraic Structure & Number Theory**		
	1	Group: Closure, Associativity, Identity, Inverse Abelian Group, Cyclic Group	3
	2	Modular Arithmetic, Addition and Multiplication modulo, Modular Inverse, Euclidean Algorithm, Extended Euclidean Algorithm Primality Testing	3
	3	Examples to illustrate applications in Cryptography	2
3	**MODULE TITLE: Probability**		
	1	Experiment and sample space, events and operations with events (Union, Intersection, Complement of Events)	1
	2	Exclusive and exhaustive events, equally likely events with examples.	1
	3	Probability of an event, basic probability rules, conditional probability.	1

	4	Bayes' Theorem	2
	5	Random Variables: Discrete and continuous random variable Probability distribution of a random variable, probability mass function, probability density function	3
	6	Expectation and variance of a random variable	1
	7	Standard Probability Distributions: Binomial probability distribution, Poisson probability distribution, Normal probability distribution, Measures of shapes	2
(Focus on problem sets involving real-world applications of probability. Real-world scenario of Binomial, Poisson and Normal Distribution.)			
4	**MODULE TITLE: Statistics**		
	1	Basic concepts of Statistics, qualitative and quantitative data, classification of data: Nominal, ordinal, interval, ratio Construction of frequency distribution, diagrammatic representation of data : Histograms, Boxplots, Bar charts, pie chart Measures of Central Tendency: mean, median and mode—their properties Measures of Dispersion: Range, mean deviation, quartile deviation, variance and standard deviation. **Highlight the use of Measures Mean, Median and Mode in Real-World Scenarios and the significance of measures of Dispersion in Data Analysis. Identify the inferences from these measures)**	10
	2	**STATISTICAL INFERENCE AND REGRESSION ANALYSIS** Correlation: Definition, scatter diagram, Pearson's Coefficient of Correlation and Rank Correlation Regression: Linear regression-fitting by least square method and interpretation.	4
5		**Lab**	
		Explore fundamental vector operations—addition, scalar multiplication, dot product, and transformation—using GeoGebra. $u^{\rightarrow}=(3,2)$ $v^{\rightarrow}=(1,4)$	15

		Using GeoGebra: 1. Visualize both vectors from the origin. 2. Perform and display vector addition 3. Apply scalar multiplication 4. Compute the dot product of $\vec{u}$ and $\vec{v}$ and interpret the result geometrically. 5. Apply a matrix transformation to rotate vector $\vec{u}$ by 90 degrees using matrix multiplication Interpret the visual and numerical results of each operation	
		Visualize the derivative (slope of a tangent) of a function using GeoGebra. https://www.geogebra.org/classic Visualize and compute partial derivatives of a multivariable function using GeoGebra's 3D Graphing environment and understand the geometric meaning of partial derivatives. https://www.geogebra.org/3d	
		Visualizing the Area Under a Curve in Geogebra https://www.geogebra.org/graphing • Plot a function (f(x)), e.g., ($f(x) = x^2$) over interval [0, 5]. • Shade the area under the curve. • Show how the definite integral corresponds to this shaded area. • Use tools like GeoGebra for visualization.	
		Visualize probability distribution in Geogebra https://www.geogebra.org/classic	

Set up Lab for Statistics

Jamovi is a free, open-source, user-friendly statistical software

Download from the official website:
https://www.jamovi.org

Analyze the study habits of students by examining their daily study hours and corresponding exam scores. Understand the central tendency, variability, and distribution of these variables.

Also interpret Output (Average study hours and exam scores, Middle value when data is sorted, How spread out the data is, Whether data is symmetric or skewed, Visualization Insights: **Histogram**: Visualize distribution shape (normal, skewed).

Boxplot: Identify median, spread, and outliers.

Hint : Prepare Your Data with two columns Study_Hours, Exam_Score

Sample Data

Study_Hours	Exam_Score
2	55
4	70
3	65
……	…..

By varying the values of study hours and corresponding exam scores for a group of students, visualize different types of data distributions (such as symmetric, right-skewed, and left-skewed) using histograms in Jamovi, and analyze how changes in data affect the shape, central tendency, and spread of the distribution.

Analyze the number of daily emails received by employees in a software company to understand communication load. Use descriptive statistics and histograms in Jamovi to determine the central tendency, variation, and distribution shape of email traffic, and interpret the implications for system design or user productivity. Comment on the shape of the distribution and central tendency. Determine the probability that more than 20 emails are received on a given day.

Either either data or import .csv

Sample Data

Day	Emails_Received
1	15
2	12
3	18
……	…..

Exploratory Data Analysis on Web User Activity Data

Explore the distribution and patterns in user session durations based on age group and device type to gain insights for web optimization. Compare average session times between age groups and also analyze device influence.

