



KANNUR UNIVERSITY
കണ്ണൂർ സർവകലാശാല

(Abstract)

FYUG- BCA Programme -Scheme and Syllabus of the Third and Fourth Semesters- Approved & Implemented for 2025 Admission - Orders issued

ACADEMIC C SECTION

FYUGPSC/FYSC-III/9089/2024

Dated: 02.09.2026

Read:-1.U .O No .ACADC/ACAD C3/22004/2024 dated 29.11.2024
2..U .O No .ACADC/ACAD C3/22004/2024 dated 24.09.2025
3.Letter No.FYUGPSC-FYSC-III/9089/2024 dated 15.04.2025
4.Letter of Even No.dated 03/12/2025
5.Minutes of the meeting of the Expert Committee held on 23.05.2026
6.Email dated 29.05.2026 from Smt. Rechitha C.R, memberof the Expert committee
7.Email dated 26.06.2026 from Dean, Faculty of Technology
8.Orders of the Vice Chancellor in file of even No. dated 13.08.2026

ORDER

1. The Scheme and Syllabus (First and Second Semesters only) of the FYUG BCA Programme were approved and implemented with effect from the 2024 admission, as per the paper read as (1) above.
2. The Scheme and Syllabus of the Third and Fourth Semesters of the FYUG BCA Programme were approved and implemented with effect from the 2024 admission, as per the paper read as (2) above.
3. As per the paper read as (3) above, an Expert Committee was constituted for preparing the complete Scheme and Syllabus of the FYUG BCA Programme.
4. As per the paper read as (4) above, the Expert Committee was reconstituted for preparing the complete Scheme and Syllabus of the FYUG BCA Programme.
5. As per the paper read as (6) above, Smt. Rechitha C.R., Member of the Expert Committee, submitted the Scheme and Syllabus of the Third and Fourth Semesters of the FYUG BCA Programme (2025 admission), along with the paper read as (5) above.
6. The Scheme and Syllabus, along with the minutes of the meeting of the Expert Committee, were forwarded to the Dean, Faculty of Technology, for verification. The Dean recommended approval of the same vide the paper read as (7) above.
7. The Vice Chancellor, after considering the recommendation of the Dean, and in exercise of the powers of the Academic Council conferred under Section 11(1), Chapter III of the Kannur University Act, 1996, and all other enabling provisions read together therewith, approved the Scheme and Syllabus of the Third and Fourth Semesters of the FYUG BCA Programme and accorded sanction to implement the same for the 2025 admission in the affiliated colleges under the University, subject to reporting to the Academic Council.
8. The Scheme and Syllabus of the Third and Fourth Semesters of the FYUG BCA Programme



implemented for 2025 admission are appended to this U.O. and uploaded on the University website, www.kannuruniversity.ac.in.

9. The U.O read (2) above stands modified to this extent.
10. Orders are issued accordingly.

Sd/-

Bindu K P G
Joint Registrar (Acad)
For REGISTRAR

To: 1.The Principals of Arts and Science Colleges affiliated to Kannur University
2.The Controller of Examinations(through the PA)

Copy To: 1. PS to VC / PA to PVC / PA to R/PA to FO/PA to CE (to circulate among the section concerned)
2. DR / AR (Acad) / AR II Exam/JR II Exam
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4. Web Manager (for uploading in the website)
5. SF/DF/FC



Forwarded / By Order


SECTION OFFICER



KANNUR UNIVERSITY

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

KUFYUGP

BACHELOR OF COMPUTER APPLICATIONS

SECOND YEAR CURRICULUM & SYLLABUS

2025 Admission Only



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

(BCA Syllabus Expert Committee)

BCA Syllabus Expert Committee

1	Ms. Kavitha M R, HoD & Assistant Professor, KBS Government College, Thalassery
2	Ms. Rechitha C R, Assistant Professor, KBS Government College, Thalassery
3	Ms. Anitha Haridas, Assistant Professor, Chinmaya Arts & Science College, Chala
4	Mr. Kevinson Kurian, HoD, Dept of Computer Science, Don Bosco Arts & Science College

Adhoc Member

1	Ms. Sreevidya P N, Chairperson, BoE-BCA-Odd Semesters, Assistant Professor, KBS Government College, Thalassery
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Special Thanks to

Dr Daphna Chacko, Assistant Professor, Department of Computer Science , Krishna Menon Memorial Govt. Women's College

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.
PO7	Lifelong Learning and Adaptability-Cultivate a commitment to continuous self-directed learning, adapting to evolving challenges, and acquiring knowledge throughout life.

PROGRAMME SPECIFIC OUTCOMES

PSO1:	Apply the knowledge of Computer Applications to understand, analyze, and solve real-world computing problems effectively.
PSO2:	Design, develop, test, and maintain software applications using modern programming languages, tools, and technologies.
PSO3:	Apply modern computing techniques for efficient organization, processing, storage, retrieval, and secure handling of information.
PSO4:	Apply current computing tools, technologies, and methodologies ethically to create innovative and practical IT solutions.
PSO5:	Work collaboratively and apply analytical and creative thinking to solve complex problems in Computer Applications and related fields.
PSO6:	Demonstrate professional ethics, social responsibility, environmental awareness, teamwork, and effective communication in computing practices.
PSO7:	Adapt to emerging technologies through continuous learning, self-improvement, and professional development.

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 – VI

(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.

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	3	3	75
4	DSC A1	5	4	100
5	DSC B1	4/5	4	100
6	DSC C1	4/5	4	100
Total		23/25	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	3	3	75
4	DSC A2	5	4	100
5	DSC B2	4/5	4	100
6	DSC C2	4/5	4	100
Total		23/25	21	525

III SEMESTER				
Sl No.	Course	Hours/Week	Credits	Total Marks
1	MDC (Kerala Studies)	3	3	75
2	VAC 1	3/4	3	75

3	DSC A3	4/5	4	100
4	DSC A4	4/5	4	100
5	DSC B3	4/5	4	100
6	DSC C3	4/5	4	100
Total		22/27	22	550

IV SEMESTER				
Sl No.	Course	Hours/Week	Credits	Total Marks
1	SEC 1	3/4	3	75
2	VAC 2	3/4	3	75
3	VAC 3	3/4	3	75
4	DSC A5	5	4	100
5	DSC A6	5	4	100
6	DSC A7	5	4	100
Total		24/27	21	550

(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	4/5	4	100
6	DSC B5	4/ 5	4	100

Total	23/26	22	550
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IV SEMESTER				
Sl No.	Course	Hours/Week	Credits	Total Marks
1	SEC A/B	3/4	3	75
2	VAC A/B	3/4	3	75
3	VAC A/B	3/4	3	75
4	DSC A6	5	4	100
5	DSC A7	5	4	100
6	DSC B6	4/ 5	4	100
Total		23/27	21	550

On completion of 3-yearUG Student will get 68 credits in majorA ($48 + 18 + 2 = 68$ (50% of 133)) and 53 credits in MajorB ($44 + 9 = 53$ (40% of 133))

GENERAL FOUNDATION COURSES							
MULTI DISCIPLINARY COURSES (MDC)							
SEME STER	COURSE CODE	COURSE NAME	CREDITS			HO URS PER WE EK	MARKS
			LEC TUR E/ TUT ORI AL	PR AC TI CA L	TO TA L		
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)							
SEME STER	COURSE CODE	COURSE NAME	CREDITS			HO URS PER WE EK	MARKS
			LEC TUR E/ TUT ORI AL	PR AC TI CA L	TO TA L		
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	2	1	3	4	75
IV	KU4VACCAP104	Basics of Computer Networks	3	0	3	3	75
	KU4VACCAP105	Basics of Internet of Things	2	1	3	4	75
	KU4VACCAP106	R Programming for Data Analytics	2	1	3	4	75
	KU4VACCAP107	Digital Marketing	2	1	3	4	75
	KU4VACCAP108	Software Project Management	3	0	3	3	75

SKILL ENHANCEMENT COURSES (SEC)							
SEM EST ER	COURSE CODE	COURSE NAME	CREDITS			HO UR S PE R WE EK	MARKS
			LEC TU RE/ TUT ORI AL	PR AC TI CA L	TO TA L		
IV	KU4SECCAP101	Digital Marketing	2	1	3	4	75
	KU4SECCAP102	Artificial Intelligence (AI) Assisted Tools	2	1	3	4	75
	KU4SECCAP103	Operating System Administration	2	1	3	4	75
	KU4SECCAP104	Fundamentals of Cloud Computing	3	0	3	3	75

DISCIPLINE SPECIFIC COURSES							
SEM ESTE R	COURSE CODE	COURSE NAME	CREDITS			HO URS PER WE EK	MARKS
			LECT URE/ TUT ORIA L	PR AC TI CA L	TO TA L		
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	Python Programming	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
	KU3DSCCAP207#	Data Analytics using Python	3	1	4	5	100
	KU3DSCCAP208#	Web Design and Development using Content Management System	3	1	4	5	100
	KU3DSCCAP209#	Fundamentals of Cloud Computing	4	0	4	4	100
	# These courses cannot be offered as major courses for BCA students.						
IV	KU4DSCCAP210	Web Technology	3	1	4	5	100
	KU4DSCCAP211	Database Management System	3	1	4	5	100
	KU4DSCCAP212	Data Structures and Algorithms	3	1	4	5	100
	KU5INTERN301	Internship (credit will be added in 5th semester)	0	0	0	0	0

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 (Discipline specific courses, Discipline specific elective)
 - i. courses with only theory
 - ii. courses with 3-credit theory and 1-credit practical.
 - iii. courses with only 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.
- In 4-credit courses with 4 credit practical, skills/knowledge implementation in research//prototype/software development, the process of translating conceptual designs, architectural guidelines, and business logic into functional, deployable code.

Course Credit	Credit		Mark		L		P		
	L	P	L	P	CCA (30%)	ESE (70%)	CCA (40%)	ESE (60%)	Total marks
4	4	0	100	0	30	70	0	0	100
	3	1	75	25	25	50	10	15	100
	0	4	0	100	0	0	40	60	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:
 - courses with only theory
 - 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
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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, KU4SECCAP102 Artificial Intelligence (AI) Assisted Tools 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
KU4SECCAP102 Artificial Intelligence (AI) Assisted Tools		
1	PROMPTS / STEPS WRITING	4
2	PERFECTION OF THE WORK	4

Mark Distribution for 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/Case study	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		i	Punctuality and Lab Skill	3
	ii	**Assignment/ Book- Article review		ii	Test Papers	5
	iii	Seminar/ Viva-Voce/Case study		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/Case study	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/Case study	5		iii	Observation Book	2	

* Minimum two test papers

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

● **4 Credit Course (0 credit theory + 4 credit practical)**

Evaluation Type (Practical only)		Marks
ESE		60
a)	Presentation (Demonstration of the project or present the research findings)	15

b)	Viva voce based on presentation	15
c)	Novelty, Relevance & Contribution	10
d)	Version control using Git and GitHub	10
e)	Report	10
CCA		40
a)	Proposal and Planning	5
b)	Punctuality & Work book	5
c)	Presentation & Viva-Voce (Minimum 3)	30
Total		100

INTERNSHIP

- All students should undergo Internship of 2-credits during the fourth semester summer break 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.
- Refer KU5INTERN301 Internship course page and appendix for guidelines and proforma

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 the 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.

EXTERNAL EVALUATION

- Examinations will be conducted at the end of each semester.
- 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** (S_i) = $\Sigma(C_i \times G_i) / \Sigma C_i$ Where C_i is the number of credits of the course and G_i 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** = $\Sigma(C_i \times S_i) / \Sigma C_i$ Where S_i is the SGPA of the semester and C_i 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	Credit: 21	Credit: 22	Credit: 24	Credit: 23	Credit: 22
SGPA: 6.9	SGPA: 7.8	SGPA: 5.6	SGPA: 6.0	SGPA: 6.3	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) = $\Sigma(C_i \times G_i) / \Sigma C_i$ Where C_i is the number of credits of the course and G_i 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

Appearances 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)	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	2	-	25	50	75	1 Hr 30 Minutes

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		7
	1	Types of Computers: Desktop, Laptop, Tablet, and Microcomputers Software Components: Operating System (OS), Driver Software, Application Software, Utility Software	
	2		
	3	Features of Operating Systems: Key Differences between Windows and Linux	
	4	Computer Languages: High-Level, Low-Level, and Machine Language, Assembler, Compiler, Linker, Loader	

2	Hardware Components and Microprocessor Basics		8
	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		8
	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		7
	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	30
	1. Identifying Hardware Components of a Computer : a. Power off the computer and open the CPU cabinet b. Identify the components on the motherboard c. Observe I/O devices d. Document the purpose of each device 2. PC Assembling 3. Linux installation 4. Illustration of Networking Hardware components 5. Identifying and Comparing Network Cables a. Document where each cable is used and its transmission speed range. b. Crimping: Physical Demonstration (Preferred). If hardware components are unavailable, demonstrate the procedure using instructional videos or network simulation software. 6. Identification of logical address, physical address, and port address 7. Setup a Wired/Wireless LAN with more than two systems 8. Configure IP address of a system and Share files over LAN 9. Testing network connectivity using Ping and IPConfig commands 10. Case study : Understand Troubleshooting basic hardware and network issues	

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)	45
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	-	-	25	50	75	1 Hr 30 Minutes

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		8
	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		8
	1	Cyberspace, Cyber Jurisprudence, Jurisprudence and Law	
	2	Genesis and Need for Cyber Law	
	3	Overview of the Information Technology Act, 2000	
	4	Amendments to the IT Act (2008 and beyond)	
	5	Legal Recognition of Electronic Documents and Digital Signatures	
	6	Certifying Authorities and Digital Certificates	
	7	Penalties and Adjudication under the IT Act	
	8	Role of CERT-In and other regulatory bodies	
3	Cyber Law and Legislation		10

	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		9
	Explore related usecases		

Essential Readings:

1. Cyber Law: Simplified by Vivek Sood, Publisher: Tata McGraw-Hill
2. Cyber Law & Cyber Crimes by Barkha & U. Rama Mohan, Publisher: Asia Law House
3. Information Technology Law and Practice by Vakul Sharma, Publisher: Universal Law Publishing
4. Cyber Laws by Krishna Kumar Yadav, Publisher: Allahabad Law Agency
5. Cyber Ethics: Morality and Law in Cyberspace by Richard Spinello, Publisher: Jones & Bartlett Learning (International Edition)

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/Case study	8
Total		75

KU3VACCAP103: INTRODUCTION TO DATA ANALYTICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	VAC	100-199	KU3VACCAP103	3(2T+1P)	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	2	-	25	50	75	1Hr 30 Minutes

Course Description: This Value Added Course (VAC) introduces BCA students to the fundamentals and practical applications of sData Analytics using Python and advanced Pandas techniques. The course is designed for students who already possess basic knowledge of Python programming and aims to develop analytical thinking and data handling skills required in modern computing and industry environments. The course covers the complete data analytics workflow including data collection, data cleaning, preprocessing, exploratory data analysis (EDA), statistical analysis, grouping and aggregation, pivot table generation, data merging, and data visualization. Students will learn to work with real-world datasets and perform analytical operations using advanced Pandas functionalities.

Course Prerequisite: Programming Basics

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the basic concepts and applications of Data Analytics	U
2	Perform basic statistical analysis such as mean, median, mode, standard deviation, and correlation on business datasets.	U
3	Learn Data Analysis process	U
4	Perform basic data cleaning, filtering, sorting, and grouping , pivot operations on real-world datasets and handle and analyze CSV and Excel datasets using Pandas library.	A

5	Develop simple data analytics solutions for datasets and create charts, graphs, and visual reports for business decision-making using Python visualization libraries	A
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**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	
CO 5							

COURSE CONTENTS

Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	MODULE TITLE- Introduction to Data Analytics and Statistics		7
	1	Introduction to Data Analytics-Meaning and importance of Data Analytics, Applications of Data Analytics,Business Analytics vs. Data Analytics ,Data Scientist vs. Data Engineer vs. Data Analyst-Role of Data Analyst, Data Science vs. Data Analytics.	
	2	Data analytics definition, Steps in data analytics,Types of Analytics-Descriptive Analytics, Diagnostic Analytics, Predictive Analytics. Examples	
	3	Process of Data Analytics- Define the Problem, Collect Data, Data Cleaning, Analyzing the Data, Data Visualization, Presenting Data(Dashboard),Sources of data -primary and secondary data- Data types -structured and unstructured data,Data collection methods	

	4	Introduction to Statistics- Definition, Types of Statistics -Descriptive , Inferential, Population, Sample, Types of data -Qualitative(Categorical), Quantitative(Numerical), Types of Quantitative data- Discrete, Continuous. Exploratory data Analysis (EDA),Descriptive Statistics- Measures of Central Tendency-Mean, Median, Mode, Measures of Dispersion-Range,Variance,Standard Deviation, Coefficient of variation, Quartiles and Percentiles, Skewness, Kurtosis, Correlation, Covariance, Z-Score	
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	MODULE TITLE- Data Preprocessing and Handling large data Sets		8
	1	Data preprocessing techniques - Data cleaning -Removing duplicates, Handling Missing values - What is Missing data, Why does it occur? Types of Missing data, Why missing data handling is important? , Strategies for Handling Missing data- Deletion, Pairwise deletion, Imputation methods- Mean, Median, Mode, K Nearest neighbour, Multiple Imputation, Use Missing as category, Domain specific substitution.	
	2	Sources of data -primary and secondary data- Data types -structured and unstructured data,Data collection methods.	
	3	Feature engineering- Encoding categorical variables, Detecting Outliers- Visualisation, Z-Score Method, IQR, Dealing with Outliers- Trimming/Remove the outliers- Quantile Based Flooring and Capping-, Mean/Median Imputation, Transformations	
	4	Handling Large Data sets- Sampling techniques, Different types of sampling, Data Transformation Techniques- Normalization, Standardization, Log Transformation, Box-Cox Transformation, Benefits of Data Transformation.	

3	MODULE TITLE- Pandas for data Analytics-1	8
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	1	Pandas-What is Pandas, and Why Use It?, Installing Pandas (pip install pandas), Understanding Series and DataFrame Objects, Creating DataFrames from Dictionaries, Lists, and NumPy Arrays; Inspecting data set- describe(), info(),dtypes(), head() and tail() functions. Selecting Rows and Columns- loc(), iloc(),query()	
	2	Loading Data from CSV, Excel - Reading CSV Files (read_csv()), Reading Excel Files (read_excel()), Writing Data to CSV, Excel(to_csv(), to_excel()), Load datasets of real- world applications like Student Mark Analysis,Sales Analysis, Employee Dataset etc.	
	3	Data Cleaning-,Handling Missing and Duplicate Values - Identifying Missing Data (isnull(), notnull()), Count Missing Values -isnull().sum(), Filling Missing Values (fillna(), interpolate(), ffill(), bfill()), Dropping Missing Data (dropna(),dropna(axis=1)), Removing Duplicate Rows (drop_duplicates());	
	4	Data Transformation: Filtering Data (loc[], iloc[], query()), Sorting Data (sort_values(), sort_index()), Applying Functions to Columns (apply(), map(), lambda functions).	

4	MODULE TITLE- Pandas for Data Analytics -2		7
	1	Grouping Data (groupby()),Concatenating DataFrames (concat()), Merging DataFrames (merge()), Joining DataFrames (join()), Aggregation Functions (mean(), sum(), count(), std())	
	2	Pivot Tables (pivot_table()), Cross-tabulation (crosstab()); Working with DateTime Data - Parsing Dates (pd.to_datetime()), Extracting Date Components (.dt.year, .dt.month, .dt.day), Date Arithmetic , Application on real world datasets.	
	3	Data Visualization using pandas-Meaning of Data Visualization, Importance of Visualization in Data Analytics, Role of Visualization in Decision Making,Choosing appropriate charts	
	4	Relationship between Pandas and Matplotlib,Basic plotting syntax in Pandas,plot parameters,Figure size and labels,Titles and legends Pandas methods-plot(), plot.line(), plot.bar(), plot.hist(), plot.scatter(), plot.pie(), plot.box(), Save plot.	
5	Teacher Specific Module : For practical courses add lab experiments		30
	<i>Directions</i>		
	1. Create and display a Series containing sales values. Create a DataFrame for Student Records and store Name, Marks, and Grade in a DataFrame. Display First and Last Rows of a Dataset ,Display Dataset Information		

	And Generate Statistical Summary . Interpret the results. 2. Load sales dataset from csv file /excel file. Find total sales, average sales, maximum and minimum sales. Display customers with sales greater than a specific amount. Sort sales data . 3. Load dataset,detect Missing Values in Dataset, Fill Missing Values,Remove Missing Records,Detect Duplicate Records, Remove Duplicate Records,Correct Data Types, Perform String Cleaning Operations 4. Load dataset, Select Specific Columns from Dataset,Select Rows using loc[] and iloc[], Filter Dataset using Conditions,Query Dataset using query(),Filter sales greater than a specified value. 5. Load dataset, Sort Dataset in Ascending Order,Sort Dataset in Descending Order,Group Dataset,Calculate Group-wise Average,Count Group-wise Records 6. Load sales dataset, Calculate descriptive statistics like Mean, Median, and Mode, Study sales variability using Variance and Standard Deviation, Find Correlation between Columns : Advertisement vs sales analysis. 7. Load dataset , handle missing values and duplicates and create Line Chart using Pandas for Monthly sales trend analysis. Create Bar Chart using Pandas for Product-wise sales comparison 8. A company maintains sales records containing employee details, employee id name department,city, product category and sales amount.Create the DataFrame, Display the first 5 rows, Display dataset information, Find total sales amount, Group data department-wise. Find department-wise total sales. Find department-wise average sales. Find city-wise maximum sales. Find category-wise minimum sales. Find count of employees in each department. 9. An institute maintains student records containing Name, department, gender, semester, and marks. Create the DataFrame.Display statistical summary. Display unique departments. Create a pivot table showing average marks department-wise. Create a pivot table showing gender-wise maximum marks. Create a pivot table showing semester-wise total marks. Create a multi-level pivot table using Department and Gender. 10. A college maintains student details(Student ID, Name Department) in one dataset and marks details (StudentID, Python, Statistics) in another dataset. Create both DataFrames. Display both datasets. Perform inner join. Identify unmatched records after merging. Calculate total marks of each student. Find average marks. Find topper in Python. Find department-wise average marks. Sort students based on total marks.	
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Essential Readings:

- Foster Provost and Tom Fawcett, “Data Science for Business”
- Wes McKinney, "Python for Data Analysis"
- Peter Bruce, Andrew Bruce, “ Practical Statistics for Data Scientists -50 Essential Concepts” .
- Laura_Igual,Santi Seguí, “Introduction to Data Science-A Python Approach to Concepts, Techniques and Applications”, 2nd Ed.
- V. Rajaraman & C.S. Ananda, “Data Analytics”, PHI Learning

- S. K. Gupta,” Fundamentals of Data Science”, Khanna Publishing .
- Al Sweigart , “Automate the Boring Stuff with Python: Practical Programming for Total Beginners”, Published by No Starch Press.

Suggested Readings:

1. V.K. Jain, “Data Science and Analytics “, Khanna Publishing
2. U. Dinesh Kumar, “Business Analytics “ , Wiley India

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)	Case study/Seminar	5
Continuous Evaluation (Practical)		10
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test Papers	5
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)	45
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	--	--	25	50	75	1Hr 30 Minutes

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		8
	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		8
	1	Transmission Media	
	2	Guided media: Twisted pair, Coaxial cable, Optical fiber	
	3	Unguided media: Radio waves, Microwaves, Infrared	
	4	Network Devices	
	4	NIC, Hub, Switch, Router, Modem, Access Point	
3	Common Protocols and Applications		10
	1	Common networking protocols:	

	2	TCP/IP, UDP, HTTP, HTTPS, FTP, SMTP, POP3, IMAP, DNS, DHCP	
	3	Concept of Ports and Sockets	
	4	Introduction to Internet and Intranet	
	5	Web browsing, Email communication	
		File transfer and remote login basics (FTP, SSH)	
4	Networking Tools and Hands-on Lab		10
	1	Basic Networking Commands:	
	2	ping, ipconfig / ifconfig, tracert / traceroute, netstat,	
	3	nslookup	
	4	Wireshark (basic packet capture and analysis)	
	5	Introduction to Packet Tracer or similar simulators	
	6	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		9
		Teacher can implement proper methodologies and evaluation metrics related with the topics	

Essential Readings:

1. **Computer Networking: A Top-Down Approach** , James F. Kurose, Keith W. Ross, Pearson
2. **Data Communications and Networking**, Behrouz A. Forouzan, McGraw Hill
3. **Computer Networks**, Andrew S. Tanenbaum, David J. Wetherall, Pearson
4. **Networking All-in-One For Dummies**. Doug Lowe, Wiley

Supplementary Reading (for lab and practical focus):

1. **Introduction to Networking Basics**, Patrick Ciccarelli, Christina Faulkner, Wiley
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 (2T+1P)	60
Learning Approach (Hours/ Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	1Hr 30 Minutes
2	2	0	25	50	75	

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 tools.	C
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**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

Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	MODULE TITLE :Introduction to IoT		7
	1	Introduction: Definition and basic concepts of IoT, Historical development of IoT, Benefits and challenges of IoT	
	2	IoT and M2M Communications: Introduction, M2M, M2M applications, Differences between M2M and IoT,	
	3	Types of IoT Devices: Wearables, Smart appliances, Embedded systems	
	4	Basic components: sensors, actuators, microcontrollers	
	5	IoT architecture	
	6	M2M standards- Bluetooth-LE, Zigbee, NFC, Wifi and LoRaWAN.	
	7	Application protocols: MQTT, CoAP, HTTP/HTTPS	

2	MODULE TITLE : Security, Usecases		8
		IoT cloud platforms (AWS IoT, Google IoT, Azure IoT – overview)	
	1	Vulnerabilities and Threats in IoT Systems: Data breaches, Hacking, Privacy concerns	
	2	Ethical Considerations: Data privacy, Bias in IoT systems, Responsible technology use	
	3	IoT applications: Energy management and smart grid applications. IoT based home automation, Smart metering for electricity consumers. IoT based weather stations, Agriculture- smart farming, Automobile IoT- Electric vehicles-platform and software, Industrial IoT.	

3	MODULE TITLE:Arduino		7
	1	Arduino Uno , Raspberry Pi	
	2	Basic architecture of Arduino Uno, Microcontroller (ATmega328P), Digital pins, analog pins, Power supply, USB interface	
	3	Basic Components Used with Arduino, Sensors (temperature, IR, ultrasonic, etc.), Actuators (LED, motor, buzzer, relay), Breadboard and jumper wire	
	4	Sending sensor data to cloud	

4	MODULE TITLE Arduino Programming		8
	1	Structure of Arduino program, setup() function, loop() function	
	2	Basic Programming Concepts, Variables and data types, Operators (arithmetic, logical, comparison), Control statements: if, else, Loops: For, while, user defined function	
	3	Digital I/O Programming : pinMode(), digitalWrite(), digitalRead()	

	4	Analog I/O Programming, analogRead(), analogWrite()	
	5	Serial communication (Serial.begin, Serial.print)	
	6	Interrupts (Basic Idea)	

	Teacher Specific Module : For practical courses add lab experiments	30
	<i>Directions</i>	
	1. Familiarization with Arduino and Necessary Software Installation (If Arduino hardware is unavailable, use simulation tools such as Autodesk Tinkercad, SimulIDE, or other suitable simulators.) 2. To interface LED/Buzzer with Arduino/simulation tool and write a program to turn ON LED for 1 sec after every 2 seconds. 3. To interface red, yellow, and green LEDs with Arduino/simulation tool and develop a program to control the LEDs in a sequential manner similar to a real traffic signal system. 4. To interface Buzzer with an Arduino / simulation tool and write a program to turn ON Buzzer for 1 second after every 2 seconds. 5. To interface Push button (IR/LDR) with Arduino/simulation tool and write a program to turn ON LED when push button is pressed 6. To interface an LDR (Light Dependent Resistor) sensor with Arduino/simulation tool and develop a program to automatically turn ON the LED during low light or darkness and turn OFF the LED during bright light conditions. 7. To interface a servo motor with Arduino/simulation tool and write a program to rotate the servo motor from 0° to 180° repeatedly using control signals.	