Sample data. Either manually type in Jamovi or Load .csv file

User_ID	Session_Duration	Age	Device_Type
1	5	18-25	Mobile
2	10	26-35	Desktop
3	12	18-25	Mobile

4	8	36-45	Tablet
5	15	26-35	Desktop
6	20	18-25	Mobile
7	18	26-35	Desktop
8	25	36-45	Tablet
9	6	18-25	Mobile
10	35	26-35	Desktop

Correlation Analysis of Coding Practice vs. Exam Scores

A computer science instructor wants to understand the relationship between the number of hours students practice coding and their final exam scores in a programming course. Additionally, the instructor wants to analyze if the rank order of students by coding hours correlates with their rank order by exam scores. Plot Scatter Diagram. Interpret Scatter Diagram, Pearson's r, Spearman's rho

Sample dataset

Student_ID	Coding_Hours	Exam_Score
1	5	55
2	12	78
3	8	65
4	15	85
5	7	62
6	10	70
7	3	50
8	20	90
9	6	58
10	11	75

Predicting Student's Programming Exam Score Based on Coding Practice Hours Using Linear Regression

For the above problem to find a linear relationship between practice hours (independent variable) and exam score (dependent variable).

Predict the **daily temperature** using weather historical data. Key influencing factors considered are:

- **Humidity**
- **Wind Speed**
- **Atmospheric Pressure**

Build a **multivariate linear regression model** using Jamovi to estimate the temperature and interpret the results.

Sample Data

Day	Humidity	Wind_Speed	Pressure	Temperature
1	60	15	1012	32
2	70	12	1010	30
3	55	20	1015	34
4	80	10	1008	28
5	65	18	1011	31
6	50	22	1016	35

Sample Questions

Module 1

Let the vector $\vec{v}$=[2

1]

A transformation is applied using the matrix

$$A = \begin{matrix} 0 & -1 \\ 1 & 0 \end{matrix}$$

a) Find the result of the transformation A. $\vec{v}$

b) Describe what happens to the direction and length of the vector after transformation.

2) How does the **sign** (positive, zero, or negative) of the dot product relate to the **angle between vectors**? Why is dot product important when comparing two directions, such as the direction of movement of an object and the direction of a force applied to it?

3) How does scalar multiplication affect the **magnitude** and **direction** of a vector?

4) A car's position over time is given by a graph. The slope at any point on the graph represents its speed. What does a **positive**, **zero**, or **negative** slope indicate about the car's motion?

5) $f(x,y)=x^2+y^2$ represents the "elevation" of a surface. What does $\partial f/\partial x$ represent in this case?

6) The graph of a function shows the rate at which water flows into a tank. What does the **area under the curve** represent over a time interval?

Module 2

1) In modular arithmetic, $17 \equiv 5 \bmod 12$. What does this mean in simple terms?

2) Use the Euclidean Algorithm to find gcd(48,18). What does the result tell you about whether a modular inverse exists for these numbers?

Module 3

1) Explain what it means for two events to be mutually exclusive with an example.

2) Are the events "rolling a 2" and "rolling an even number" mutually exclusive? Why or why not?

3) Why is **variance** important in understanding data spread?

4) Describe one real-life scenario where the **binomial distribution** is useful.

Module 4

1. You are given the following dataset representing the scores of 12 students in a programming test:

56, 72, 68, 45, 89, 77, 54, 62, 70, 80, 66, 75, 56, 72, 68, 45, 89, 77, 54, 62, 70, 80, 66, 75, 56, 72, 68, 45, 89, 77, 54, 62, 70, 80, 66, 75

Calculate the mean, median, and mode of the data.
Find the range, variance, and standard deviation of the scores.

Interpret the results:

a) What does the mean score tell you about the overall performance?

b) How does the median compare with the mean, and what might that indicate about the distribution?

c) What does the standard deviation tell you about the consistency of student scores?

d) Are there any signs of skewness or outliers from your calculations or frequency distribution?

2) You have collected data on the number of hours studied and the marks obtained by 8 students in an exam:

Student	Hours-Studied (X)	Marks-Obtained (Y)
1	2	50
2	3	55
3	5	65
4	4	60
5	6	70
6	8	85
7	7	75

8	9	90

Plot a scatter diagram of the data (Hours Studied vs Marks Obtained).

Based on the scatter plot, describe the nature of the relationship between hours studied and marks obtained.

Without calculating the exact value, would you expect the Pearson correlation coefficient to be close to +1, 0, or -1? Explain why.

2) For the given dataset, Regression Line is Y=105+15X

Day (X)	No of UsersVisiting a Website (Y)
1	120
2	135
3	150
4	165
5	180
6	195
7	210

a) What is the meaning of the slope b=15 in this context?

b) Interpret the intercept a=105 what does it represent in this scenario?

c) Using the regression line, predict the number of users visiting the website on day 8.

d) If the website team wants to reach 300 users, on which day does the regression model predict this will happen?

e) How would you assess whether this linear model is a good fit for the data?