	8. To design a barrier gate system using a servo motor where the gate opens when a push button is pressed and closes automatically after a delay. 9. To interface a temperature sensor and write a program to print temperature readings.	
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Essential Readings:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.
3. Simone Cirani,” Internet of things: Architecture, protocols and standards”, Wiley, 2019
4. B.K Thripathy, J Anuradha, “Internet of things (IoT) _ technologies, applications, challenges and solutions “, CRC press, 2018
5. Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.

Suggested Readings:

- a) Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
3. Editors Ovidiu Vermesan
- b) 2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014

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)	Case study/Seminar	5
Continuous Evaluation (Practical)		10
a)	Lab Skills and Punctuality	3
b)	Observation Book	2
c)	Test Papers	5
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)	60

Learning Approach (Hours/ Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	2	-	25	50	75	1Hr 30 Minutes

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	7
	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.)	8
	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()	8
	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	7
	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.		30

	2. Create variables of different data types and check the data types using the class() function 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.	
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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

KU4VACCAP107 : DIGITAL MARKETING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	VAC	100-199	KU4VACCAP107	3(2+1)	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	2	-	25	50	75	1Hour 30 Minutes

Course Description: This course introduces the fundamental concepts and techniques of digital marketing in today's fast-growing digital environment. Students will explore key channels such as SEO, social media, email, and content marketing, while gaining basic practical skills to create and manage effective online marketing campaigns.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the fundamentals of digital marketing, social media marketing, and content marketing strategies.	U
2	Create and manage engaging digital content for social media platforms to improve online audience interaction and brand visibility.	C
3	Apply Search Engine Optimization (SEO) techniques and paid advertising methods to increase website traffic and online reach.	A
4	Design and implement email marketing campaigns using appropriate tools and performance measurement techniques.	C
5	Analyze digital marketing campaign performance using web analytics and reporting tools for effective decision-making.	An

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

Mapping of COs with PSOs

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	1	2	1	2	2
CO2	3	2	1	2	1	2	2
CO3	3	2	2	3	1	2	3
CO4	3	2	2	3	1	2	2
CO5	3	2	3	3	2	2	3

COURSE CONTENTS

Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	Basics of Digital Marketing		7
	1	Overview of digital marketing, Importance of digital marketing for businesses	
	2	Terminologies, 10Ps of digital marketing, Landscape/digital marketing channels: Overview	
	3	Basics of creating a digital marketing strategy, Setting SMART Goals in Digital Marketing	
	4	Understanding Customer Behavior in the Digital Age	
2	Social Media Marketing & Content Marketing		8
	1	Introduction to Social Media Marketing, Importance of Social Media in Business, Popular Social Media Platforms: Facebook, Instagram, LinkedIn, YouTube, Types of Social Media Content, Benefits and Challenges of Social Media Marketing, Social Media Marketing Strategies, Building Brand Communities on Key Platforms	
	2	Creating Business Profiles on Social Media, Basics of Social Media Campaigns, Social Media Branding Basics, Introduction to Influencer Marketing, Paid Promotions on Social Media	

	3	Types of Digital Content: Text content, Images, Videos, Infographics, Blogs Basics of Content Creation, Writing Simple and Engaging Content, Storytelling in Digital Marketing Content Planning for Improved Ranking, Content Marketing Platforms and Tools	
	4	Engaging Content Creation for Social Media Channels, Introduction to Social Media Analytics. Understanding Likes, Shares, Comments, and Reach, Measuring Engagement Rate	
3	SEO and Paid Advertising		7
	1	Introduction to Search Engine Optimization (SEO), Importance of SEO in Online Marketing, Introduction to Paid Advertising, Difference between Organic Search and Paid Search, Overview of Search Engines and Search Results	
	2	Search Engine Optimization (SEO) Principles - Optimizing Websites for Search Visibility, Content Optimization for SEO, Image Optimization Basics, Mobile-Friendly Website Design, Website Speed and Performance Basics, Internal Linking and Navigation	
	3	How Search Engines Work, Keywords and Keyword Research Basics, Types of Keywords: Short-tail keywords, Long-tail keywords, On-Page SEO Basics: Title tags, Meta descriptions, Headings, URL structure Introduction to Off-Page SEO, Importance of Backlinks	
	4	Paid Advertising Fundamentals, Types of Paid Ads: Search ads, Display ads, Social media ads and Video ads, Introduction to Pay-Per-Click (PPC) Advertising	
	5	Introduction to Google Ads, Introduction to Meta Ads, Creating Simple Search Advertisements, Creating Social Media Advertisements	
	6	Introduction to Website Traffic Analysis, Measuring Advertisement, Performance, Understanding Clicks, Impressions, and CTR, Conversion Tracking Basics	
4	Email Marketing		8
	1	Types of Marketing Emails: Promotional emails, Newsletter emails, Welcome emails, Reminder emails	
	2	Effective Email Marketing Strategies - Building Email Lists and Segmentation Creating Marketing Emails: Structure of a Marketing Email, Writing Effective Subject Lines, Creating Simple Email Content, Adding Images, Buttons, and Links, Designing Responsive Email Templates Call-to-Action (CTA) in Emails, Personalization in Email Marketing	

	3	Introduction to Email Analytics: Understanding Open Rate, Understanding Click-Through Rate (CTR), Bounce Rate and Unsubscribe Rate, Improving Email Performance	
	4	Email Marketing Automation Tools: Mailchimp, Brevo, MailerLite Professional Email Writing Etiquette, Best Practices for Effective Campaigns	
5	Teacher Specific Module :		30
	<i>Lab Exercise</i>		
	1. Exercise 1: Keyword Research (SEO Basics) a. Aim: To identify relevant keywords for a product/service. b. Tools Required: Web browser (Google search) c. Procedure: i. Choose a product (e.g., handmade soaps, backpacks). ii. Think of words a customer may type in Google. iii. List at least 10 keywords. iv. Check related searches on Google for more ideas. d. Output: List of 10–15 relevant keywords. 2. Exercise 2: Social Media Post Creation a. Aim: To design a basic promotional social media post. b. Tools Required: Canva/any design tool c. Procedure: i. Select a business (e.g., bakery, clothing brand). ii. Create a caption for promotion. iii. Add 5–8 relevant hashtags. iv. Design or describe an image for the post. d. Output: One complete social media post. 3. Exercise 3: Content Writing (Blog) a. Aim: To create simple marketing content. b. Tools Required: Text editor/Blog site c. Procedure: i. Choose a topic (e.g., Newly launched Sunscreen”, ”Newly launched online Tutorial App”). ii. Write 80-100 words. iii. Use simple language and a clear structure (intro, body, conclusion). d. Output: : A short blog/article. 4. Exercise 4: Email Marketing Draft a. Aim: To design a promotional email. b. Tools Required: Text editor/Email c. Procedure: i. Choose a product or offer. ii. Write a subject line. iii. Add greeting and message content. iv. Include a call-to-action (e.g., Buy Now”, ”Shop Now”, ”Join Now” etc.,). d. Output: : One sample marketing email. 5. Exercise 5: Competitor Analysis a. Aim: To study digital marketing strategies of competitors. b. Tools Required: Web browser		

	c. Procedure: - Visit 2 company websites or social media pages. - Observe their content, offers, and posting style. - Note key differences. d. Output: Short comparison report (5–6 points). 6. Exercise 6: Digital Campaign Planning - Aim: To design a simple digital marketing campaign. - Tools Required: Notebook/Text editor - Procedure: - Select a product/service. - Identify target audience - Choose a platform (Instagram, Facebook, Whatsapp, Email, etc.). - Suggest one campaign idea. - Output: Basic campaign plan. 7. Exercise 7: Hashtag Research - Aim: To identify effective hashtags. - Tools Required: Instagram/Google - Procedure: - Choose a topic (fitness, food, fashion). - Search for trending hashtags. - List at least 10 hashtags. - Output: List of hashtags.	
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Essential Readings:

- Digital Marketing 2026 by Seema Gupta | 3rd Edition, Mc Graw hill
- Fundamentals of Digital Marketing, Puneet Singh Bhatia, Pearson Education
- Digital Marketing For Dummies
- Digital Marketing: Tools, Techniques, and Trends

Suggested Readings:

- Digital Marketing Strategy, Implementation and Practice Dave Chaffey, Fiona Ellis-Chadwick, Publisher Pearson, 8th Edition
- https://learndigital.withgoogle.com/digitalgarage?utm_source=chatgpt.com
- https://academy.hubspot.com/?utm_source=chatgpt.com

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

- **Employability for the Course:** Completing a digital marketing course prepares a student for a wide array of specialized career paths: SEO Specialist, Social Media Manager, Performance Marketer / PPC Analyst, Content Strategist and Digital Analyst etc.,

KU4VACCAP108: SOFTWARE PROJECT MANAGEMENT

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
IV	VAC	100-199	KU4VACCAP108		3(3T+0P)	45
Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0	0	25	50	75	1 Hr 30 Minutes

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: 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		10
		Why is Software Project Management Hard? Project, Project Stakeholders, Project Scope, W5HH Principle, Types of Software Projects: Software products, Software services, Project Management Activities: Planning, Staffing, Directing, Monitoring and Controlling, Project Life Cycle, Project Management Processes, ISO 21500, Life Cycle, Traditional versus Modern Project Management Practices.	
2	MODULE TITLE: Project Evaluation and Programme Management		8
		Cash-flow forecasting, Cost-benefit analysis, Tangible costs. Intangible costs, Direct Costs, Indirect costs, Fixed Costs, Variable costs, cost-benefit evaluation techniques are: Net benefit (profit) analysis, Payback period, Return on investment, Present value analysis, Net present value (NPV), Internal rate of return (IRR), Break-even analysis Activity: Cost-benefit analysis A company is planning to develop a payroll application and is currently engaged in C-B analysis. Study of the market shows that if the company can target it efficiently and no competing products become available, it will obtain a high level of sales generating an	

annual income \$800000. It estimates that there is a 1 in 10 chance of this happening. However a competitor might launch another application before its own launch date., and then sales might generate only \$100000 per year. It estimates that there is 30% chance of this happening. The most likely outcome is somewhere in between these 2 extremes- it will gain a market lead by launching before any competing product becomes available, and achieve annual income of \$650000. The expected sales income are shown in following table.

Cost-benefit analysis - Example

Sales	Annual sales income (i)	Prob. (p)	Expected value (i*p)
High	800000	0.1	80000
Medium	650000	0.6	390000
Low	100000	0.3	30000
Expected income			500000

Development costs estimated to be \$750000

- Sales levels are expected to be constant for atleast 4 years
- Annual cost are estimated at \$200000

Would you advice going ahead with the project?

MODULE TITLE- Project Estimation Techniques

10

3

Project Planning Activities: Estimation, Project scheduling, Staff organization, Risk handling, Miscellaneous plans:– quality assurance plan, configuration management plan

Fundamental estimation questions: size, effort, calendar time, total cost, COCOMO Models

Activity :

- 1) Suppose you are developing a software product in the organic mode. You have estimated the size of the product to be about 100,000 lines of code. Compute the nominal effort and the development time.
- 2) Suppose that a certain software product for business application costs Rs. 50,000 to buy off-the-shelf and that its size is 40 KLOC. Assuming that in-house developers cost Rs.

	6000 per programmer-month (including overheads), compute the nominal effort and the development time and total cost of the project.																																					
4	MODULE TITLE-Project Scheduling, Resource allocation, Monitoring and Quality control	8																																				
	Project Scheduling, Work breakdown structure, Gantt Chart, Activity Network, critical path, Project Scheduling using PERT/CPM, Earliest Start (ES), Earliest Finish (EF), Latest Start (LS), Latest Finish (LF), Slack, Computation of Project Characteristics using PERT/CPM: Forward pass, Backward pass, Identify critical paths Activity: Computation of Project Characteristics using PERT/CPM																																					
	<table><tr><th>Activity Label</th><th>Activity Name</th><th>Duration (Weeks)</th><th>Precedence</th></tr><tr><td>A</td><td>Hardware Selection</td><td>6</td><td>---</td></tr><tr><td>B</td><td>System configuration</td><td>4</td><td>---</td></tr><tr><td>C</td><td>Install hardware</td><td>3</td><td>A</td></tr><tr><td>D</td><td>Data migration</td><td>4</td><td>B</td></tr><tr><td>E</td><td>Draft office procedures</td><td>3</td><td>B</td></tr><tr><td>F</td><td>Recruit staff</td><td>10</td><td>---</td></tr><tr><td>G</td><td>User training</td><td>3</td><td>E,F</td></tr><tr><td>H</td><td>Install and test</td><td>2</td><td>C,D</td></tr></table>	Activity Label	Activity Name	Duration (Weeks)	Precedence	A	Hardware Selection	6	---	B	System configuration	4	---	C	Install hardware	3	A	D	Data migration	4	B	E	Draft office procedures	3	B	F	Recruit staff	10	---	G	User training	3	E,F	H	Install and test	2	C,D	
	Activity Label	Activity Name	Duration (Weeks)	Precedence																																		
	A	Hardware Selection	6	---																																		
B	System configuration	4	---																																			
C	Install hardware	3	A																																			
D	Data migration	4	B																																			
E	Draft office procedures	3	B																																			
F	Recruit staff	10	---																																			
G	User training	3	E,F																																			
H	Install and test	2	C,D																																			
Resource Allocation																																						
Project Monitoring and Control																																						
Software Quality management																																						
5	Teacher Specific Module : Monitor Case study Case study : Students are directed to select a real-world software system, analyze its requirements, and prepare a case study by applying software project management concepts such as project planning, scheduling (Gantt/PERT/CPM), resource allocation, effort estimation (COCOMO), risk analysis, and quality considerations	9																																				

Essential Readings:

1. Software Project Management, 6th Edition, Bob Hughes, Mike Cotterel, Rajib Mall, McGraw-Hill, 2018
2. Kathy Schwalbe, Information Technology Project Management, Cengage Learning, Inc., 9th Edition, Student Edition: ISBN-13: 978-1-337-10135-6.
3. 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:

1. [Preview: Software Project Management | SWAYAM](#): NPTEL course: Software Project Management by Prof. Rajib Mall & Prof. Durga Prasad Mohapatra, IIT Kharagpur
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	8
Total		75

SKILL ENHANCEMENT COURSES (SEC)

KU4SECCAP101 : DIGITAL MARKETING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	SEC	100-199	KU4SECCAP101	3(2+1)	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	2	-	25	50	75	1Hour 30 Minutes

Course Description: This course introduces the fundamental concepts and techniques of digital marketing in today's fast-growing digital environment. Students will explore key channels such as SEO, social media, email, and content marketing, while gaining basic practical skills to create and manage effective online marketing campaigns.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the fundamentals of digital marketing, social media marketing, and content marketing strategies.	U
2	Create and manage engaging digital content for social media platforms to improve online audience interaction and brand visibility.	C
3	Apply Search Engine Optimization (SEO) techniques and paid advertising methods to increase website traffic and online reach.	A
4	Design and implement email marketing campaigns using appropriate tools and performance measurement techniques.	C
5	Analyze digital marketing campaign performance using web analytics and reporting tools for effective decision-making.	An

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

Mapping of COs with PSOs

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	1	2	1	2	2
CO2	3	2	1	2	1	2	2
CO3	3	2	2	3	1	2	3
CO4	3	2	2	3	1	2	2
CO5	3	2	3	3	2	2	3

COURSE CONTENTS

Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	Basics of Digital Marketing		8
	1	Overview of digital marketing, Importance of digital marketing for businesses	
	2	Terminologies, 10Ps of digital marketing, Landscape/digital marketing channels: Overview	
	3	Basics of creating a digital marketing strategy, Setting SMART Goals in Digital Marketing	
	4	Understanding Customer Behavior in the Digital Age	
2	Social Media Marketing & Content Marketing		7
	1	Introduction to Social Media Marketing, Importance of Social Media in Business, Popular Social Media Platforms: Facebook, Instagram, LinkedIn, YouTube, Types of Social Media Content, Benefits and Challenges of Social Media Marketing, Social Media Marketing Strategies, Building Brand Communities on Key Platforms	
	2	Creating Business Profiles on Social Media, Basics of Social Media Campaigns, Social Media Branding Basics, Introduction to Influencer Marketing, Paid Promotions on Social Media	

	3	Types of Digital Content: Text content, Images, Videos, Infographics, Blogs Basics of Content Creation, Writing Simple and Engaging Content, Storytelling in Digital Marketing Content Planning for Improved Ranking, Content Marketing Platforms and Tools	
	4	Engaging Content Creation for Social Media Channels, Introduction to Social Media Analytics. Understanding Likes, Shares, Comments, and Reach, Measuring Engagement Rate	
3	SEO and Paid Advertising		8
	1	Introduction to Search Engine Optimization (SEO), Importance of SEO in Online Marketing, Introduction to Paid Advertising, Difference between Organic Search and Paid Search, Overview of Search Engines and Search Results	
	2	Search Engine Optimization (SEO) Principles - Optimizing Websites for Search Visibility, Content Optimization for SEO, Image Optimization Basics, Mobile-Friendly Website Design, Website Speed and Performance Basics, Internal Linking and Navigation	
	3	How Search Engines Work, Keywords and Keyword Research Basics, Types of Keywords: Short-tail keywords, Long-tail keywords, On-Page SEO Basics: Title tags, Meta descriptions, Headings, URL structure Introduction to Off-Page SEO, Importance of Backlinks	
	4	Paid Advertising Fundamentals, Types of Paid Ads: Search ads, Display ads, Social media ads and Video ads, Introduction to Pay-Per-Click (PPC) Advertising	
	5	Introduction to Google Ads, Introduction to Meta Ads, Creating Simple Search Advertisements, Creating Social Media Advertisements	
	6	Introduction to Website Traffic Analysis, Measuring Advertisement, Performance, Understanding Clicks, Impressions, and CTR, Conversion Tracking Basics	
4	Email Marketing		7
	1	Types of Marketing Emails: Promotional emails, Newsletter emails, Welcome emails, Reminder emails	
	2	Effective Email Marketing Strategies - Building Email Lists and Segmentation Creating Marketing Emails: Structure of a Marketing Email, Writing Effective Subject Lines, Creating Simple Email Content, Adding Images, Buttons, and Links, Designing Responsive Email Templates Call-to-Action (CTA) in Emails, Personalization in Email Marketing	

	3	Introduction to Email Analytics: Understanding Open Rate, Understanding Click-Through Rate (CTR), Bounce Rate and Unsubscribe Rate, Improving Email Performance	
	4	Email Marketing Automation Tools: Mailchimp, Brevo, MailerLite Professional Email Writing Etiquette, Best Practices for Effective Campaigns	
5	Teacher Specific Module :		30
	<i>Lab Exercise</i>		
	8. Exercise 1: Keyword Research (SEO Basics) - Aim: To identify relevant keywords for a product/service. - Tools Required: Web browser (Google search) - Procedure: - Choose a product (e.g., handmade soaps, backpacks). - Think of words a customer may type in Google. - List at least 10 keywords. - Check related searches on Google for more ideas. - Output: List of 10–15 relevant keywords. 9. Exercise 2: Social Media Post Creation - Aim: To design a basic promotional social media post. - Tools Required: Canva/any design tool - Procedure: - Select a business (e.g., bakery, clothing brand). - Create a caption for promotion. - Add 5–8 relevant hashtags. - Design or describe an image for the post. - Output: One complete social media post. 10. Exercise 3: Content Writing (Blog) - Aim: To create simple marketing content. - Tools Required: Text editor/Blog site - Procedure: - Choose a topic (e.g., Newly launched Sunscreen”, ”Newly launched online Tutorial App”). - Write 80-100 words. - Use simple language and a clear structure (intro, body, conclusion). - Output: : A short blog/article. 11. Exercise 4: Email Marketing Draft - Aim: To design a promotional email. - Tools Required: Text editor/Email - Procedure: - Choose a product or offer. - Write a subject line. - Add greeting and message content. - Include a call-to-action (e.g., Buy Now”, ”Shop Now”, ”Join Now” etc.,). - Output: : One sample marketing email. 12. Exercise 5: Competitor Analysis - Aim: To study digital marketing strategies of competitors. - Tools Required: Web browser		

	c. Procedure: - Visit 2 company websites or social media pages. - Observe their content, offers, and posting style. - Note key differences. d. Output: Short comparison report (5–6 points). 13. Exercise 6: Digital Campaign Planning - Aim: To design a simple digital marketing campaign. - Tools Required: Notebook/Text editor - Procedure: - Select a product/service. - Identify target audience - Choose a platform (Instagram, Facebook, Whatsapp, Email, etc.). - Suggest one campaign idea. - Output: Basic campaign plan. 14. Exercise 7: Hashtag Research - Aim: To identify effective hashtags. - Tools Required: Instagram/Google - Procedure: - Choose a topic (fitness, food, fashion). - Search for trending hashtags. - List at least 10 hashtags. - Output: List of hashtags.	
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Essential Readings:

- Digital Marketing 2026 by Seema Gupta | 3rd Edition, Mc Graw hill
- Fundamentals of Digital Marketing, Puneet Singh Bhatia, Pearson Education
- Digital Marketing For Dummies
- Digital Marketing: Tools, Techniques, and Trends

Suggested Readings:

- Digital Marketing Strategy, Implementation and Practice Dave Chaffey, Fiona Ellis-Chadwick, Publisher Pearson, 8th Edition
- https://learndigital.withgoogle.com/digitalgarage?utm_source=chatgpt.com
- https://academy.hubspot.com/?utm_source=chatgpt.com

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

- **Employability for the Course:** Completing a digital marketing course prepares a student for a wide array of specialized career paths: SEO Specialist, Social Media Manager, Performance Marketer / PPC Analyst, Content Strategist and Digital Analyst etc.

KU4SECCAP102: ARTIFICIAL INTELLIGENCE (AI) ASSISTED TOOLS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	SEC	100-199	KU4SECCAP102	3(2T+1P)	60
Learning Approach (Hours/ Week)			Marks Distribution		Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total
2	2	-	25	50	75
					1 Hour 30 Minutes

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:

MO DUL E	UN IT	DESCRIPTION	HOURS
1	Introduction to AI and AI Tools		7
	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		8

	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		8
	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		7
	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		30
	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	
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Essential Readings:

1. Artificial Intelligence Basics

- *Artificial Intelligence: A Guide for Thinking Humans*, Melanie Mitchell, Penguin
- *Artificial Intelligence: A New Synthesis*, Nils J. Nilsson, Morgan Kaufmann ■

2. AI Tools and Applications

- *The Art of Prompt Engineering with ChatGPT: Crafting Effective Prompts for Work, Creativity, and Learning*, Nathan Hunter

3. Multimedia and Productivity Tools

- *AI for Creators: A Guide to AI Tools for Content Creation*, Chris Lu
- *AI and You: How to Think, Create and Collaborate with AI*, Dan Fitzpatrick

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
IV	SEC	100-199	KU4SECCAP103	3 (2T+ 1P)	60

Learning Approach (Hours/Week)		Marks Distribution				Duration of ESE (Hours)
Lecture	Practical/Internship	Tutorial	CE	ESE	Total	1 Hour 30 Minutes
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.

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
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CO1	2						2
CO2	2						
CO3	2						
CO4	2	2		2			2

COURSE CONTENTS

MODU LE	UNIT	DESCRIPTION	HOU RS
I	MODULE TITLE: Operating System Fundamentals and Installation		
	1	Overview of OS types: Windows vs. Linux	7
	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)	7
	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	8
	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	8
	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, touch, mv, rm -r, cat, chmod, chown 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.		30

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/win3>

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

KU4SECCAP104: FUNDAMENTALS OF CLOUD COMPUTING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	SEC	100-199	KU4SECCAP104	3(3+0)	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	-	-	25	50	75	1 Hour 30 Minutes

Course Description: This course introduces the fundamental concepts and techniques of cloud computing, including cloud architecture, virtualization, service and deployment models, and cloud platforms. It focuses on understanding how computing resources are delivered over the internet and how cloud technologies are used to store, manage, and process data efficiently. The course also covers cloud security, real-world applications, and emerging trends, enabling students to understand and apply cloud-based solutions to modern computing problems.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the fundamental concepts of cloud computing, evolution of computing, and basic cloud architecture.	U
2	Apply the concepts of virtualization and cloud technologies	A
3	Understand and use basic cloud platform services, pricing models, and management features on platforms like Amazon Web Services, Microsoft Azure, and Google Cloud Platform.	A
4	Understand the concepts of cloud security and applications, including risks and challenges, data security and privacy, backup and disaster recovery, real-world applications, big data integration, and emerging trends in cloud computing.	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	1	1	1			2
CO 2	3	2	3	1			2
CO 3	3	2	3	2	1		3
CO 4	2	1	2	3	2	2	3

COURSE CONTENTS

Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	MODULE TITLE- Introduction To Cloud Computing		8
	1	Introduction , Features of cloud computing, Benefits and limitations of cloud computing,	
	2	Evolution of computing platforms Mainframe → Client-Server → Distributed Systems → Cloud Computing	
	3	Cloud Deployment Models: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud	
	4	Cloud Service Models: PaaS, SaaS, IaaS, XaaS	
	5	Basic Cloud Architecture: Front end, Back end	
2	MODULE TITLE- Virtualization And Cloud Technologies		8
	1	Virtualization ,Types of virtualization, Application virtualization-Network virtualization, OS virtualization, Storage virtualization, Server virtualization, Data virtualization.	
	2	Tools and Products available for Virtualization	
	3	Data Centers in Cloud computing	
3	MODULE TITLE- Cloud Platforms And Service Management		10

	1	Cloud Service Providers: Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform	
	2	Cloud Pricing Models: Pay as you go, Subscription model, Reserved Instances / Savings Plans, Spot Instances (AWS concept)	
	3	Cloud Management, Cloud Management Task: Auditing System Backups, Monitoring & Logging, Solution Testing and Validation Benefits of Effective Cloud Management	
4	MODULE TITLE- Cloud Security & Applications		10
	1	Introduction: Cloud security, Risks & Challenges in Cloud	
	2	Data Security & Privacy, Backup & Disaster Recovery	
	3	Real-world Applications of cloud	
	4	Introduction to Big Data and Cloud Integration	
	5	Emerging Trends in cloud: Edge computing, AI & ML, IoT and Cloud Integration, Green cloud computing	
5	Teacher Specific Module		9
	<i>Directions</i>		
	1.	Identify everyday apps and classify them under cloud services using platforms like Amazon Web Services, Microsoft Azure, and Google Cloud Platform.	

Essential Readings:

1. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Tata McGraw Hill Edition, Fourth Reprint, 2010
2. Mastering Cloud Computing – Rajkumar Buyya
3. Ronald L.Krutz, Russell vines, Cloud Security: A Comprehensive Guide to Secure Cloud
4. Kumar Saurabh, Cloud Computing, Wiley India
5. Gautam, Enterprise Cloud Computing Technology Architecture Applications, Shroff

Suggested Readings:

1. K. Chandrasekaran – Essentials of Cloud Computing
2. <https://www.slideshare.net/slideshow/fundamentals-of-cloud-computing-191620361/191620361>

3. https://www.lpude.in/SLMs/Master%20of%20Computer%20Applications/Sem_2/DECAP470_CLOUD_COMPUTING.pdf

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		50
Continuous Evaluation		25
a)	Test Papers	12
b)	Assignment	5
c)	Viva/Seminar	8
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)	60

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:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	MODULE 1:		
	1	Set Theory: Basic concepts- Set Operations, Properties of Set operations, Subset Venn diagram- Cartesian product.	12
	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.	12
	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.	
4	MODULE 4:		
	1	Planar graph- Shortest Paths in Weighted Graphs- Euler's Paths and Circuits, Hamiltonian Paths and Circuits.	12
	2	Storage representation and manipulation of graphs. Coloring, chromatic number.	
5	MODULE 5: Teacher Specific Module		
	Teacher can implement proper methodologies and evaluation metrics related with the topics		12

Essential Readings:

1. Discrete 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 Papers	15
b)	Assignment	10
c)	Viva/seminar/Case study	5
Total		100

KU3DSCCAP202: PYTHON PROGRAMMING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCCAP202	4(3+1)	75

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 hours

Course Description:

This course introduces students to the fundamentals of Python programming and its applications in software development, data analysis, and visualization. The course begins with core programming concepts such as variables, data types, operators, control structures, functions, modules, and data structures, enabling students to develop logical and structured programs. It further explores object-oriented programming principles, exception handling, file operations, and database connectivity for building reliable and modular applications.

The course also emphasizes scientific and data-oriented programming using NumPy, Pandas, and Matplotlib for numerical computation, data manipulation, analysis, and visualization. Students gain practical exposure to creating interactive graphical user interfaces and developing project-based applications using modern software development practices. Concepts such as modular coding, virtual environments, and version control with Git and GitHub are incorporated to prepare learners for collaborative and industry-oriented software development environments.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand and apply the fundamentals of Python programming including data types, control structures, functions, modules, and data structures to develop basic programs.	A
2	Apply object-oriented programming concepts, exception handling, file handling, and database connectivity to develop structured and reliable Python applications.	A/An

3	Perform numerical computation, data analysis, and visualization using NumPy and Matplotlib.	An
4	Perform data analysis using Pandas	C
5	Develop interactive GUI and Apply software development practices including modular coding, virtual environments, and version control using Git and GitHub for project-oriented software development.	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	3	3	1	1	1	1	2
CO 2	3	3	2	2	1	2	2
CO 3	2	2	3	2	2	1	2
CO 4	2	2	3	2	2	1	2
CO 5	2	3	2	3	2	3	3

COURSE CONTENTS

Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	MODULE TITLE: Basics of Python		12
	1	Introduction to Python, features, Installing Python and setting up development environment, use of pip, Running python programs	
	2	Basics of Python-Variables and Data Types, Keywords, Mutable and Immutable objects, Operators and Expressions, Using Comments, docstring, Input and Output in Python, Working with strings , Formatting output, fstring.	
	3	Data Structures in Python-working with Lists, Tuples, Sets and Dictionaries-operations and methods.	

	4	Conditional statements, Loops, List comprehension, Dictionary comprehension. Range and enumerate functions.	
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2	MODULE TITLE-Functions, OOP and other Concepts		11
	1	Functions- define and call functions, return statements, different types of arguments and scope and lifetime, Lambda functions, Modules and packages.	
	2	Object-Oriented Programming (OOP) Basics-Classes and objects Constructors and destructors,OOP Concepts - Inheritance, Polymorphism, Encapsulation and abstraction, Method overriding, Operator overloading.	
	3	Exception Handling- Types of errors, Built-in Exceptions -IndexError, OverflowError, ZeroDivisionError,RuntimeError, try, except, else, finally, raise statement, User-defined exceptions,Assertions.	
	4	File handling-Text files,CSV files-Open, Close, Read and write only, with statement, File Handling exceptions.	

3	MODULE TITLE -Python for Data Analysis		12
	1	Data Processing using NumPy-Introduction to Numerical Computing, Need for NumPy, Features of NumPy,Advantages of NumPy over Python Lists, Installing and Importing NumPy, NumPy Array Basics ndarray, attributes, dtype, create arrays(array, zeros, ones, empty, linspace, arrange, random), Two-Dimensional Array	
	2	Numpy- Indexing, Slicing,Copying, splitting and Shape Manipulation (reshape, transpose, resize), Flattening Arrays,Stacking Arrays, Broadcasting, Vectorized Operations, Matrix Operations- Basics,Matrix Addition and Multiplication,Dot Product, Cross Product, Matrix Transpose, Determinant, Inverse of Matrix, Eigenvalues and Eigenvectors,Rank of Matrix.	
	3	Introduction to Data Analysis-Introduction to Pandas, Data Structures-Series, DataFrame,Creating Series, Indexing, Slicing, Series Attributes, Operations on Series, Introduction to DataFrame, Creating DataFrames DataFrame Attributes, Row and Column Selection,Indexing and Slicing Accessing Rows and Columns- <code>loc[]</code> and <code>iloc[]</code> , Renaming Columns, Adding and Deleting Rows/Columns,Data Types in DataFrame.	
	4	Data Handling and Cleaning - Missing Data Handling, Duplicate Data Handling, Removing Duplicates, Replacing Values.Reading and Writing	

		Files- CSV Files, excel files and JSON Files, File Parameters and Options, Data Analysis using Pandas -Descriptive Statistics , Data Selection and Filtering Grouping and Aggregation-GroupBy, Aggregation Functions, Multi-level Grouping, Pivot Tables, Data merging and combining.	
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4	MODULE TITLE- Software development using Python and data visualisation		10
	1	GUI Programming with streamlit-Installing and running streamlit programs. Widgets- text_input() ,number_input() ,button() ,selectbox() ,radio() ,checkbox() ,date_input() ,Password Input ,Messages-Success, Error, Warning, Displaying Tables ,Simple Log in form, Student Registration Form.	
	2	Data Visualization -Matplotlib module,pyplot, figure(), axes, subplot(), plot(),formatting a plot -title(),text(), xlabel(), ylabel(), legend(), grid(),savefig(), show(), grid(),Line chart,Bar chart,Scatter chart, Pie chart,Histogram,Plotting Simple Mathematical Functions (sin x, x2).	
	3	Introduction to Software Development Practices -Modular Coding-importing modules, code reuse and project organisation,Virtual Environments,Git and GitHub Basics	

5	Teacher Specific Module : For practical courses add lab experiments		30
	<i>Directions</i>		
	• Write a program to count vowels, consonants, digits, and special characters in a string given as input. • Write a program to find the largest and second largest element in a list. • Write a program to count word frequency using a dictionary. • Write a program to sort dictionary by keys and the by values • Write a program using list comprehension to generate prime numbers. • Write a program to generate Fibonacci series using loops. • Sort strings by length using lambda function. • Sort dictionary using multiple values and lambda function. • Write a program to demonstrate Inheritance and polymorphism. • Write a program to read and write text files .Use exceptions. • Write a Python program using Pandas to create and analyze a student dataset containing student name, marks and grade. Use the following data: <pre>data = { "Name": ["Aman", "Diya", "Rahul", "Sneha", "Arjun"], "Marks": [78, 92, 85, 67, 74], "Grade": ["B", "A", "A", "C", "B"]}</pre> Perform the following operations: 1.Create a Pandas DataFrame using the given dataset.		

	2. Display the complete dataset. 3. Display the first 3 rows of the dataset. 4. Check whether the dataset contains missing values. 5. Create a histogram showing mark distribution. 6. Find median and standard deviation of marks. . • Create dataframe from the given data = {"Name": ["Aman", "Diya", "Rahul", "Sneha", "Arjun"], "Department": ["CS", "IT", "CS", "ECE", "IT"], "Marks": [78, 92, 85, 67, 74], "Attendance": [85, 90, 88, 75, 80], "Grade": ["B", "A", "A", "C", "B"]}. 1. Display Dataset Information 2. Display Statistical Summary 3. Display only student names and marks 4. Display students scoring more than 80 marks. 5. Sort students based on marks in descending order. 6. Add a new column named "Bonus" containing: 5 marks bonus for every student. • Using the above dataframe answer the following questions. 1. Create a new column named "Total" by adding marks and bonus. 2. Find average marks department-wise. 3. Count the number of students in each grade category. 4. Calculate: mean, median, standard deviation of student marks. 5. Display students having maximum attendance. 6. Increase marks of all students by 5. • Write a Python program using Pandas to clean and preprocess the following student dataset. Perform the following operations: • Create a DataFrame containing student details. • Identify missing values in the dataset. • Replace missing values in the Marks column using the mean value. • Remove duplicate rows from the dataset. • Convert student names into uppercase. • Rename the column Marks to Score. • Display the cleaned dataset. • Plot simple mathematical functions. • Create simple login form using streamlit • Create student registration form using streamlit • Sample program to use Git and Github	
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Essential Readings:

1. Al Sweigart ,Automate the Boring Stuff with Python: Practical Programming for Total Beginners.

2. Reema Thareja, *Python Programming Using Problem Solving Approach*, Oxford University Press (India).
3. Mark Summerfield, *Programming in Python 3 : A Complete Introduction to the Python Language*, Second Edition
4. THE NORTHERN HIMALAYAS, *Mastering Python: A Journey Through Programming and Beyond*, THE NORTHERN HIMALAYAS
5. Sheetal Taneja & Naveen kumar: Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications,
6. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.

Suggested Readings:

1. Introduction to Computation and Programming using Python, by John Guttag, 2 nd edition, 2016, PHI India.
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.

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)	75

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

MODU LE	UNIT	DESCRIPTION	HOURS
I	MODULE TITLE: Digital Systems Basics		
	1	Number Systems and Codes: Binary, Octal and hexadecimal conversions	10
	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	10
	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	12
	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	13
	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. Write a program to perform data transfer operations 3. 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. 4. 8086 Assembly program that takes two numbers, perform addition and subtraction 5. A program to swap two 8-bit numbers using a temporary variable. 6. Find the given number is odd or even. 7. Display numbers (0-9) using loop 8. A program for BCD addition of two 16 bit numbers. 9. A program to insert a byte into a string. 10. A program to check whether a string	30

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, 2nd 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)	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	-	35	65	100	1:30

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

M O D U L E	U N I T	DESCRIPTION	HOURS
1	MODULE TITLE: Linear Algebra & Calculus		12
	1	Vector: Definition of vectors, Real coordinate spaces, Magnitude of a vector	
	2	Vector operations: addition, scalar multiplication, visualisation	
	3	Linear Independence, bases, dimension	
	4	Vector dot products, Interpretation of dot product	
	5	Orthogonal vectors	
	6	Matrix, Linear transformations, Eigen value, Eigen Vector (Geometric interpretation of concept)	
	7	Differentiation: Concept, Rate of change, slope of a function, Visualisation	
	8	Partial Derivatives: Concept, Derivatives w.r.t. one variable in multivariable functions, Gradient	
	9	Maxima and Minima (Optimization), Using first and second derivative	
	10	Integration: concept, Definite Integral, indefinite Integral, Area under curve	
	11	Examples to illustrate applications in Computer Science	
2	MODULE TITLE: Algebraic Structure & Number Theory		10
	1	Group: Closure, Associativity, Identity, Inverse Abelian Group, Cyclic Group	
	2	Modular Arithmetic, Addition and Multiplication modulo, Modular Inverse, Euclidean Algorithm, Extended Euclidean Algorithm Primality Testing	
3	3	Examples to illustrate applications in Cryptography	
	MODULE TITLE: Probability		12
	1	Experiment and sample space, events and operations with events (Union, Intersection, Complement of Events)	
3	2	Exclusive and exhaustive events, equally likely events with examples.	
	3	Probability of an event, basic probability rules, conditional probability.	

	4	Bayes' Theorem	
	5	Random Variables: Discrete and continuous random variable Probability distribution of a random variable, probability mass function, probability density function	
	6	Expectation and variance of a random variable	
	7	Standard Probability Distributions: Binomial probability distribution, Poisson probability distribution, Normal probability distribution, Measures of shapes	
(Focus on problem sets involving real-world applications of probability. Real-world scenario of Binomial, Poisson and Normal Distribution.)			
4	MODULE TITLE: Statistics		11
	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)	
	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.	
5	Module: Teacher specific module : Lab		
		Explore fundamental vector operations—addition, scalar multiplication, dot product, and transformation—using GeoGebra. $\vec{u}=(3,2)$ $\vec{v}=(1,4)$	30

	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	
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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 <table><tr><th>Day</th><th>Emails_Received</th></tr><tr><td>1</td><td>15</td></tr><tr><td>2</td><td>12</td></tr><tr><td>3</td><td>18</td></tr><tr><td>.....</td><td>.....</td></tr></table>	Day	Emails_Received	1	15	2	12	3	18									
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 <table><tr><th>User_ID</th><th>Session_Duration</th><th>Age</th><th>Device_Type</th></tr><tr><td>1</td><td>5</td><td>18-25</td><td>Mobile</td></tr><tr><td>2</td><td>10</td><td>26-35</td><td>Desktop</td></tr><tr><td>3</td><td>12</td><td>18-25</td><td>Mobile</td></tr></table>	User_ID	Session_Duration	Age	Device_Type	1	5	18-25	Mobile	2	10	26-35	Desktop	3	12	18-25	Mobile	
User_ID	Session_Duration	Age	Device_Type																
1	5	18-25	Mobile																
2	10	26-35	Desktop																
3	12	18-25	Mobile																

		<table><tr><td>4</td><td>8</td><td>36-45</td><td>Tablet</td></tr><tr><td>5</td><td>15</td><td>26-35</td><td>Desktop</td></tr><tr><td>6</td><td>20</td><td>18-25</td><td>Mobile</td></tr><tr><td>7</td><td>18</td><td>26-35</td><td>Desktop</td></tr><tr><td>8</td><td>25</td><td>36-45</td><td>Tablet</td></tr><tr><td>9</td><td>6</td><td>18-25</td><td>Mobile</td></tr><tr><td>10</td><td>35</td><td>26-35</td><td>Desktop</td></tr></table>	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						
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 ρ Sample dataset <table><tr><th>Student_ID</th><th>Coding_Hours</th><th>Exam_Score</th></tr><tr><td>1</td><td>5</td><td>55</td></tr><tr><td>2</td><td>12</td><td>78</td></tr><tr><td>3</td><td>8</td><td>65</td></tr><tr><td>4</td><td>15</td><td>85</td></tr><tr><td>5</td><td>7</td><td>62</td></tr><tr><td>6</td><td>10</td><td>70</td></tr><tr><td>7</td><td>3</td><td>50</td></tr><tr><td>8</td><td>20</td><td>90</td></tr><tr><td>9</td><td>6</td><td>58</td></tr><tr><td>10</td><td>11</td><td>75</td></tr></table>	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	
Student_ID	Coding_Hours	Exam_Score																																		
1	5	55																																		
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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 <table><tr><th>Day</th><th>Humidity</th><th>Wind_Speed</th><th>Pressure</th><th>Temperature</th></tr><tr><td>1</td><td>60</td><td>15</td><td>1012</td><td>32</td></tr><tr><td>2</td><td>70</td><td>12</td><td>1010</td><td>30</td></tr><tr><td>3</td><td>55</td><td>20</td><td>1015</td><td>34</td></tr><tr><td>4</td><td>80</td><td>10</td><td>1008</td><td>28</td></tr><tr><td>5</td><td>65</td><td>18</td><td>1011</td><td>31</td></tr><tr><td>6</td><td>50</td><td>22</td><td>1016</td><td>35</td></tr></table>	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
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																																	