Essential Readings:

1. Introduction to Linear Algebra, Gilbert Strang, Wellesley-Cambridge Press, 6th Edition
2. An Introduction to Mathematical Cryptography by Jeffrey Hoffstein, Jill Pipher, and Joseph H. Silverman
3. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna Book Publishing Company, 2010
4. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.

Suggested Readings:

1. Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press., 2020
2. Pal Nabendu and Sarkar Sahadeb, Statistics: Concepts and Applications, Second Edition, PHI, 2013

Web Resources

1. **https://nptel.ac.in/courses/111106112**
2. **https://nptel.ac.in/courses/111105041**
3. https://www.youtube.com/playlist?list=PLblh5JKOoLUK0FLuzwntyYI10UQFUhsY9
4. **https://www.youtube.com/playlist?list=PLblh5JKOoLUK0FLuzwntyYI10UQFUhsY9**
5. **https://www.khanacademy.org/math/linear-algebra**
6. **https://www.3blue1brown.com**

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**65**
Theory		**50**
Practical		**15**
CCA		**35**
Continuous Evaluation (Theory)		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Viva/Seminar	8
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test	5
Total		**100**

KU3DSCCAP205: LINUX SYSTEM ADMINISTRATION

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCCAP205	4 (3T+ 1 P)	5

Learning Approach (Hours/ Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/Internship	Tutorial	CE	ESE	Total	
3	2	-	35	65	100	1.5 Hrs

Course Description: The primary benefit of Linux is its open-source distribution, which allows programmers to create their own unique distribution of Linux OS. C Programming language is used to write the majority of Linux code. The majority of web servers, smartphones, laptops, supercomputers, and cloud servers are powered by Linux due to its excellent security, reliability, and open-source nature. A Linux system administrator has a very critical role in managing and maintaining Linux-based systems

Course Prerequisite: KU1DSCCAP101 : Foundations of Computers and Programming

Course Outcomes:

CO No.	Expected Outcome	Learning Domain
1	To learn basic Linux commands and understand the file system structure	A
2	To understand the Boot loaders and the configuration files	U, An
3	To learn different system services, maintenance and configuring these	U
4	Understand and develop Shell Scripting	A, C

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	2	2					2
CO2	2	2					
CO3	2	2					2

CO4	3	2	2		2	3	2

COURSE CONTENTS

MODULE	UNIT	DESCRIPTION	HOURS
I	MODULE TITLE: **Introduction to Linux OS and commands**		
	1	Intro to Open Source free Software, History & Features of Linux	16
	2	Basic Linux Commands: Currently logged-in user: whoami, w, logname, who, id, uname. Managing Files & Directories: ls, touch, cat, rm, mv,cp, mkdir,cd, pwd. Other commands: man, grep, more, sort, wc, du, df, cal, date, bc	
	3	Files and Directories, Types of files, directory tree, relative and absolute pathnames, referring home directory	
	4	File permissions: user,group,ls (long listing), changing file permissions (chmod and umask commands)	
	5	Types of users in Linux, creating a user account (adduser or useradd)	
II	MODULE TITLE: **Shell Scripting**		
	1	Introduction to Shell and Types of shell	14
	2	Basic shell configuration files for Bourne and bash shell: /etc/profile, /etc/bashrc, ~/.bash_profile, ~/.bashrc, ~/.bash_history.	
	3	Bourne shell scripts, script execution, variables and parameters, shell environment variables	
	4	Control structures - if then else, if then elif, for loop, while loop, until loop , case	
III	MODULE TITLE: **Linux Operating System Management**		

	1	Boot process: LILO - boot process, /edc/lilo.conf file, GRUB - /etc/grub.conf file	15
	2	Brief Introduction to Run levels.	
	3	Mounting: mounting file systems, structure of /etc/fstab, mount, umount commands	
	4	Periodic command execution: at and cron, crontab file	
	5	Starting and stopping different services – service command and systemctl command	
IV	MODULE TITLE: **System Maintenance**		
	1	Backup and Restore: types of backup - full, differential, incremental	15
	2	Backup and Restore commands: cpio, tar commands.	
	3	Linux OS Installation: Partitioning - SWAP, root, boot, EFI partitions and mount points	
	4	Installation and uninstallation of software packages in a Linux system (any distribution of Linux)	

V	**LAB EXPERIMENTS**	
	LINUX ADMINISTRATION 1. Linux installation, upgradation and rescue. 2. Boot loader configuration using GRUB 3. The service command 4. Managing process- viewing status, killing, restarting etc using ps. 5. Adding and deleting user accounts, changing passwords 6. Scheduling jobs using cron 7. Mounting and unmounting external file systems 8. Setting the value of umask, changing the permissions, owner and groups 9. Installation and removal of packages 10. Archiving and Backup using tar. Restoring backup 11. Compressing and decompressing files using any one tool **SHELL Programming** 1. Get a name and number from the user, create a file with that name and number. Also display the contents of the file. o If the name is XXX and number is 2 the filename must be XXX_2. use cat command to create a file. Create the file with 10 different lines, then display the first 5 lines of the file using head command.	15