Model Questions

Module 1

Let the vector $\vec{v} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

A transformation is applied using the matrix

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

- Find the result of the transformation A. $\vec{v}$
 - Describe what happens to the direction and length of the vector after transformation.
- 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?
 - How does scalar multiplication affect the **magnitude** and **direction** of a vector?
 - 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?
 - $f(x,y)=x^2+y^2$ represents the "elevation" of a surface. What does $\partial f/\partial x$ represent in this case?
 - 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

- In modular arithmetic, $17 \equiv 5 \pmod{12}$. What does this mean in simple terms?
- 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

- 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
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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
[To be offered as Minor course]

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC	200-299	KU3DSCCAP205	4(3+1)	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	-	35	65	100	1:30

Course Description: *This course provides non-computer science students with fundamental knowledge and practical skills in Linux system administration. The course introduces Linux operating systems, command-line operations, file and user management, installation, networking, shell scripting, and routine administrative tasks. Emphasis is given to hands-on learning and practical system administration activities.*

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the basic concepts of Linux operating systems, Linux file systems, and command-line environments.	U
2	Use Linux commands for file handling, directory management, text editing, and file system navigation.	A
3	Perform basic Linux administration tasks including user management, permission handling, process monitoring, and software installation.	A,C
4	Configure basic networking functions and use Linux tools for connectivity	A,C
5	Develop simple shell scripts and perform routine system maintenance, backup and scheduling in Linux environments.	A,AN,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	3	1	1	1	1	2
CO 2	3	3	2	2	1	2	2
CO 3	2	2	3	2	2	1	2
CO 4	2	2	3	2	2	1	2
CO 5	2	3	2	3	2	3	3

COURSE CONTENTS

Contents for classroom transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	Basics of Linux OS		11
	1	Introduction to Operating Systems ,Introduction to Linux and Open Source Software, Features and Advantages of Linux, Linux Distributions	
	2	Linux File System Structure, Understanding Terminal and Shell, Basic Linux Commands: pwd, ls, cd, mkdir, rmdir, touch, cp, mv, rm, clear, history	
	3	Viewing File Contents: cat, more, less File Searching and Filtering: find, grep File Compression and Archiving: zip, unzip, tar	
	4	Introduction to Text Editors: nano / vi basics	

2	User Management and Process Administration		12
	1	Linux Users and Groups, Types of Users User Account Management : adduser, passwd (with -l and -u option) , deluser, usermod	
	2	Group Management: groupadd, groupdel, usermod, gpasswd File Ownership, File and Directory Permissions Commands: chmod, chown, chgrp	
	3	Understanding Linux Processes, Foreground and Background Processes Viewing Running Processes: ps, top Process Control Commands : kill, jobs	
3	Software Installation and Networking Basics		12
	1	Linux Package Management, Installing and Removing Software: apt / yum basics	
	2	System Update and Upgrade, Managing Linux Services, Starting and Stopping Services	
	3	Introduction to Networking Concepts, IP Address Basics, DNS Concepts	
	4	Network Configuration Basics, Network Commands: ping, ip/ifconfig, netstat	
4	Shell Scripting and System Maintenance		10
	1	Introduction to Shell Scripting, Bash Shell Basics Writing Simple Shell Scripts, Variables and User Input	
	2	Conditional Statements, Loops in Shell Scripting File Handling in Scripts: Create, Read and display file, Rename files automatically, Delete temporary files, Check whether a file/dir exists, Create a backup script, Search for a word inside a file, Count the number of files in a directory, Create an Automatic backup scripts	
	3	Automating Simple Administrative Tasks, Scheduling Jobs using cron, Backup and Restore Basics	
	4	Basic Troubleshooting Techniques: Checking system date and time, Viewing hostname, Viewing Linux/Distribution version, Permission denied errors, Checking file ownership and permissions, Searching files, Checking user	

		details, Checking installed software, Package installation errors, Checking internet connectivity, Viewing IP address	
5	Teacher Specific Module : Lab experiments		30
	<i>Directions</i>		
	● Installation of Linux OS Basic Linux Commands ● Navigating directories using cd command ● Creating, copying, moving, and deleting files ● Viewing and editing text files, - touch, cat, vi ● Searching files and text contents File Compression and Archiving ● Compressing and extracting files using zip and tar User and Permission Management ● Creating users and groups ● Changing passwords ● Assigning file permissions ● Changing ownership of files and directories Process and System Monitoring ● Viewing running processes ● Managing background and foreground jobs ● Checking disk space and memory usage Shell Scripts ● Write a shell script to display a welcome message. ● Write a shell script to display the current logged-in username. ● Write a shell script to accept a name from the user and display it and create a user in that name ● Write a shell script to check whether a file exists. ● Write a shell script to create a new directory. ● Write a shell script to display the current date and calendar. ● Write a script for Automatic Daily Backup. ie., a script that can be used in offices, and companies to automatically back up important files, periodically. ● Write a script for Internet Connectivity Check, i.e., to verify whether the system is connected to the internet. Software and Service Management ● Installing software packages ● Updating Linux systems ● Starting and stopping services Networking Activities ● Checking IP configuration ● Testing network connectivity using ping System Administration Tasks		

	• Scheduling tasks using cron • Performing basic troubleshooting activities	
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Essential Readings:

- UNIX and Linux System Administration Handbook, 5th Edition, by Trent R. Hein, Evi Nemeth, Garth Snyder, Ben Whaley, Dan Mackin, O'Reilly
- Linux Administration: A Beginner's Guide, Wale Soyinka, sixth edition
- Linux Command Line, A Complete Introduction, William Shotts, No Starch Press.
- Unix Shell Programming, Yashavant Kanetkar
- Linux Shell Scripting Cookbook, Shantanu Tushar & Sarath Lakshman

Suggested Readings:

- Linux Basics For Hackers
- <https://labex.io/tutorials/linux-online-linux-terminal-and-playground-372915>
- <https://ubuntu.com/tutorials/command-line-for-beginners#1-overview>

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

Employability for the Course: After completing this course, students will acquire practical Linux administration and command-line skills that are useful in academic, office, networking, cloud, and IT support environments. The course improves technical confidence, troubleshooting ability, and system handling skills

KU3DSCCAP206: MOBILE APPLICATION DEVELOPMENT
[To be offered as Minor course]

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCCAP206	4 (3T+ 1 P)	75

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	10
	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	12
	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	12
	2	Button, Radio Button, CheckBox, ImageButton, ToggleButton, Rating Bar	
	3	ListView, Gallery View, AutoText Complete	
	4	User interaction with Views and Activities	

	MODULE TITLE: Handling Pictures and Menus with Views and data storage		
IV	1	Creating Menus: options Menu, Context Menu, Sub menu	11
	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		30
	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		

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, 4th Edition.
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

KU3DSCCAP207: DATA ANALYTICS USING PYTHON
[To be offered as Minor course]

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
3	DSC	200-299	KU3DSCCAP207	4(3+1)	75

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 course introduces students to the fundamentals of Python programming and data analytics techniques especially used in business environments. It focuses on handling CSV and Excel datasets, applying basic statistical analysis, performing data manipulation using NumPy and Pandas, and creating visual reports using Python libraries.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the basic concepts and applications of Data Analytics	U
2	Apply Python programming fundamentals for solving simple analytical problems.	A
3	Perform basic statistical analysis such as mean, median, mode, standard deviation, and correlation on business datasets.	A
4	Perform basic data cleaning, filtering, sorting, and grouping operations on real-world datasets and handle and analyze CSV and Excel datasets using Pandas library.	A
5	Develop simple data analytics solutions for sales, finance, customer, and student-related datasets and create charts, graphs, and visual reports for business decision-making using Python visualization libraries .	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	1	2	2	1	1	2
CO 2	3	3	2	2	1	1	2
CO 3	2	2	3	2	2	1	3
CO 4	2	2	3	2	2	1	2
CO 5	3	2	3	3	2	2	3

COURSE CONTENTS

Contents for Classroom Transaction:

MOD ULE	U N I T	DESCRIPTION	HOURS
1	MODULE TITLE- Introduction to Data Analytics and Python		11
	1	Introduction to Data Analytics-Meaning and importance of Data Analytics, Applications of Data Analytics, Data analytics definition-steps in data analytics,Types of Analytics- Descriptive Analytics, Diagnostic Analytics, Predictive Analytics.	
	2	Statistics for Data Analytics -Mean,Median,Mode,Variance,Standard Deviation,Correlation,Covariance	
	3	Introduction to Python -Features of Python for data analysis,Installing Python and Jupyter Notebook and Google colab,Running Python Programs Keywords in Python,Statements , Comments , Indentation , Variables and Data Types,Operators and Expressions,Input and Output statements, Strings.	
	4	Python Data Structures (Concept and basic methods only) -Lists,Tuples,Dictionaries,Control structures- Branching and Looping Statements,Functions - built in functions-print(), input(),len(),range(), sum(), max(), min(), sorted() , user defined function-def, function call and return statement.	
2	MODULE TITLE- PROCESS OF DATA ANALYSIS and Introduction to Pandas		12

	1	Process of Data Analysis- Define the Problem, Collect Data, Data Cleaning, Analyzing the Data, Data Visualization, Presenting Data(Dashboard)	
	2	Sources of data -primary and secondary data- Data types -structured and unstructured data,Data collection methods -- Methods to collect primary and secondary data	
	3	Introduction to Pandas- Why Pandas used for data analysis? Pandas data structures- Series, DataFrames , how to create series and Data Frames- Read and Write Excel and CSV files-read_excel(),to_excel, read_csv() , to_csv()	
	4	Pandas- Inspecting data set- describe(), info(),dtypes(), head() and tail() functions. Selecting Rows and Columns- loc(0, iloc(), Filtering , Sorting. Load datasets of real- world applications like Student Mark Analysis,Sales Analysis, Employee Dataset etc.	

3	MODULE TITLE		12
	1	Data preprocessing techniques - Data cleaning -Removing duplicates, Handling Missing values - What is Missing data, Why does it occur? Types of Missing data, Why missing data handling is important? , Strategies for Handling Missing data- Deletion, Pairwise deletion, Imputation methods- Mean, Median, Mode, K Nearest neighbour, Multiple Imputation, Use Missing as category, Domain specific substitution	
	2	Feature engineering- Encoding categorical variables, Detecting Outliers- Visualisation, Z-Score Method, IQR, Dealing with Outliers- Trimming/Remove the outliers- Quantile Based Flooring and Capping-, Mean/Median Imputation, Transformations	
	3	Handling Large Data sets- Sampling techniques, Different types of sampling, Data Transformation Techniques- Normalization, Standardization, Log Transformation, Box-Cox Transformation, Benefits of Data Transformation.	

4	MODULE TITLE		10
	1	Data Cleaning and Preprocessing using Pandas- Load dataset, Detect Missing Values -isnull(0, notnull(), Count Missing Values -isnull().sum() ,Remove Missing Values -dropna() , dropna(axis=1) , Fill Missing Values - Fill with Constant Value fillna(), with mean, forward fill, Backward fill, Application on real world datasets.	

	2	Removing Duplicate Records -duplicated(), drop_duplicates(), Correcting Data Formats -dtypes(), astypes(), to_datetime(),String Cleaning Operations -str.strip() ,str.lower(), str.upper(), replace(), Filtering Incorrect Data -query(), Sorting -sort_values(), sort_index(), Grouping Data-groupby, Aggregate functions.	
	3	Data Visualization using pandas-Visualization, Importance of visualisation, plot(), Line chart, scatter plot, Barchart, Histogram.Save plot.	
	4	Data cleaning and preprocessing of real world application data sets.	

	Teacher Specific Module : Lab experiments		30
	<i>Directions</i>		
	5	1. Create a list containing city names. Display all city names in uppercase. Sort city names alphabetically. Find the city name with maximum length. Count the total number of cities. Check whether a particular city exists in the list. 2. Create a sales dictionary with product names and sales values. Display all products and sales. Find the product with maximum sales. Calculate total sales.Add a new product to the dictionary. Delete a product from the dictionary. 3. Input a string with extra spaces. Remove leading and trailing spaces. Convert text to lowercase. Convert text to uppercase. Replace a specific word. Display cleaned string. 4. Create a dictionary containing student name, roll number, and marks. Display the student details. Add grade information to the dictionary.Update marks value. Display only dictionary keys. Display only dictionary values. 5. Create a list of numbers. Append a new number. Insert a number at a specific position. Remove a number from the list. Find the sum of all numbers. Reverse the list. 6. Create and display a Series containing sales values. Create a DataFrame for Student Records and store Name, Marks, and Grade in a DataFrame. a. Display First and Last Rows of a Dataset ,Display Dataset Information b. And Generate Statistical Summary . Interpret the results. 7. Load sales dataset from csv file /excel file. Find total sales, average sales, maximum and minimum sales. Display customers with sales greater than a specific amount. Sort sales data . 8. Load dataset,detect Missing Values in Dataset, Fill Missing Values,Remove Missing Records,Detect Duplicate Records, Remove Duplicate Records,Correct Data Types, Perform String Cleaning Operations	

	9. Load dataset, Select Specific Columns from Dataset, Select Rows using loc[] and iloc[], Filter Dataset using Conditions, Query Dataset using query(), Filter sales greater than a specified value. 10. Load dataset, Sort Dataset in Ascending Order, Sort Dataset in Descending Order, Group Dataset using groupby(), Calculate Group-wise Average, Count Group-wise Records 11. Load sales dataset, Calculate descriptive statistics like Mean, Median, and Mode, Study sales variability using Variance and Standard Deviation, Find Correlation between Columns : Advertisement vs sales analysis. 12. Load dataset, handle missing values and duplicates and create Line Chart using Pandas for Monthly sales trend analysis. 13. Load dataset, handle missing values and duplicates create Bar Chart using Pandas for Product-wise sales comparison. 14. Load dataset, handle missing values and duplicates create Histogram using Pandas for Student marks distribution. 15. Load dataset, handle missing values and duplicates create Scatter Plot using Pandas for Advertisement expenditure vs sales.	
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Essential Readings:

1. Peter Bruce & Andrew Bruce, Practical Statistics for Data Scientists -50 Essential Concepts, O'Reilly Media, Inc.
2. Al Sweigart, "Automate the Boring Stuff with Python: Practical Programming for Total Beginners", Published by No Starch Press.
3. Foster Provost and Tom Fawcett, "Data Science for Business" .
4. Wes McKinney, "Python for Data Analysis".
5. Laura_Igual, Santi Seguí, "Introduction to Data Science-A Python Approach to Concepts, Techniques and Applications", 2nd Ed.

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

**KU3DSCCAP208: WEB DESIGN AND DEVELOPMENT USING CONTENT
MANAGEMENT SYSTEM
[To be offered as Minor course]**

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC	200-299	KU3DSCCAP208	4(3+1)	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	-	35	65	100	1:30

Course Description: This course provides comprehensive contents to Content Management Systems (CMS), Wordpress, and its role in managing digital content. Students will learn the fundamentals of CMS, its features, and how to implement and manage the CMS platform. The course covers the importance of CMS, types of CMS platforms, features and functionality, installation and configuration, content management hands-on, and advanced Wordpress topics.

Course Prerequisite: Fundamentals of Web Development

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Identify the concept of Content Management System and its importance	U An
2	Demonstrate proficiency in installing, configuring, and customizing WordPress for different website requirements	U A
3	Develop a website with different contents like text, image, video, links etc.,	A C
4	Design and manage digital content using a CMS. Learn advanced maintenance practices for a website	A C

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

Mapping of Course Outcomes to PSOs

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	1	1	2	1	1	2
CO2	3	3	2	2	1	1	2
CO3	3	3	2	2	1	2	2
CO4	3	2	2	3	2	2	3

COURSE CONTENTS

Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	Introduction to Content Management Systems		11
	1	Basics of Web Designing -World Wide Web (WWW), W3C, Web Browser, Web Server, Web Hosting, Web Pages, DNS, URL	
	2	Overview of HTML (Concept only) and its role in Web Development Overview of Content Management Systems, Importance and benefits of using CMS	
	3	Types of CMS platforms: Open-source vs. proprietary	
	4	Comparison of popular CMS platforms: WordPress, Joomla, Drupal	
2	WordPress Fundamentals		12
	1	Installation and setup of WordPress	
	2	Exploring the WordPress dashboard and interface	
	3	Understanding WordPress themes and templates	
	4	Customizing WordPress themes using HTML and CSS	
	5	Creating and publishing different types of content (posts, pages, media	
3	Content Creation and Management		12

	1	Organizing content with categories and tags, Utilizing WordPress editor for content creation and formatting	
	2	Incorporating multimedia elements (images, videos, audio) into content	
	3	Managing comments and discussions on WordPress site	
	4	Comparing WordPress with other popular CMS platforms such as Joomla and Drupal	
4	Advanced WordPress Techniques		10
	1	Implementing custom post types and taxonomies	
	2	Introduction to theme development with WordPress	
	3	Utilizing child themes for customization without affecting core themes	
	4	Introduction to WordPress APIs for extending functionality	
5	Teacher Specific Module		30
	List of Lab Experiments		
	Experiment 1: Installation and Setup of WordPress Aim: To install and set up WordPress and explore its dashboard Steps: Install and start Apache and MySQL using XAMPP/WAMP Download WordPress and extract it into htdocs folder Create a database using phpMyAdmin Run WordPress setup through browser (localhost) Enter database details and create admin account Login to WordPress dashboard Explore options like Posts, Pages, Media, Appearance, Plugins, Settings Expected Output: WordPress is successfully installed and dashboard is accessible Experiment 2: Creating and Managing Pages Aim: To create and manage pages in WordPress. Create pages: Home, About Us, Contact Steps: Login to WordPress dashboard Go to Pages → Add New		

	Enter page title and content Publish the page Explore page templates (default, full-width, etc.) Edit and update page content Expected Output: Multiple pages are created and displayed on the website Experiment 3: Customizing Themes Aim: To change and customize WordPress themes, Apply and customize a theme Steps: Go to Appearance → Themes Browse and install a new theme Activate the theme Go to Appearance → Customize Change site title, colors, fonts, and layout Modify header, footer, and background Expected Output: Website appearance changes according to selected theme and customization Experiment 4: Installing and Testing Plugins Aim: To install and test WordPress plugins. Install plugins for different functionalities Steps: Go to Plugins → Add New Search for plugins (SEO, Contact Form, Gallery) Install and activate plugins Configure plugin settings Test functionality (e.g., submit contact form, check SEO suggestions) Expected Output: Plugins are installed and working as expected Experiment 5: Creating Custom Menus Aim: To create and manage navigation menus. Create a menu for site navigation Steps: Go to Appearance → Menus Create a new menu Add pages (Home, About, Contact) to menu	
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	Arrange menu items (drag and drop) Assign menu to primary navigation location Save menu Expected Output: Custom navigation menu is created and visible on website Experiment 6: Adding Media to Website Aim: To add and manage media files in WordPress. Add images, videos, and audio Steps: Go to Media → Add New Upload images, videos, or audio files Insert media into pages/posts Adjust size, alignment, and captions Preview the page Expected Output: Media files are successfully displayed on the website.	
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Essential Readings:

- Professional WordPress: Design and Development" by Brad Williams, David Damstra, and Hal Stern
- WordPress For Dummies" by Lisa Sabin-Wilson 4. WordPress: The Missing Manual" by Matthew MacDonald
- Learning WordPress: A Step by Step Tutorial to Build Your WordPress Website" by John Richards University
- WordPress Codex: <https://codex.wordpress.org/>
- <https://deanebarker.net/books/squirrel/>

Suggested Readings:

- <https://www.tutorialspoint.com/wordpress/index.htm>
- <https://learn.wordpress.org/>
- <https://www.youtube.com/channel/UChA624rCabHAmD6lpkLOW7A>

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

7. Employability for the Course:

- a. After completing this course, students can work as: WordPress Developer (Beginner / Junior Level), Web Designer, CMS Developer, Website Administrator, Front-End Developer (Basic Level), Freelance Website Developer, Blogger / Content Manager.
- b. Students can find opportunities in: IT Companies and Web Development Firms, Digital Marketing Agencies, Startups and Small Businesses, E-commerce Companies, etc.,

KU3DSCCAP209: FUNDAMENTALS OF CLOUD COMPUTING
[To be offered as Minor course]

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC	200-299	KU3DSCCAP209	4(4+0)	60

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 introduces the fundamental concepts and techniques of cloud computing, including cloud architecture, virtualization, service and deployment models, and cloud platforms. It focuses on understanding how computing resources are delivered over the internet and how cloud technologies are used to store, manage, and process data efficiently. The course also covers cloud security, real-world applications, and emerging trends, enabling students to understand and apply cloud-based solutions to modern computing problems.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the fundamental concepts of cloud computing, including its characteristics, benefits and limitations, evolution of computing, deployment models, service models, and basic cloud architecture.	U
2	Apply the concepts of virtualization and cloud technologies, including different types of virtualization, data centers, cloud infrastructure, and resource management in cloud environments.	A
3	Understand and use basic cloud platform services, pricing models, and management features on platforms like Amazon Web Services, Microsoft Azure, and Google Cloud Platform.	A
4	Understand the concepts of cloud security and applications, including risks and challenges, data security and privacy, backup and disaster recovery, real-world applications, big data integration, and emerging trends in cloud computing.	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	1	1	1			2
CO 2	3	2	3	1			2
CO 3	3	2	3	2	1		3
CO 4	2	1	2	3	2	2	3

COURSE CONTENTS

Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	MODULE TITLE- INTRODUCTION TO CLOUD COMPUTING		12
	1	Introduction , Features of cloud computing, Benefits and limitations of cloud computing,	

	2	Evolution of computing platforms Mainframe → Client-Server → Distributed Systems → Cloud Computing	
	3	Cloud Deployment Models: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud	
	4	Cloud Service Models: PaaS, SaaS, IaaS, XaaS	
	5	Basic Cloud Architecture: Front end, Back end	

2	MODULE TITLE- VIRTUALIZATION AND CLOUD TECHNOLOGIES		12
	1	Virtualization ,Types of virtualization Application virtualization-Network virtualization - OS virtualization- Storage virtualization- Server virtualization- Data virtualization	
	2	Tools and Products available for Virtualization	
	3	Data Centers in Cloud computing	

3	MODULE TITLE- CLOUD PLATFORMS AND SERVICE MANAGEMENT		12
	1	Cloud Service Providers: Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform	
	2	Cloud Pricing Models: Pay as you go, Subscription model, Reserved Instances / Savings Plans, Spot Instances (AWS concept)	
	3	Cloud Management Cloud Management Task: Auditing System Backups, Monitoring & Logging, Solution Testing and Validation Benefits of Effective Cloud Management	

4	MODULE TITLE- CLOUD SECURITY & APPLICATIONS		12
	1	Introduction: Cloud security, Risks & Challenges in Cloud	
	2	Data Security & Privacy Backup & Disaster Recovery	
	3	Real-world Applications of cloud	

	4	Introduction to Big Data and Cloud Integration	
	5	Emerging Trends in cloud: Edge computing, AI & ML, IoT and Cloud Integration, Green cloud computing	

	Teacher Specific Module : For practical courses add lab experiments		12
	<i>Directions</i>		
5	- Identify everyday apps and classify them under cloud services using platforms like Amazon Web Services, Microsoft Azure, and Google Cloud Platform. - A college wants to move its learning management system from local servers to cloud infrastructure to support online classes and assignments. Compare on-premise and cloud solutions and Identify suitable cloud service model - An online shopping startup experiences heavy traffic during festival sales and needs scalable infrastructure. Suggest cloud deployment strategy - Create accounts in any two cloud storage platforms and compare their features. Compare storage size, sharing options, and user interface. Prepare a comparison table.		

Essential Readings:

- Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Tata McGraw Hill Edition, Fourth Reprint, 2010
- Mastering Cloud Computing – Rajkumar Buyya
- Ronald L.Krutz, Russell vines, Cloud Security: A Comprehensive Guide to Secure Cloud
- Kumar Saurabh, Cloud Computing, Wiley India
- Gautam, Enterprise Cloud Computing Technology Architecture Applications, Shroff

Suggested Readings:

- K. Chandrasekaran – Essentials of Cloud Computing
- <https://www.slideshare.net/slideshow/fundamentals-of-cloud-computing-191620361/191620361>
- https://www.lpude.in/SLMs/Master%20of%20Computer%20Applications/Sem_2/DECAP470_CLOUD_COMPUTING.pdf

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		70
Continuous Evaluation		30
a)	Test Papers	15
b)	Assignment	5
c)	Viva/Seminar	5
d)	Case study/activity	5
Total		100

KU4DSCCAP210: WEB TECHNOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC	300-399	KU4DSCCAP210	4(3+1)	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	35	65	100	1:30

Course Description: This course provides a comprehensive introduction to web development covering front-end and back-end technologies. It includes HTML5 for structuring web pages, CSS for styling and responsive design, JavaScript for client-side interactivity, and PHP with MySQL for server-side programming and database integration. The course emphasizes practical implementation through hands-on labs, mini-projects, and a final case study to develop full-stack web applications. Students will gain experience in designing dynamic, interactive, and data-driven websites following industry practices.