	2. Write a program to greet a user by 'Good Morning', Good Afternoon' or 'Good Evening' based on time o get the system time using the 'date' command. Read the name from the user, if the name is 'XXX' then greet with 'Hello XXX, Good Morning! ' 3. Write a shell program to check whether a number is positive,negative or zero 4. A program to create 10 users. Use loop structure, get usernames from the user and assign same password to all the users 5. A demo program to test different file operators. Read filename from the user. Check if the file exists, if it exists then display the contents, otherwise create the file. Check whether the size of the file is zero, check whether the file is having read, write and execute permission	

Essential Readings (Books, Journals, E-sources Websites/ weblinks)

1. Yashavant Kanetkar, UNIX Shell Programming, BPB
2. Eleen Frisch, Essential System Administration, 3rd Edition, O'Reilly Media

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**65**
Theory		**50**
Practical		**15**
CCA		**35**
Continuous Evaluation (Theory)		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Viva/Seminar	8
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test	5
Total		**100**

KU3DSCCAP206: MOBILE APPLICATION DEVELOPMENT

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCCAP206	4 (3T+ 1 P)	5

Learning Approach (Hours/ Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/Internship	Tutorial	CE	ESE	Total	1.5 Hrs
3	2	-	35	65	100	

Course Description: Mobile App Development is a course designed to provide students with a comprehensive understanding of the tools, and techniques involved in creating mobile applications for android platforms. The course aims to equip students with both the theoretical knowledge and practical skills necessary to embark on a career in app development. The curriculum is structured to cover key aspects of the app development lifecycle, user interface (UI) design, simple app designs and implementation

Course Prerequisite: KU1DSCCAP101: Foundations of Computers and Programming

Course Outcomes:

CO No.	Expected Outcome	Learning Domain
1	Understand Mobile App Development Concepts	U
2	Develop Programming Proficiency and Explore Mobile App Architecture	C
3	Design User-Friendly Interfaces configuring these Apps	C
4	Manage Data in Mobile Apps	A

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	2	2	3	2	2		2
CO2	3	3	3	3	3	2	2
CO3	3	3	3	3	3	2	2

CO4	3	3	3	3	3	2	2

COURSE CONTENTS

MODULE	UNIT	DESCRIPTION	HOURS
I	MODULE TITLE: **Introduction to Mobile App development and Getting an Overview of Android**		
	1	Overview of mobile app development	15
	2	Understanding different mobile platforms (iOS, Android)	
	3	Introducing Android Studio: Android APIs, Android Architecture Application Framework, Application components	
	4	The Manifest File, ANDROID Environment Setup: Steps for setting the environment, installing the SDK.	
II	MODULE TITLE: **Using Activities, Fragments, and Intents, Layouts in Android**		
	1	Working with Activities: Creating and Starting an activity, Lifecycle of an activity, Applying themes and Styles on Activity, Displaying a dialog, hiding the title of the activity	16
	2	Using Intents: Exploring Intent objects, resolution and filters. Linking the activities using Intent. Passing the data using an intent object.	
	3	Fragments: Fragments Implementation. Finding Fragments, Adding, removing and replacing fragments. Finding Activity using fragment	
	4	Layouts: Linear Layout, Relative Layout, Scrollview Layout, Table Layout, Frame Layout and TabLayout	
III	MODULE TITLE: **Working with the User Interface Using Views and View Groups**		
	1	TextView, EditText View	14
	2	Button, Radio Button, CheckBox, ImageButton, ToggleButton, Rating Bar	

	3	ListView, Gallery View, AutoText Complete	
	4	User interaction with Views and Activities	
IV	MODULE TITLE: **Handling Pictures and Menus with Views and data storage**		
	1	Creating Menus: options Menu, Context Menu, Sub menu	15
	2	Displaying Images in the Gallery and Grid View	
	3	Using the Image switcher view	
	4	Notifying the user: Toast, Status Bar, Dialog Notification	
V	**LAB EXPERIMENTS**		
	1. Android: Environment Setup, Implementation of Android feature in real time application 2. Demonstration of Android – UI Layouts, UI Controls & Event Handling 3. Create two activities. Launch the second activity from the first using a button click. Apply a custom theme to an activity and hide its title bar. 4. Create two activities, First activity collects user data with views, Second activity receives and displays data 5. Show an alert dialog with Yes/No buttons when a button is clicked. Send user input from Activity A to Activity B and display it. 6. Create a fragment and add it to an activity. Replace it with another fragment using a button. 7. Create a form with TextView labels, EditText input fields (name, email), and a Submit Button. On clicking the button, show a Toast with entered data. Add the features where the user selects gender (RadioButton), hobbies (CheckBox), enable/disable notifications (ToggleButton), and gives a rating (RatingBar). 8. Use buttons to show a simple Toast, an AlertDialog with Yes/No, a system Notification in the status bar 9. Load and display a set of drawable images in a Gallery and a GridView. 10. Execution of Android – adding pictures and menus and using notifications		15

Essential Readings (Books, Journals, E-sources Websites/ weblinks)

1. Android Application Development (With Kitkat Support), Black Book Kindle Edition by Pradeep Kothari
2. Jerome DiMarzio, "Beginning Android Programming with Android Studio", 4thEdition.
3. "Android Studio 4.0 Development Essentials – Kotlin Edition" by Neil Smyth:
4. https://developer.android.com/guide
5. https://developer.android.com/codelabs/basic-android-kotlin-compose-first-app#0
6. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips and Chris Stewart

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**65**
Theory		**50**
Practical		**15**
CCA		**35**
Continuous Evaluation (Theory)		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Viva/Seminar	8
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test	5
Total		**100**

KU4DSCCAP207: SOFTWARE ENGINEERING

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
4	DSC	200 – 299	KU4DSCCAP207		4(4T+0P)	4
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	--	--	30	70	100	2

Course Description: This course targets to expose the students to the challenges of large-scale software development and would familiarise them as to how to overcome those. Starting with basic life cycle model concepts, it would discuss requirements, specification, design specifically object-oriented design, testing issues and Software Quality standards.

Course Prerequisite: KU1DSCCAP101: Foundations of Computers and Programming
KU2DSCCAP106 **:** Programming with C and C++

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the basic processes in the software development lifecycle.	U
2	Familiarise yourself with different SDLC models and their significance.	U

3	Gather, analyse and specify software requirements effectively	A
4	Design software systems using modular design principles and object-oriented approaches.	A
5	Develop and execute effective testing strategies to ensure software quality.	A, C
6	Familiarise SQA and important Quality Standards	U

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1				**2**			
CO 2	**2**	**2**	**2**				
CO 3	**2**	**2**		**2**		**2**	
CO4							
CO5					**2**		
CO 6		**2**				**2**	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**MODULE TITLE -Introduction to Software Engineering**		
	1	a)Software Engineering Definition ,Evolution, b)Software Development Projects c)Exploratory style of software development	**15**

		d) Emergence of software Engineering e) Computer systems engineering f) program versus software, software process, software characteristics.	
	2	a)Software Life Cycle Models- Basic Concepts	
		b)Waterfall model and its extensions	
	3	a)Rapid Application Development Model b)Spiral model	
	4	a)Agile development Models	
		b)Basic Idea of Extreme programming Model	
		c)Basic Idea of Scrum Model	
		d)Comparison of Different life cycle models e) Selecting an appropriate life cycle model for a project CASE STUDY - PART1	
2	**MODULE TITLE- Requirements Analysis and Specification and Basics of Software Design**		
	1	a) Overview -Requirements Engineering b) Requirements gathering /elicitation c) Requirements Analysis	15
	2	a) Software Requirements Specification (upto 4.2.10)	
	3	a) Software Design- Overview b) How to characterize a good software design c) Cohesion and Coupling d) Layered arrangement of modules e) Approaches to software design	
	4	a) Function Oriented Software Design -Introduction, Overview of SA/SD Methodology b) Structured analysis c) Structured Design d) Detailed Design, Design Review. CASE STUDY- Part 2	
	MODULE TITLE- UML and Object Oriented Software Development		

	1	a) Object Modelling using UML-Basic object Oriented Concepts a) UML- Origin of UML, Evolution, b) UML Diagrams	15
	2	a) Use Case Model (Upto 7.4.3) b) Class Diagrams, Object diagrams, c) Interaction diagrams, Activity Diagrams, State Chart Diagrams, d) Package, Component and Deployment Diagrams, UML 2.0	
	3	a) Object Oriented software Development- OOA Vs.OOD b) Patterns c) Some common design patterns- Model View Controller Pattern, Publish-Subscribe Pattern, Intermediary pattern	
	4	a) OOAD Methodology- Unified process Model b) Applications of Analysis and Design Process c) OOD Goodness Criteria CASE STUDY -Part 3	
	MODULE TITLE- Coding, Testing and SQA		
	1	a) Coding b) Coding Standards and Guidelines c) Code Review d) Software Documentation	

4

15

	2	a) Testing - Basic Concepts and Terminologies, Verification Vs. Validation, Testing Activities, Why design Test Cases, b) Testing in the Large Vs. Small, Unit Testing, BlackBox Testing, White Box testing, c) Debugging, Program analysis Tools, Integration Testing, d) Testing Object oriented Programs, System Testing -- Some General Issues Associated with testing - Testing Documentation, Regression Testing	
	3	a) Software Reliability b) Statistical Testing	
	4	a) Software Quality b) Software Quality Management System c) ISO 9000(Upto 11.5.4), SEI CMM, CMMI d) Few Other Important Quality Standards,Six Sigma e) CASE STUDY- Part 4 & Presentation	
5	**Teacher Specific Module**		
	Familiarise Tools for Software Engineering		5
	Emerging Trends in Software Engineering		

Guidelines to conduct Case Study

1. Choose any one of the case studies (Examples are given below)
    1. Student Marks Analysis System
    2. Library Management System
    3. E-Commerce Website
    3. Inventory Control System
    4. Food Delivery Management system
    5. Logistics Management System

2. Do the following exercises for that Case Study. Use appropriate software tools for each one.
    1. Write the complete problem statement
    2. Write the software requirements specification document
    3. Draw the entity relationship diagram
    4. Draw the data flow diagrams
    5. Draw use case diagrams
    6. Draw activity diagrams for all use cases
    7. Draw sequence diagrams for all use cases
    8. Draw collaboration diagram
    9. Assign objects in sequence diagrams to classes and make class diagram.
    10. Write sample code.
    11. Write test cases and test results after unit testing.

Essential Readings:

1. Rajib Mall, Fundamentals of Software Engineering, Fourth edition, PHI Learning Private Limited (For all modules except given in Essential readings:No. 2)
2. K. K. Aggarwal, Yogesh Singh, Software Engineering, 3rd Ed, New Age, International Publication (For Modules 1.1.b, 2.1.a, 2.1.b and 2.2.d only)

Suggested Readings:

1. Ian Sommerville, Software Engineering, 10th Ed, Pearson
2. Roger S Pressman, Software Engineering: A Practitioner's Approach, 6th Ed, TMH

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Papers	15
b)	Assignment	5
c)	Case study	10
Total		**100**

KU4DSCCAP208: DATABASE MANAGEMENT SYSTEM

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	DSC	200 - 299	KU4DSCCAP208	4 (3T+ 1P)	5

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	35	65	100	1.5 Hrs

Course Description: Databases are the backbone of almost all the digital services and e-governance solutions. Modern businesses and financial systems heavily depend on databases systems and transaction processing for their successful operation. This course introduces the students to the various theoretical and practical principles involved in the design and use of database systems with the help of database management systems (DBMS) and SQL.

Course Prerequisite: KU1DSCCAP101: Foundations of Computers and Programming , KU3DSCCAP201: Discrete Structures

Course Outcomes:

CO No.	Expected Outcome	Learning Domains

1	Understand fundamental database concepts and architecture	U
2	Ability to construct an ER model and derive the relational schemas from the model.	U, C
3	Apply normalization techniques to design efficient database schemas	A, C
4	Construct efficient SQL queries to retrieve and manipulate data as required	An, C
5	To apply procedural programming concepts by developing PL/SQL blocks	A, C
6	Introduce advanced DBMS topics and trends	U

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1					2		
CO 2		2		2		2	
CO 3	2					2	2
CO 4		2			2	2	
CO 5		2		2	2		
CO 6				2			

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**MODULE TITLE : Introduction & ER Model**		12
	1	Overview of DBMS, Characteristics of Database system, Database Users	
	2	Data Models and Schema	
	3	Three-Schema-architecture, Data Independence	
	4	Database Languages	
	5	Database architecture	
	6	ER model: basic concepts, entity set & attributes, notations	
		Relationships and constraints – cardinality, participation, notations	
		Weak entities	
	7	Extended ER diagram	
2	**MODULE TITLE: Relational Database Design**		
	1	Structure of relational Databases, Integrity Constraints	

	2	ER to Schema synthesis	14
	3	Need for normalisation, database anomaly	
	4	Functional Dependencies, Types, Closure, Finding keys	
	5	Desirable Properties of Decomposition, Dependency Preserving, Lossless Decomposition (Basic idea only)	
	6	First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Fourth Normal Form	
3	**MODULE TITLE : Query Language**		
	1	Relational algebra: select, project, SET operations	15
	2	Join - Equi-join, Natural join	
	3	Introduction to SQL, data types	
	4	Constraints: Primary key, Foreign Key, Unique, Not Null, Check	
	5	DDL: create, alter, drop, use of auto increment	
	6	DML: Insert, delete, update, select	
	7	Aggregate Functions	
	8	GROUP BY, HAVING Clauses	
	9	Data Sorting and Filtering, ORDER BY, GROUP BY, LIKE, IN, BETWEEN	
	10	SET operations	
	11	Joins: INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN	
	12	Subqueries: Single-row and Multi-row	
4	**MODULE TITLE: Advanced SQL, PL/SQL Programming and NoSQL Databases**		

	1	Views: Creating and Using Views	13
	2	Introduction to Transactions: COMMIT, ROLLBACK	
	3	Creating user, Access control, DCL, grant, revoke	
	4	Introduction to SQL security: SQL Injection (Basic Idea only)	
	5	Introduction to PL/SQL, Declaration	
	6	Procedures and Functions, IN, OUT, IN OUT parameters	
	7	Cursors	
	8	Triggers	
	9	Exception Handling	
	10	Structured, Unstructured, semi structured data	
	11	NoSQL Databases: Introduction, properties of NoSQL Databases, types of NoSQL database	
	Teacher Specific Module		
5	**Lab Experiments**		**15**
	Set up Lab: Install MySQL		
	Case Study: A group activity, a group of maximum 3 can be made. Identify a DBMS case study. Write the problem statement. Draw the E-R diagram. Convert ER Model to Relational Model. Apply normalization to remove the redundancies and anomalies in the above relational tables, normalize up to Third Normal Form.		
	Frame and execute suitable SQL queries **1.** Create table Department with fields Dept_no (primary key), Dept_Name, (unique), location (Check) **2.** Create table Employee with fields Emp_no (primary key), Emp_Name, Salary default 5000, Dept_ID refer Dept_No in Department table and on delete set null, Dob not null		

	3. Create table Dependent with fields Dep_id, Dept_Name and Emp_id with references Emp_no in Employee and on delete cascade **Create the above tables. Define the PRIMARY KEY, FOREIGN KEY, NOT NULL, DEFAULT, CHECK and UNIQUE constraints wherever appropriate.** **4.** Display the description of Employee table **5.** Insert records by satisfying constraints **6.** Select all records from the Employee table **7.** Delete the records of all employees in Dept_No 6. Delete records by satisfying constraints **8.** Add attributes HireDate, Address, Designation in Employee table **9.** Delete the attribute Address **10.** Update designation details of Employees **11.** List employees whose salary greater than 30000 **12.** Display annual salary of all employees **13.** Rename HireDate to Hire_Date **14.** Update the Employee table by giving an increment of 500 to manager **15.** Write a query to change the salary of an employee to 80000 whose ID is 105, if the existing salary is less than 50000.	
	Implementation of various aggregate functions in SQL 1. Find the number of employees 2. Find the average salary of all employees. 3. Find the highest salary of all employees. 4. Find the minimum salary. 5. Display total salary of all employees 6. Count the distinct employee designations	
	Implementation of Group By, Having, ORDER BY, LIKE, IN, BETWEEN operators 1. Find the number of employees in each department 2. Display the total number of dependents for each employee	

	3. Display average employee salary by department 4. Find the dept_no where the average salary of all employees is more than 1500. 5. Display the total number of dependents for each employee 6. Display the total number of dependents for each employee for employees who have at least two dependents. 7. Display employee names in descending order. 8. Find employees whose name start with N 9. Find employees whose name contains “thra” 10. Display employee name, salary where salary is between 10000 and 20000	
	Implementation of Join 1. List employees with their department names 2. Show employees with their dependents 3. Count of employees in each department 11. Display the names of employees in CS department	
	Implementation of SUBQUERIES 1. Find employees who earn more than the average salary 2. List employees who have dependents 3. Find employees who work in the same department as employee with emp_id = 101 4. Find employees whose salary is greater than salary of employee named 'Mizhi 5. Display departments with no employees'	
	6. Implement SET operations	
	Creation of Views 1. Create a view showing only employees with salary greater than 5000 2. Create a view with average salary per department 3. Create a view with Employee name and department name	

	Creating user, Access control, DCL, grant, revoke	
	PL/SQL Programming 1. Create a function to count employees in a given department 2. Create a MySQL function named check_salary_status that takes an employee ID as input and returns a string: High: if the employee's salary is greater than 5000, Medium: if the salary is between 3000 and 5000 (inclusive), Low: if the salary is less than 3000 Create a MySQL AFTER UPDATE trigger on the employee table to log changes into an employee_audit table. Whenever an employee's record is updated, log the ID, name, salary, and the time of update into employee_audit	
	3. **Install and Configure MongoDB to execute NoSQL Commands.**	
	Frame and execute suitable SQL queries for your case study selected at the beginning.	

Essential Readings:

1. Database System Concepts by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, 7th Edition, McGraw-Hill Education, 2010.
2. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition

Suggested Readings:

1. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, Third Edition, McGraw-Hill
2. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

Assessment rubrics

Evaluation Type		Marks
End Semester Evaluation		**65**
Theory		**50**
Practical		**15**
CCA		**35**
Continuous Evaluation (Theory)		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Case Study	8
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test	5
Total		**100**

KU4DSCCAP209: DATA STRUCTURES AND ALGORITHMS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	DSC	200 - 299	KU4DSCCAP209	4 (3T+ 1P)	5

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	35	65	100	1.5 Hrs

Course Description: The objective of the course is to introduce the fundamentals of Data Structures, Abstract concepts and how these concepts are useful in problem solving. This course provides a basic understanding of algorithms and techniques to compare different algorithms that solve the same problem. The course also introduces fundamental data structures used in computer science related problems. The algorithms introduced in the course may be implemented in the lab using C.

Course Prerequisite: KU1DSCCAP101, KU2DSCCAP106, KU3DSCCAP111

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the fundamental concepts of Data Structures and their applications.	U

2	To introduce the basic concepts of algorithms	U
3	Implement Data Structures using C/ C++ programming language	A, C
4	Use the appropriate data structure in context of solution of given problem	An, C
5	Implementing various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs	A, C
6	Understanding various searching & sorting techniques	U, A, An

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1					2		
CO 2					2		
CO 3	2	2				2	
CO 4				2	2	2	
CO 5	2		2				2
CO 6				2	2		

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	**UNIT**	**DESCRIPTION**	**HOURS**

1	**INTRODUCTION**		15
	1	Data types – primitive and non-primitive, Definition of data structure, data structure operations. Types of Data Structures- Linear & Non-Linear Data Structures.	
	2	Algorithms : Complexity, Time Space tradeoff -- Average, best and worst case of algorithms. Complexity of Algorithms, Asymptotic Notations for Complexity of Algorithms	
	3	**Arrays:** Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging	
	4	Two-Dimensional Arrays, Representation of Two-Dimensional Arrays in Memory, Matrices and Sparse Matrices, Multi-Dimensional Arrays.	
	5	Searching: Linear Search and Binary Search, Comparison of Methods.	
2	**SORTING, LINKED LISTS AND HASHING**		
	1	Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort	15
	2	**Linked Lists:** Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. Applications of Linked Lists: Addition of Polynomials.	
	3	**Hashing and Collision:** Hashing, Hash Tables, Types of Hash Functions, Collision, Collision Resolution with Open Addressing and Chaining	
3	**STACK AND QUEUE**		
	1	**Stacks:** Definition, Representation of Stacks using Arrays and Linked List Operations on Stacks using Arrays and Linked List	15

		Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of Postfix Expression.	
	2	**Recursion:** Definition, Recursive Notation, Runtime Stack, Applications of Recursion: Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi.	
	3	**Queues:** Definition, Representation of Queues using Array and Linked List Types of Queue: Simple Queue, Circular Queue, Double-Ended queue, Priority Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues.	
4	**GRAPHS AND TREES**		12
	1	**Graphs:** Definition, Terminology, Representation, Traversal—DFS and BFS	
	2	**Trees:** Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL Tree.	
5	**TEACHER-SPECIFIC MODULE: LAB EXPERIMENTS USING C**		
	1. Write a program for insertion and deletion operations in an array. 2. Write a program to search for an element in an array using Linear Search and Binary Search. 3. Write a program to sort an array using Bubble Sort, Selection Sort and Insertion Sort. 4. Write a program to perform Quick Sort and Merge Sort. 5. Write a program to add and subtract two matrices. 6. Write a program to multiply two matrices. 7. Write a program to insert an element into a Singly Linked List: i) At the beginning		15

	ii) At the end iii) At a specified position 8. Write a program to delete an element from a Singly Linked List: i) At the beginning ii) At the end iii) A specified element 9. Write a program to perform the following operations in a Doubly Linked List: i) Create a DLL and Search for an element 10. Write a program to perform the following operations in a Circular Linked List: i) Create ii) Delete an element from the end 11. Write a program to implement stack operations using an array. 12. Write a program to implement stack operations using a linked list. 13. Write a program to add two polynomials using linked lists. 14. Write a program to evaluate a postfix expression using a stack. 15. Write a program to perform the following using recursion: i) Find the factorial of a number ii) Find the GCD of two numbers 16. Write a program to implement simple queue operations using an array. 17. Write a program to implement circular queue operations using an array. 18. Write a program to implement circular queue operations using a linked list. 19. Write a program to do the traversal operations on a binary search tree. i) Preorder Traversal ii) Inorder Traversal iii) Postorder Traversal 20. Write a program to perform insertion operations in a binary search tree.	

Essential Readings:

1. DebasisSamanta, Classic Data Structures, 2nd Ed, PHI

2. G. A. V. Pai, Data Structures and Algorithms: Concepts, Techniques and Applications, 1st Ed, TMH

Suggested Readings:

1. Yashavant Kanetkar, "Data Structures Through C", 4th Edition, BPB Publications, 2022.
2. Ellis Horowitz, SartajSahni and Dinesh Mehta, Fundamentals of Data Structures in C++, 2nd Ed, Universities Press

Assessment rubrics

Evaluation Type		Marks
End Semester Evaluation		**65**
Theory		**50**
Practical		**15**
CCA		**35**
Continuous Evaluation (Theory)		**25**
a)	Test Papers	12
b)	Assignment	5
c)	Viva/Seminar	8
Continuous Evaluation (Practical)		**10**
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test	5
Total		**100**