Course Prerequisite: Database Management System

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Develop structured and semantic web pages using HTML5.	C
2	Apply CSS to design visually appealing and responsive web interfaces.	A
3	Implement client-side interactivity using JavaScript, including DOM manipulation and form validation.	A,C

4	Build dynamic web applications using PHP for server-side processing and MySQL	A,C
5	Develop problem-solving skills through real-world web application projects.	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	2	3	1	1		1	2
CO 2	2	3	1	1		1	2
CO 3	3	3	2	2	1	1	2
CO 4	3	3	3	2	1	2	2
CO 5	3	3	2	3	2	3	3

COURSE CONTENTS

Contents for Classroom Transaction:

MODU LE	U NI T	DESCRIPTION	HOUR S
1	MODULE TITLE : HTML5 Fundamentals		12
	1	HTML5 Structure & Boilerplate	
	2	HTML tags and elements, Attributes	
	3	Semantic & Non-Semantic Tags	
	4	Text Formatting & Lists	
	5	Hyperlinks and navigation, image, audio, video integration	
	6	Tables	

	7	Forms & Input Types, HTML Form Validation	
	8	Iframe	
	9	HTMLBest Practices.	
2	MODULE TITLE : CSS		10
	1	CSS Basics, CSS Selectors, Id/Class/Universal Selectors	
	2	Colors, Units & Typography	
	3	Box Model	
	4	Margin, Padding & Border	
	5	Positioning, Backgrounds, Hover Effects	
	6	Responsive styling Overview : Viewport Meta Tag, Media Queries, Responsive Units, Flexbox Basics, Responsive Images	
3	MODULE TITLE : Introduction to JavaScript		12
	1	Introduction to JavaScript, Role of JavaScript in web development	
	2	Variables & Data Types	
	3	Operators, Conditional Statements, Loops	
	4	Arrays & Objects	
	5	Introduction to DOM Manipulation	
	6	Event Handling Basics: Mouse and keyboard events, Event handlers	
	7	JavaScript Form Validation Basics	
4	MODULE TITLE : PHP and MySQL		11
	1	Introduction to PHP: Uses of PHP	
	2	General Syntactic Characteristics - Primitives, Operations, and Expressions	

	3	Control Statements, Arrays, Functions, Pattern Matching	
	4	Form Handling	
	5	Cookies, Session Tracking	
	6	Basic MySQL Database Connectivity	
5	Teacher Specific Module :		30
	<i>Directions</i>		
	1. Version Control & Collaboration : Git Fundamentals, Repository Initialization, Staging, Commit, Branching, Merging, Resolving Merge Conflicts, GitHub Repository Creation, Push and Pull Operations, README Creation. 2. Create a webpage demonstrating text formatting tags and lists. 3. Design a webpage with hyperlinks, images, audio and video integration. 4. Create a student mark list using HTML tables. 5. Design a student registration form using different input types. 6. Implement HTML form validation using validation attributes. 7. Embed webpages or videos using iframe. 8. Create a personal portfolio webpage with: Header and navigation. About section. Skills list. Image integration, Contact information 9. Develop a simple landing page using semantic HTML tags. 10. Design a registration form using: Text fields, Email and password inputs, Radio buttons and checkboxes, Form validation attributes 11. Basic Webpage Styling using Selectors 12. Design a structured content page using text styling and box model. 13. Create structured layouts using CSS positioning and Flexbox. 14. Enhance UI using backgrounds and interactivity. 15. Design a web page to demonstrate Text alignment and Border colours using internal CSS 16. Create a simple responsive card layout using Flexbox and media queries. 17. Create a webpage and display messages using JavaScript. 18. Write a JavaScript program to check whether a student is eligible for admission based on marks. 19. Write a JavaScript program to store details of multiple products using an array of objects and display all product details using a		

	loop. Also display whether each product is Available or Not Available based on stock quantity. 20. Design a web page with a form to accept student details and calculate the result. The system should validate input fields and display whether the student has Passed or Failed based on marks entered. 21. Create a webpage where a button changes the text of a paragraph dynamically. 22. Create a login form and validate user inputs before submission. 23. Write a PHP program to perform arithmetic operations and display results. 24. Practice arrays and conditional statements in PHP. 25. Write a PHP program to store and display a username using cookies or session. 26. Write a PHP program to connect to a MySQL database and insert student records. 27. Simple Student Registration System - Form input (name, age, marks) - Store data in MySQL - Display stored records - Use sessions for login message 28. Case study : Develop a web application using HTML, CSS, JavaScript, PHP, and MySQL with form validation, data storage, and record display.	
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Essential Readings:

1. P. J. Deitel, H.M. Deitel, Internet & World Wide Web How To Program, 4/e, Pearson International Edition 2010.
2. Robert W Sebesta, Programming the World Wide Web, 7/e, Pearson Education Inc., 2014.
3. Bill Kennedy, Chuck Musciano, HTML: The Definitive Guide, 3rd Ed, O'Reilly Media
4. Flanagan David, JavaScript: The Definitive Guide, 6th Ed, O'Reilly Media
5. RasmusLerdorf, Kevin Tatroe, Peter MacIntyre, Programming PHP, 3rd Ed, O'Reilly Media

Suggested Readings:

1. Bob Boiko, Content Management Bible, 2nd Edition, Wiley Publishers.
2. Chris Bates, Web Programming Building Internet Applications, 3/e, Wiley India Edition 2009.
3. Dream Tech, Web Technologies: HTML, JS, PHP, Java, JSP, ASP.NET, XML, AJAX,
4. Jeffrey C Jackson, Web Technologies A Computer Science Perspective, Pearson Education Inc. 2009.

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

KU4DSCCAP211: DATABASE MANAGEMENT SYSTEM

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
4	DSC	200 - 299	KU4DSCCAP211		4 (3T+ 1P)	75
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: Foundations of Computers and Programming, 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:

M O D U L E	U N I T	DESCRIPTION	HOURS
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1	MODULE TITLE : Introduction & ER Model		11
	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		12
	1	Structure of relational Databases, Integrity Constraints	
	2	ER to Schema synthesis	
	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		12
	1	Relational algebra: select, project, SET operations	
	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		10
	1	Views: Creating and Using Views	
	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		
	Lab Experiments		30
	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.		
5	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 11. Create a view showing only employees with salary greater than 5000 12. Create a view with average salary per department 13. 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 (Just introduce data format by Insert Data, display data)	

	Frame and execute suitable SQL queries for your case study selected at the beginning.	
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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

KU4DSCCAP212: DATA STRUCTURES AND ALGORITHMS

Semester	Course Type	Course Level	Course Code		Credits	Total Hours
4	DSC	200 - 299	KU4DSCCAP209		4 (3T+ 1P)	75
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:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	INTRODUCTION		11
	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	12
	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		12
	1	Stacks: Definition, Representation of Stacks using Arrays and Linked List Operations on Stacks using Arrays and Linked List 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		10
	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.	
		TEACHER-SPECIFIC MODULE: LAB EXPERIMENTS USING C / C++	30
5		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 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.	
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Essential Readings:

1. Debasis Samanta, 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, Sartaj Sahni 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

KU5INTERN301:INTERNSHIP

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
V	Internship		KU5INTERN301	2	120

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
-	-	-	15	35	50	-

All students should undergo Internship of 2-credits during the fourth semester summer break 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.

The following guidelines are issued for students undertaking their internship as part of the BCA programme. Students are expected to adhere to these guidelines to ensure successful completion and academic credit.

3. Internship Duration and Completion

- a. Students may secure internships through the Internship Kerala Portal, managed by the Kerala State Higher Education Council (KSHEC). Internships offered through Central/State Govt. portals for offering internship/ apprenticeship/ skill development/ training programmes shall also be considered as equivalent to internship courses
- b. Private Sector Requirements: If the Internship Provider Organization (IPO) is from the private sector, the following conditions must be met.
 - i. Experience: Private organizations must have a minimum of 10 years of operational experience in their respective fields.
 - ii. Documentation: To ensure academic standards, colleges are advised to establish a Memorandum of Understanding (MoU) with these organizations, clearly outlining the scope and details of the internship.
- c. Following conditions shall be followed for research-focused internship
 - i. Host Institution: Research internships may be undertaken at any recognized higher education institution (not their parent institute), university department (not their parent department), research laboratory, or industry facility, provided the host possesses the requisite infrastructure for the proposed study.
 - ii. Students are also permitted to utilize Centers of Excellence or laboratories facilitated by State or Central Government agencies, including those within their parent institution.
- d. There should be a minimum 120 hrs. of engagement for the students of BCA in the Internship.
- e. Summer vacations and other holidays can be used for completing the Internship.
- f. In the BCA Honours program, institute/ industry visit or study tour can be part of Internship. Visit to national research institutes, research laboratories and places of scientific importance should be part of the study tour. A brief report of the study tour has to be submitted with photos.
- g. Extensions and Deadline Compliance: While the standard requirement is to complete the internship before the end of the Fifth Semester, the following exceptions apply
 - i. Extensions: In unavoidable circumstances, a student may be permitted to complete the internship before the end of the Sixth Semester, subject to prior formal permission from the University.
 - ii. Mandatory Registration: Regardless of when the internship is physically completed, all students must register for the internship course during the Fifth Semester course registration period. Failure to register during this window may result in a delay in credit awarding.

4. Nature and Continuity of Work

- a. The internship should be relevant to the field of Computer Applications / IT. The institution at which the Internship will be carried out should be prior-approved by the Department Council of the College where the student has enrolled for the UG Honours program.

- b. Students are encouraged to select work that can be extended into their final year project.
- c. The work undertaken should demonstrate practical application of technical skills such as programming, data analysis, web development, cybersecurity, etc.
- d. If deemed necessary, the Internship Supervisor is authorized to visit the internship sites to physically verify the nature of the work and monitor student performance.

5. Weekly Reporting and Guidance

- a. A faculty member in the department shall be assigned as an Internship Supervisor for each student at the beginning of the academic year by the Department for monitoring and supervising the student during the internship. In exceptional cases, a full time Post Doctoral Fellow in the department can also be the Internship Supervisor. Their duties include:
 - i. Mentorship: Guiding students in identifying interest areas and suitable internship placements.
 - ii. Monitoring: Supervise and monitor student progress throughout the internship period.
 - iii. Documentation: Maintaining records of the organization's consent, the Internship Mentor's evaluation report, and the student's final report.
 - iv. Evaluation: Conducting internal assessments and arranging examiners for the Viva Voce examination.
 - v. Coordination: It is recommended that the Supervisor conduct at least one formal meeting (online or offline) with the external Internship Mentor during the program
- b. Each student must report to their assigned faculty guide on a weekly basis to update on the progress of the work. Updates should include:- skills/tools learnt/implemented, tasks completed during the week, challenges faced and learning outcomes. Regular interaction with the guide is mandatory to ensure proper direction and progress

6. Work Documentation (Work Register)

- a. There shall be a designated Internship Mentor at the institute/organisation where the Internship is offered, who should monitor the regularity and performance of the student.
- b. The students should make regular and detailed entries, Daily activities, Hours worked Skills acquired etc., into a personal work book throughout the period of Internship. The workbook must be regularly signed and verified by the internship mentor/ authority at the organization.
- c. The work book will be a record of the progress of the Internship and the time spent on the work, and it will be useful in writing the final report. Refer the appendix for the format of the register

7. On completion of the internship

- a. At the end of the internship, students must have tangible work to demonstrate, such as a software application/module, website or system prototype. data analysis report or dashboard or any technical implementation relevant to their domain
- b. The outcome should clearly reflect the learning and contribution of the student.

8. Final Submission Requirements

- a. Students must submit the following upon completion:
 - i. Internship Report (well-documented and structured)
 - 1. The report must include the following components:

- a. Cover Page: Title of the internship, Student's Name, University Register Number, Academic Year, and the names of the College and Department.
- b. Declaration: A signed statement of authenticity by the student.
- c. Official Certificate: The original certificate signed by the Head of the Internship Institution.
- d. Content Body: A detailed account of the work performed, total duration of the engagement, and the specific learning outcomes achieved.
- ii. Internship Workbook register (day-wise) duly signed by the authority
- iii. Completion Certificate (provided by the organization)
- iv. Presentation and Demonstration of the developed work/project

9. Evaluation Criteria

- a. The internship will be evaluated based on:
 - i. Completion of required hours
 - ii. Quality and relevance of work
 - iii. Regular reporting and discipline
 - iv. Documentation and record maintenance
 - v. Report and work/project presentation and demonstration
- b. The credits and marks for the Internship will be awarded only at the end of fifth semester
- c. The evaluation of Internship shall be done internally through continuous assessment mode by a committee internally constituted by the Department Council of the college where the student has enrolled for the UG Honours program.
- d. There shall be no provision for improvement of marks once the internship evaluation is finalized
- e. To be valid for university records, the Internship Report must be formally signed by the Internship Supervisor and the Head of the Department.
- f. The internship shall be evaluated internally by a committee constituted by the Head of the Department (HoD), employing assessment methods appropriate to the nature of the internship.
- g. The Internship supervisor shall provide a performance rating on a scale of A (Excellent), B (Good), C (Average), and D (Poor), which will serve as the basis for awarding marks and credits. Marks and credits shall be assigned based on this grading scale. The official award of credits and marks shall be recorded only upon the conclusion of the Fifth Semester.

10. General Instructions

- a. Students must maintain professional conduct throughout the internship and adhere to the rules and policies of the organization.
- b. Must ensure originality in work, plagiarism or misconduct will lead to disqualification.
- c. Any issues or changes must be immediately reported to the internal supervisor.

The scheme of evaluation of CCA and ESE is given below:

Components of Evaluation of Internship	Weightage	Marks
CCA	30%	15
ESE	70%	35

Evaluation Type		Marks
ESE		35
a)	Presentation	20
b)	Viva	10
c)	Report	05
CCA		15
a)	Punctuality & Work book	05
b)	Acquisition of skill (Presentation/Viva/Practical Test)	10
Total		50

APPENDIX

SUMMER INTERNSHIP - WORK REGISTER FORMAT

Maintain a 100 page notebook for the Work Register

First Page

- Student Name
- Register Number
- Year & Semester
- Internship Title
- Organization Name, Address
- Duration (From – To)
- Internship Supervisor in the College
- Internship Mentor in the Organization, Name, designation and Contact

Second Page: Internship Details

- Organization short profile - one paragraph
- Department and work assigned for you
- Internship objectives
- Technologies/tools learnt/used
- Scope of work

Daily Work Log Format

Use the following structure for each day in a separate page:

Date :

Task Assigned :

Work Done - Description:

Tools / Technologies Used/Learnt:

Learning Outcome:

External Guide/Authority Signature:

Example Entries

Date: 06-04-2026

Task Assigned: Develop user input module for database

Work Done - Description: Created a Python script to accept user input (ID, name, age, course) and insert data into MySQL table. Implemented input validation and exception handling.

Tools/Technologies Used/Learnt: Python, MySQL, MySQL Connector

Learning Outcome: Learned dynamic user input handling, validation, and database insertion using Python

External Guide/Authority Signature:

Last Page - After completing the internship

1. Description about the technical skills gained

- Programming languages used/learnt
- DBMS used/learnt
- Tools used/learnt
- Frameworks used/learnt

2. Description about the soft skills developed

- Communication and Teamwork
- Time management
- Meeting the Deadlines
- Timely Submission of the work

3. Brief Report about the work

Acceptance Letter from the Internship Centre

Course Code: _____

1. Name of the Student: _____

2. Register No.: _____

3. Details of the Internship Centre Selected:

a. Name of the Centre: _____

b. Address of the Centre: _____

c. Nature of activities undergoing in the Centre: _____

- d. Proposed kind of engagement by the candidate at the Centre: _____

- e. Expected enhancement of skills/knowledge: _____

- f. Name of the Mentor: _____
- g. Contact No.: _____

Place: _____

Signature of the Student

Date: _____

COUNTERSIGNED

Name and Signature of the Mentor with Seal: