KL
(DEEMED TO BE UNIVERSITY)

STUDENT
handbook
2023-2024

Bachelor of Computer Applications

Department of CSA

Koneru Satyanarayana,
Chancellor

Sri Koneru Satyanarayana, BE, FIE, FIETE, MIEEE graduated in Electronics and Communication Engineering in the year 1977. Along with Sri Koneru Lakshmaiah, he is the co-founder of the Institute which was established in the year 1980. He is an educationist of eminence and also an industrialist of great repute. He runs a number of industries in and around Vijayawada.

Dr. K. S. Jagannatha Rao
Pro-Chancellor

Prof. K. S. Jagannatha Rao was one of the leading scientists in neuroscience research in globe. He was the Director on Institute for Scientific Research and Technological Advances (INDICASAT AIP), Republic Panama and contributed lot in building innovation in higher education and research in Panama since 2010. He played a key role in building PRISM (Panamanian Research Institutes of Science and Medicine) in Latin America. Dr. Rao has his research area on Brain Research and established Alzheimer's Centre and published 165 papers in leading Biochemistry and Neuroscience Journals, supervised 19 Ph.D students. He is also adjunct faculty of Biomedical Informatics of UTHS, Houston, and Advisory Board Member of UT- El Paso Minority Health NIH program, USA and Adjunct Faculty, Methodist Research Institute, Houston, USA. He was elected Member of Panamanian Association for the Advancement of Science (APANAC) - Considered as National Science Academy of Panama. He received his undergraduate and Ph.D degrees from Sri Venkateswara University, Tirupati. Later, joined in Central Food Technological Research Institute, Mysore. He received Sir C. V. Raman Award by Karnataka State Council of Science and Technology, 2003.

Prof. G P S Varma
Vice-Chancellor

Prof. G P S Varma, Vice-Chancellor, KLEF, is one of the most widely experienced leaders in Indian higher education, known for his commitment to expanding student opportunity, catalyzing academic innovation, and encouraging university's civic engagement and service to society. He adorned the position of Chairman, ISTE (Indian Society for Technical Education)- AP State, TSEMCET Test Committee Member-2021 nominated By Telangana State Govt, APEAMCET Admission Committee Member in 2016 by Andhra Pradesh State Council of Higher Education, Govt. of Andhra Pradesh. He has been a very farsighted Peer Team Visit Member for National Assessment and Accreditation Council (NAAC), Expert Committee Member for University Grants Commission (UGC) Autonomous Visits. He has been an Advisory Council Member for (CEGR) Centre for Education Growth, and Research India International Centre, New Delhi, and Board Member for Big-Data Analytics Forum.

Dr. A. V. S. Prasad
Pro-Vice Chancellor

Dr. A. V. S. Prasad, M.E and Ph.D from JNTU, Hyderabad is a professor in Civil Engineering. He has a rich experience of 33 years in academics which includes 26 years in administration at various cadres ranging from Head of Department, Dean, Principal, Director and Pro-Vice Chancellor. He has served as Director of Audisankara group of institutions and Narayana Group of Institutions for 18 years and was instrumental in getting these institutions accredited by NAAC, NBA, Autonomous and gained many laurels from the State Government, JNTU etc. He has served as Pro-Vice Chancellor of KL University for 3 years.

He has extensive knowledge of administrative system, maintaining statutory norms of bodies like AICTE, UGC etc and has a good understanding of NBA, NAAC procedures and norms. He served as Member, Chairman of Board of Studies at JNTU(A), KLCE(Autonomous) and KL University.

Dr. Venkatram Nidumolu
Pro-Vice Chancellor

Dr. Venkatram Nidumolu, Pro-Vice Chancellor is High performing, strategic thinking professional with more than 15years of administration experience and 20 years of teaching experience in KLEFand 30 years overall experience in the higher education sector. He graduated in B.Tech (ECE) from Acharya Nagarjuna University, pursued M.S degree from BITS, PILANI in software Systems. He received Ph.D award from Acharya Nagarjuna University. He held the positions like HOD, Joint Register, Principal, and Dean-Academics before becoming Pro-Vice Chancellor. He was core member of all NBA, NAAC, & other accreditations since 2004 and he has good experience in handling of quality issues and assessment related practices.

ACRONYMS

Sl No	Acronyms	Full Form
1	KLEF	Koneru Lakshmaiah Education Foundation
2	CET	Common Entrance Test
3	KLEEE	KLEF Engineering Entrance Examination
4	JEE	Joint Entrance Examination
5	BT	Biotechnology
6	CE	Civil Engineering
7	CS	Computer Science &Engineering
8	EC	Electronics & Communication Engineering
9	EE	Electrical & Electronics Engineering
10	CM	Computer Engineering
11	ME	Mechanical Engineering
12	AD	Artificial Intelligence & Data Science
13	CI	Computer Science & Information Technology
14	CGPA	Cumulative Grade Point Average
15	SGPA	Semester Grade Point Average
16	LTPS	Lecture, Tutorial Practical, Skill
17	SEE	Semester-End Examinations
18	SIE	Semester-In Examinations
19	OJET	On-the-job Engineering Training
20	IRP	Industrial Relations and Placements
21	PS	Practice-School
22	OPAC	Online Public Access Catalog
23	QCM	Quality Circle Meeting
24	MOOC	Massive Open Online Course
25	MOU	Memorandum of Understanding
26	OD	On Duty
27	(A,B]	Between A and B excluding value A and including value B
28	COE	Controller of Examinations
29	VLSI	Very Large-Scale Integration
30	MTech	Master of Technology
31	COA	Council of Architecture
32	JEE	Joint Entrance Examination
33	NATA	National Aptitude in Architecture

34	PC	Professional Core
35	BSAE	Building Science and Applied Engineering
36	PE	Professional Elective
37	PAECC	Professional Ability Enhancement Compulsory Courses
38	SEC	Skill Enhancement Course
39	OE	Open Elective
40	CTIS	Cloud Technology and Information Security
41	DS	Data Science
42	IoT	Internet of Things
43	IPA	Intelligent Process Automation
44	B.B.A.,LL.B.	Bachelor of Business Administration and Bachelor of Laws
45	LL.B.	Bachelor of Laws
46	BCI	Bar Council of India
47	CLAT	Common Law Admission Test
48	HM	Hotel Management
49	BTK	Basic Training Kitchen
50	QTK	Quantitative Training Kitchen
51	ATK	Advanced Training Kitchen
52	MBA	Master of Business Administration
53	BBA	Bachelor of Business Administration
54	MSc (F&C)	Master of Science (Finance & Control)
55	BA	Bachelor of Arts
56	M.Sc.	Master of Science
57	PCI	Pharmacy Council of India
58	PY	Pharmacy
59	B. Com (H)	Bachelor of Commerce with Honors
60	ACCA	Association of Chartered Certified Accountants

INTRODUCTION

The President of Koneru Lakshmaiah Education foundation, Er. Koneru Satyanarayana, along with Late Sri. Koneru Lakshmaiah founded the K L College of Engineering in the Academic year 1980-81. With the mighty vision and restless efforts of Er. Koneru Satyanarayana K L College of Engineering carved a niche for itself through excellence in engineering education, discipline and record numbers of placements and was the leading college in the state of AP. K L College of Engineering achieved NBA Accreditation for all its B.Tech. Programs in 2004 and later re-accredited in 2007. K L College of Engineering was transformed into an autonomous engineering college in the year 2006. In 2008 this college received a record grade of 3.76 on a 4 points scale with "A" Grade from NAAC; and in February 2009, the college, and Accredited by National Assessment and Accreditation Council (NAAC) of UGC as 'A++' with highest Grade of 3.57 CGPA on 4-point scale in 2018, through its founding society "Koneru Lakshmaiah Education Foundation" was recognized as Deemed to be University by the MHRD-Govt. of India, Under Section 3 of UGC Act 1956. This Deemed to be University is named as "KLEF".

Location

KLEF is situated in a spacious 100-acre campus on the banks of Buckingham Canal of river Krishna, eight kilometers from Vijayawada city. Built within a rural setting of lush green fields, the institute is a virtual paradise of pristine nature and idyllic beauty. The campus has been aptly named "Green Fields" and the splendid avenue of trees and gardens bear testimony to the importance of ecology and environment. The campus ambience is most befitting for scholastic pursuits. The University is situated in a built-up area of around 15, 00,000 sq.ft.

Vision

To be a globally renowned university.

Mission

To impart quality higher education and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all-round development of the students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.

Facilities

Central Library: E-Resources

The Central Library is the largest and holds materials to serve the whole University community. It has materials relevant to the Engineering, Science & Humanities courses offered by the University. The library system contains more than one lakh and fifty thousand books and periodicals on all subjects related to the teaching and research interests of the University staff and students. The library has over 36,000 electronic journal titles, academic databases and 32.98 lakhs eBooks. Access is available on campus on student computers and remotely.

The Data Centre

A State-of-the-Art Data center with advanced servers provides a highly interactive learning environment with full-fledged hardware and software training facilities.

Physical Education – Sports Facilities

KLEF encourages students to explore their latent talents by providing good games and sports facilities.

The institute is equipped with the following –

Sport/Game	No. of Courts	Sport/Game	No. of Courts
Athletic track	1	Handball Court	1
Hockey Field	1	Netball Courts	2
Badminton Courts	4	Throw ball courts	2
Tennikoit Courts	2	Beach Volleyball Court	1
Cricket Field with Net practice	3	Football Field	1
Volleyball Courts	2	Basketball Courts	2
Tennis Courts	2	Kabaddi Courts	2
Kho Kho Court	1	Table Tennis	6
Soft Ball	1	Chess	20
Archery	1	Caroms	12

The University has a State-of-the-Art Indoor Stadium of 30000 sq.ft. with:

- 4 wooden Shuttle Courts/ Basketball Court
- Yoga and Meditation Centre
- Dramatics
- 8 Table Tennis Tables
- Hobby Centre
- Gymnasium for Girls
- Gymnasium for Boys
- Multipurpose room with Chess, Caroms etc.
- Power lifting/Weightlifting

Accommodation – Hostels

- KLEF has separate hostels for boys and girls with well furnished rooms and modern amenities.
- The overall atmosphere is very conducive for the students to concentrate on their studies.
- A state- of – the- art kitchen and spacious dining area has been provided for both the hostels.
- Generators have been provided as power backup. Emphasis has been laid on hygiene and cleanliness for healthy living. A customized menu caters to the student needs, it keeps changing according to their tastes.
- Teaching staff will have to address the academic and personal problems of the students. Round-the-clock security, communication, dispensary facilities are also available.

Facilities in the Hostels

- Protected drinking water
- State of the art kitchen, dining hall
- Newspapers, telephones, toilets and bathrooms are well maintained.
- Every student in the hostel is provided with a cot, study table, chair and a rack.
- Fan and light are also provided in each room.
- Gas & Steam based hygienic food preparation.
- Palatable regional, national and international cuisines
- Cleanliness and Safety STD/ISD Facilities
- Medical Kits and First Aid Boxes Soft drinks, snacks, Fruits etc.
- Laundry Stationary shop

Hostel Rules and Regulations

- Students are hereby informed that while staying in the hostel, it is essential to be responsible for maintaining dignity by upholding discipline.
- They must be obedient to the hostel warden/floor in –charges. Valuable items like jewelry etc. should not be kept with students while staying in the hostel.
- It is student's own responsibility to safeguard her/his Laptops, Money by locking suitcases and bags.
- If any loss is found, management will not take any responsibility. Students must intimate to the hostel authorities before giving police complaints against losses.
- Students are not allowed to indulge in smoking; consumption of Alcohol, Narcotic drugs etc., and defaulters will be strictly viewed upon.
- Students are directed that after locking their rooms they must hand over the keys to security and can collect them on returning to the hostel.
- Students must switch off Fans, Lights, Geysers, A/C's etc., before leaving their rooms.
- Visitors are not allowed inside the hostel at any time; however, they are allowed into the visitor's hall with the prior permission of the warden.
- Only family members listed by the parents are allowed to contact the student. Visiting hours are up to 7.30 pm only and after 7.30 pm visitors are required to leave the premises.
- Hostel students are not allowed to come into the hostel after 3.00 pm for morning shift students and 6.00pm for day shift students.
- Those students who are utilizing the computer lab, library etc., after the times specified must submit the permission slip to the security while entering the hostel.
- During public holiday outings, those who seek permission to leave the hostel will have to obtain written permission from the warden. Permission will be given only to those students who get permission from parents to leave the hostel during holidays/outings.
- Moving out of campus without permission is strictly prohibited. Strict study hours from 7.30 am to10.30 pm shall be maintained in the hostel.
- The hostellers must be in their allotted rooms during study hours. The general complaints of any kind should be noted in the complaint register, which is available at the hostel office.
- Registered complaints will only be entertained. Any health problem should be brought to the notice of Warden/Floor In – charge for necessary treatment.

Transportation

The institution runs 80 buses covering all the important points in Vijayawada City, Mangalagiri, Guntur and Tenali towns with a total seating capacity of 4000 students in two shifts. Transport is available 24

hrs, In case of any emergency in the institute /hostels. Transportation is available for conducting industrial tours and visits etc. Regular transport facility available up to 10PM.

Healthcare

A full-fledged health centre with all the facilities is established to cater the needs of the students, staff, Faculty and the public in the adopted villages. It consists of three doctors (Homoeopathy, Ayurvedic and Allopathy).

Cafeteria

KLEF has a spacious canteen with the latest equipment and hygienic environment which provides quality food and prompts service and caters to the needs of all the students and staff. A central cafeteria of 1500 sq.m. is available on the campus. Mini cafes and fast-food centres are available in various blocks. The canteen is open from 6:30 a.m. to 8:30 p.m. There is a wide variety of North- Indian and South-Indian cuisine and the students enjoy the pleasure of eating during the breaks. Cool aqua water for drinking is available.

Placements

KLEF has meticulously planned to make all its outgoing students employed. The University had installed the infrastructure, employed well experienced faculty, designed and delivered programs that help to enhance the communication and soft skills which are required for making the students employable. An excellent system is in place that considers all the issues that make a student employable. The University has been successful for the last 7 years in employing all the students who have registered and eligible for placement through its offices located across the country. About 50 trained personnel work extensively to make the students ready for recruitment by the industry.

Counselling and Career Guidance

A special Counselling Cell consisting of professional student counselors, psychologists, and professors counsels/helps the students in preparing themselves to cope with studies, perform well in the tests & various competitions. This Cell provides its services to the students in getting the solutions for their personal problems and provides career guidance with the help of the Industrial Relations and Placements (IRP) department. A group of 20 students are allotted to each faculty member who counsels them regularly and acts as their mentor.

Social Service Wings

KLEF has a social service wing which is used to channelize the social service activities of the faculty, staff and students. It has adopted 5 nearby villages and conducts activities like medical camps, literacy camps and educates the villagers regarding hygiene and health care on a regular basis.

NSS/NCC Wings

NCC/NSS is a credit course designed with an intent to transform NCC/NSS activities into curricular activities from an extracurricular thereby providing credits to students involved in NCC/NSS along with other attended advantages to the students in the university.

Hobby Clubs

Wholly and solely managed by the students, contributed much to the cultural life of the campus and to the cultural evolution of the students. Few student bodies and clubs operate in the campus like music society, dance club, drama society, literary and debating club, English press club, drawing club,

painting club, mime club, computer club etc. Students manage entire activities and budget of the organization for the entire semester in advance. Around 4000 students are active members of the Hobby Clubs.

Life Skills and Inner Engineering

KLEF feels that it is its responsibility to mold the students as good human beings, contributing to the country and to society by producing responsible citizens. Along with the regular programs every student admitted into KLEF undergoes a one-week special life skills /orientation program. Through this program, KLEF is producing the students with clarity of thoughts and charity at heart. Strict regularity, implicit obedience, courtesy in speech and conduct, cleanliness in dress. Life skills and inner engineering teach a student his/her obligation towards GOD, himself /herself his/her country and fellow human beings. Every student is encouraged to practice his/her own religious faith and be tolerant and respectful towards other religions.

Technical Festival

KLEF organizes various programs for the all-round development of the students.

The technical festival and project exhibition is organized in the odd semester (October) every year to elicit the innovative ideas and technical skills of the students.

Cultural Festival

The cultural festival in the even semester (February) of every year is the best platform for the students to exhibit their talents and creativity. Through these festivals KLEF is imparting organizational skills, leadership skills, competitive spirit, and team behavior skills to our students. Along with the knowledge, KLEF festivals provide recreation to the student community.

Center for Innovation, Incubation and Entrepreneurship (CIIE)

KLEF being a pioneering institute supporting Academics and Research in Engineering, Science and Technology is endowed with the entire infrastructure and highly experienced faculty, has a Centre for Innovation, Incubation and Entrepreneurship (CIIE) that comprises of: Innovation Centre which aims to inculcate a spirit of innovation. Incubation Centre which aims to incubate innovations through prototype product development. Entrepreneurship Development Centre (EDC) which aims at fostering entrepreneurial skills among the students.

College of Law

KLEF College of Law was established in the Academic Year 2015-16 with the prior approval of the Bar Council of India (BCI). The College of Law at KL University is training students for the Five Year Integrated BBA.,LL.B. program as well as 3 Year LL.B. program and LL.M. in four specialization fields. College of Law also offers research activity with PhD both full time and part time. The College of Law makes constant efforts in the process of improving the infrastructure to provide best possible ambiance, library, internet and digital classrooms.

Vision

1. To be a centre of excellence in research oriented legal education in harmony with global technological advancement.
2. To be a catalyst in the process of social engineering in accordance with National and International legal scenario.

Mission

1. To impart and disseminate knowledge of law and legal processes with a sense of professional social responsibility and spread legal literacy in the community.
2. To offer quality legal education and training in the industry related activities and make them professionally competent.

Facilities

Moot Court

In order to facilitate the students to learn and develop legal advocacy skills, the College of Law aims at providing the students with best possible resources. We strongly believe that the student's performance in terms of learning and executing the professional skills, will enhance if they are given suitable infrastructural facilities.

The Moot Court Room at College of Law is in similar stature to that of an actual court room and creates an ambience of practical legal learning. The room gives a true experience of a court room with enhanced aura; it has court appearance and has a capacity to accommodate over 150 students in a single session. In addition to this, elevated seating for the judges alongside aptly positioned witness-box. The room is available for general classroom practice of the students as well as conducting Moot Court Competitions at national level.

Library

College of Law caters to the needs of the students and teachers with its huge and updated volume of books ofline and online. The library has an extensive and quality collection of over 3000 books and volumes of journals magazines and newspapers. Remote access to online database like Manupatra, LexisNexis, SCC Online, etc. is available at the library. We can comfortably accommodate the students on rolling basis.

Classrooms

Comfortable classrooms with adequate seating capacity are available at College of Law. The classrooms are well equipped for digital method of teaching. Projectors, speakers are pre-installed to give best mode of teaching.

Extension Activities

Legal Aid Club

Access to justice is immensely important as availability of justice and mere attainment of legal knowledge is not sufficient. The KLEF Legal Aid Committee consists of both students and guided by faculty members. The committee aims at imparting awareness regarding basic rights required to be known to the needy people. Regular legal awareness programs in and around Andhra Pradesh are organized.

Moot Court Society

The Moot Court Society is founded to develop the interests of students in the activity of mooting, facilitate students to understand intricacies of legal research, acquire sufficient stronghold over the utilization of online legal databases, organize research to crisp and clear legal propositions on the issues presented in a moot proposition which finally culminates in to a clinching argument in a moot

court competition. Our faculty members, alumni and our student members host weekly sessions throughout the academic year on various aspects of mooting which range from introduction to mooting, use of research operators, tenets of legal reading and research, interpretation of statutes, moot demonstrations, drafting a moot problem, drafting a memorandum, formatting a memorandum and mechanics of oral advocacy.

Pro Bono Club

The KLEF Pro Bono Club, constituted under the Department of Justice's Nyaya Bandhu Programme, aims at providing legal assistance and awareness to the marginalized sections of the society. The Club seeks to instil in the minds of young law students the spirit of rendering pro bono assistance to the community and grow into their full potential as justice change makers.

CHAPTER 2

PROGRAMS LIST AND ELIGIBILITY CRITERIA

The disciplines in which the courses of study are available at Computer Science and Applications are as follows –

Program	Duration	Eligibility	Percentage of Marks in the Qualifying Exam	Total Seats
BCA	3 years	10+2	45%	240
BCA(Honors)	3 years	10+2	45%	60

Admissions will be done based on marks obtained in the qualifying examination and personal interview.

CHAPTER 3

PROGRAM EDUCATIONAL OBJECTIVES (PEOs) AND PROGRAM OUTCOMES (POs)

Program Educational Objectives (PEOs)

PEO	DESCRIPTION
1	Serve as a computer professional and practice computer application strategies in a broad range of industrial, societal and real-world applications
2	Demonstrate the process of life-long learning through higher studies and entrepreneurship with emerging innovative technologies
3	Integrate and apply technologies in a responsible professional and ethical manner.

Program Outcomes (POs)

PO	DESCRIPTION
1	Problem Solving: Ability to apply the knowledge of fundamental computing technologies, mathematics, and programming principles to solve the problem in computer application areas.
2	Problem Analysis: Ability to identify computer application-oriented problem and analyze the component of problem using principles of mathematics and computing technologies
3	Design / development of solutions: Ability to design solutions for computer application problems and design system components or processes that meet the specified needs with appropriate consideration for public health, safety, cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems: Ability to investigate procedures and validate effective solution with principles of evaluation strategies and interpret result for valid conclusions in the area of computer applications
5	Modern tool usage: Ability to select and apply modern tools and technologies for optimized solution in the dynamic requirement of computer applications
6	Project Management: Ability to promote leadership and project management functions as a member or in diverse teams in multi-disciplinary settings
7	Environment and sustainability: Ability to demonstrate the knowledge of solutions, related documents, and their impacts on societal and environmental contexts, leading towards sustainable development
8	Ethics: Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of computing principles in application areas
9	Society: Ability to design a computing system to meet desired needs of the society within realistic constraints such as safety, security, and applicability in multidisciplinary domains with innovative thoughts
10	Communication: Ability to communicate effectively the decision maker to deliver the solution and operational procedures

PO – PEO/PSO Matrix

S.No.	Program Objectives (POs)	Program Educational Objectives (PEOs)		
		1	2	3
1	**Problem Solving** : Ability to apply the knowledge of fundamental computing technologies, mathematics and programming principles to solve the problem in computer application areas.	√		
2	**Problem Analysis** : Ability to identify computer application oriented problem and analyze the component of problem using principles of mathematics and computing technologies			√
3	**Design / development of solutions**: Ability to design solutions for computer application problems and design system components or processes that meet the specified needs with appropriate consideration for public health, safety, cultural, societal, and environmental considerations.			√
4	**Conduct investigations of complex problems** : Ability to investigate procedures and validate effective solution with principles of evaluation strategies and interpret result for valid conclusions in the area of computer applications.		√	
5	**Modern tool usage** : Ability to select and apply modern tools and technologies for optimized solution in the dynamic requirement of computer applications	√	√	√
6	**Project Management** : Ability to promote leadership and project management functions as a member or in diverse teams in multi-disciplinary settings	√		
7	**Environment and sustainability**: Ability to demonstrate the knowledge of solutions, related documents and their impacts on societal and environmental contexts, leading towards sustainable development	√		
8	**Ethics:** Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of computing principles in application areas		√	√
9	**Society**: Ability to design a computing system to meet desired needs of the society within realistic constraints such as safety, security and applicability in multidisciplinary domains with innovative thoughts	√		
10	**Communication** : Ability to communicate effectively the decision maker to deliver the solution and operational procedures	√		√

CHAPTER 4

ACADEMIC REGULATIONS

This document supplements the KLEF rules and regulations to assist all students. It is required that every individual must abide by these regulations. The regulations stated in this document are subject to change or can be relaxed/modified without prior notice at the discretion of the Hon'ble Vice Chancellor.

Terminology

- **Academic Council:** The Academic Council is the highest academic body of the University and is responsible for the maintenance of standards of instruction, education and examination within the University. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

- **Academic Year:** It is the period necessary to complete an actual course of study within a year. It comprises of two consecutive semesters i.e., Even and Odd semester.

- **Audited Course:** It is a course of study which has neither evaluation component nor grade. **Assignments:** Assignments are given to students to continuously evaluate their learning effectiveness and to provide direction for their improvements.

- **Backlog Course:** A course is considered to be a backlog course if the student has obtained a failure grade (F).

- **Basic Sciences:** The courses of foundational nature in the areas of Mathematics, Physics, Chemistry, Biology etc., are offered in this category.

- **Betterment:** Betterment is a way that contributes towards improving the student's **grade** in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course. **Board of Studies:** Board of Studies (BOS) is an authority as defined in UGC regulations, constituted by Vice Chancellor for each department separately. They are responsible for curriculum design and update in respect of all the programs offered by a department.

- **Branch of Study:** It is a branch of knowledge, an area of study or a specific program (like Civil Engineering, Mechanical Engineering, Computer science Electrical and Electronics Engineering, Electronics and communication, Biotechnology, Business Management, Technology Management, Health care Management, Banking and finance, Business analytics, Commerce, Creative arts and Media studies, Computer applications, Fine arts, Architecture, Law, Hotel Management etc.)

- **Case-Based Learning:** Case study method is important learning and evaluation tool, through which simulated or real world business problems are analyzed. The students are tested for case studies in each subject. This reinforces their understanding of the concepts and their ability to apply the same in real-life situations

- **Certificate course:** It is a course that makes a student gain hands-on expertise and skills required for holistic development. It is a mandatory course (as reflected in the program's curriculum structure) or optional course (as reflected in the program's curriculum structure) for the award of degree.

- **Change of Branch:** Change of branch means transfer from one's branch of study to other.

- **Compulsory course:** Course required to be undertaken for the award of the degree as per the program.

- **Course:** A course is a subject offered by the University for learning in a particular semester.

- **Course Handout:** Course Handout is a document, which gives complete plan of the course. It contains the details of the course viz. Course title, Course code, Pre-requisite, Credit structure, team of instructors, Course objectives, Course rationale, Course Outcomes and the relevant syllabus, textbook(s) and reference books, Course delivery plan and session plan, evaluation method, chamber consultation hour, course notices and other course related aspects. In essence, course handout is an agreement between students (learners) and the instructor.

- **Course Outcomes:** The essential skills that need to be acquired by every student through a course.

- **Course Specific Project:** It is an applied project carried out as part of the course for understanding specific concepts.

- **Credit:** A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week or two hours per week of tutorials/ self-learning/ practical/ field work during a semester.

- **Credit point:** It is the product of grade point and number of credits for a course.

- **Credit Transfer:** The procedure of granting credit(s) to a student for course(s) undertaken at another institution.

- **Cumulative Grade Point Average (CGPA):** It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured   by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

- **Curriculum:** Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

- **Degree:** A student who fulfills all the Program requirements is eligible for the award of the degree.

- **Degree with Specialization:** A student, who fulfills the entire Program requirements of   her/his discipline and successfully completes a specified set of Professional elective courses in a specialized area, is eligible for the award of the degree with specialization.

- **Department:** An academic entity that conducts relevant curricular and co-curricular activities,

- involving both teaching and non-teaching staff and other resources.

- **Detention in a course:** Student who does not obtain minimum prescribed marks in continuous in-semester evaluation and /or minimum prescribed attendance in a course shall be detained in that particular course.

- **Directed Independent Study (DIS):** Students are encouraged to take up independent study   for self-development under the guidance faculty members.

- **Dropping from the Semester:** A student who doesn't want to register for the semester should do so in writing in a prescribed format before commencement of the semester.

- **Elective Course:** A course that can be chosen from a set of courses. An elective can be Professional Elective, Open Elective, Management Elective, Sectoral Elective, Humanities Elective, Modular Elective etc.

- **Engineering Sciences**: The courses belonging to basic evolutionary aspects of engineering from Mechanical Sciences, Electrical Sciences and Computing like Engineering Mechanics, Data structures, Network Theory, Signal Analysis etc..

- **Evaluation:** Evaluation is the process of judging the academic work done by the student in her/his courses. It is done through a combination of continuous in-semester assessment and semester end examinations.

- **Foundation courses**: The courses that constitute essential course sets which are of foundational nature and are necessary to be completed for seeking enrolment in to the Specialization courses.

- **Grade:** It is an index of the performance of the students in a said course. Grades are denoted by alphabets.

- **Grade Point:** It is a numerical weight allotted to each letter grade on a 10 - point scale.

- **Honors Degree:** A student who fulfills all the Program requirements of her/his discipline and successfully completes a specified set of additional courses within the same program is eligible to receive an Honors degree.

- **Humanities Elective**: A course offered in the area of Liberal Arts.

- **Industrial Training:** Training program undergone by the student as per the academic requirement in any company/firm. It is a credited course.

- **Industrial Visit:** Visit to a company/firm as per the academic requirement.

- **Internship module**: It is industrial training program with minimum duration of 8 to 12 weeks depending upon the program.

- **In-Semester Evaluation:** Summative assessments used to evaluate student learning, acquired skills, and academic attainment during a course.

- **Live projects**: It is an applied project carried out as part of the course for understanding specific concepts of a course by carrying out a study in select organizations.

- **Make-up Test:** An additional test scheduled on a date other than the originally scheduled date. **Management elective**: A course that develops managerial skills and inculcates entrepreneurial skills.

- **Management Research Project (MRP):** Course that a student has to undergo during his/her final year which involves the student to undertake empirical research, which is carefully planned to achieve a particular aim. It is a credit based course.

- **Mini project:** Mini Project is a credit-based course that a student has to undergo during his/her academic term, which involves the student to explore in a discipline belonging to their research interest within their program area.

- **Minor Degree:** A student who fulfills all the Program requirements of her/his discipline and successfully completes a specified set of courses from another discipline is eligible to receive a minor degree in that discipline.

- **Modular Electives:** It is a set of specialization courses offered as part of ERP.

- **Multi- Section Course:** Course taught for more than one section.

- **Open Elective:** This is a course of interdisciplinary nature. It is offered across the University for all Programs.

- **Operational Work-Out:** It is part of select few courses, offered under active learning that facilitates application of thematic learning. It carries certain weightage within that particular course.

- **Over loading:** Registering for more number of credits than normally prescribed by the program in a semester.

- **Practice School:** It is a part of the total program and takes one full semester in a professional location, where the students and the faculty get involved in finding solutions to real-world problems. A student can choose Project/Practice School during one semester of his/her Academic Year as suggested by BOS of respective department, to meet the final requirements for a degree.

- **Pre-requisite:** A course, the knowledge of which is required for registration into higher level course.

- **Professional Core:** The courses that are essential constituents of each Professional discipline are categorized as Professional Core courses for that discipline.

- **Professional Elective**: A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.
- **Program:** A set of courses offered by the Department. A student can opt and complete the stipulated minimum credits to qualify for the award of a degree in that Program.

- **Program Educational Objectives:** The broad career, professional, personal goals that every student will achieve through a strategic and sequential action plan.

- **Project:** Course that a student has to undergo during his/her final year which involves the student to undertake a research or design, which is carefully planned to achieve a particular aim. It is a credit based course.

- **Project based laboratory:** Project Based Laboratory is a student-centric learning methodology that involve students in design, problem-solving, decision making, and investigative activities; gives students the opportunity to work in teams, over extended periods of time; and culminate in realistic products or presentations.

- **Reading seminars:** It is an active learning technique as part of the course for understanding specific concepts by means of referring articles and presenting the summary.

- **Re-Appearing**: A student can reappear only in the semester end examination for the Theory component of a course, subject to the regulations contained herein.

- **Registration**: Process of enrolling into a set of courses in a semester/ term of the Program.

- **Re-Registering:** A student desiring to repeat a course is permitted to do so, subject to the regulations contained herein.

- **Sectoral Elective:** Focused elective courses that are offered to meet the career aspirations of a student in identified industrial sectors that pave better placement opportunities.

- **Semester:** It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days including examination and preparation holidays. The odd Semester starts normally in July/ August and even semester in December.

- **Semester End Examinations:** It is an examination conducted at the end of a course of study.

- **Single Section Course:** Course taught for a single section.

- **Social Service:** An activity designed to promote *social* awareness and generate well-being; to improve the life and living conditions of the society.

- **Student Outcomes:** The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

- **Substitution of Elective course:** Replacing an elective course with another elective course as opted by the student.

- **Summer term:** The term during which courses are offered from May to July. Summer term is not a student right and will be offered at the discretion of the University.

- **Term Paper:** A *'term paper'* is a research report written by students that evolves their course based knowledge, accounting for a grade. Term paper is a written original research work discussing a topic in detail. It is a credit based course.

- **Under-loading:** Registering for lesser number of credits than normally prescribed by the Program in a semester.

- **Withdrawal from a Course:** Withdrawing from a Course means that a student can drop from a course within the first two weeks of the odd or even Semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

Academic Instructions

- Students are expected to wish/greet all senior officials of the KLEF with due respect.
- Students should be courteous and polite in dealing with all Faculty & staff.
- Students should maintain silence and/or speak in a soft voice in and around the classrooms, library, laboratories, and offices of the Deans, Program Chairs, Senior Officials, faculty rooms and corridors of academic buildings. It must be noted that shouting, talking in loud voice or in chorus, using indecent, abusive, and discourteous language anywhere within the institution premises are considered serious acts of indiscipline and are punishable.
- Students should not issue any public or press statement, send letters to editors, government, public servants or notaries without prior permission and approval of the Registrar of KLEF in writing.
- Students should keep the status, dignity, prestige, and reputation of KLEF high and not engage in anything that might directly or indirectly undermine the standing of the institution.
- Students must always adhere to a prescribed/decent dress code befitting the dignity of a technical/professional student within the campus.
- Ragging of any student is a serious act of indiscipline and has been totally banned by the Hon'ble Supreme Court of India. A student found involved in any form of ragging, verbal or physical, inside or outside the institutional campus, hostels, or buses shall be treated as per the anti-ragging rules of the KLEF.
- Students must not be involved in quarreling or fighting or any indecent verbal or physical activity among themselves, or with staff and faculty or visitors. Direct or indirect involvement in any such activity will be considered as serious breach of discipline and strict disciplinary action will be taken against the students that engage in such activities.
- Students are not allowed to sit on the boundary walls on the higher floors of any building, or engage in gossiping, making noise or any other such activity.

Working Hours

The University operates between 7:20am to 5:00pm (in shifts) on all weekdays.

Class Environment

The institute is a community of learners. Students have a responsibility of creating and maintaining an environment that supports effective learning to receive effective instructions in classrooms and laboratories. KLEF expects students to conduct themselves in an orderly and cooperative manner by adhering to University Rules & Regulations.

Laboratory Environment

A conducive learning environment in the laboratory is essential and the students are advised to follow the guidelines mentioned below:

- Always listen carefully to the faculty especially for the safety precautions to take in the moot court or laboratories.
- Accidents resulting in injuries may occur if precautions are not taken.
- Eating in laboratories is strictly prohibited.
- Proper dress code is to be followed as prescribed by faculty.
- Students should familiarize themselves with the location of all the equipment which may be available.
- Follow evacuation procedures quickly and quietly, if needed.
- Students should always conduct themselves in a responsible and cautious manner. Risky behaviors such as pushing, running, jumping etc., are unwarranted.
- Only materials required to complete and record the experiment instructions, (e.g. pencils, books, memorials, paper, etc.) should be brought into the laboratory.
- Equipment must be carefully handled to prevent breakage or damage, otherwise appropriate penalties/disciplinary action may be levied/imposed.
- Lab station must be cleaned prior to leaving.
- Any accident, no matter how small or big, must be reported to the concerned faculty immediately.

Registration Process

For every course, the student must undertake the registration process prior to commencement of the coursework, based on the following conditions:

- Registration into a course will be permitted only for such courses, which are offered by KLEF in that semester.
- A student must clear the pre-requisite(s) if any, to register into a course.
- KLEF reserves the right to register.
- Registration for add/drop/change of a course will be permitted only within one week from the scheduled date of commencement of classes.
- Students can register up to a maximum of 32 credits of their choice in a semester to meet their Program requirements.
- Students, who wish to register for additional credits through Overloading or less credits through Under loading, must seek prior permission from Dean-Academics.
- Students who have opted for minor degree, honors degree, can register for a greater number of credits in a semester through Overloading (subjected to guidelines appropriate to

compliance on eligibility).

- KLEF reserves the right to withdraw within one week of the commencement of the semester any elective course offered, if adequate number of students have not registered or for any other administrative reasons. In such cases, the students are permitted to register for any other elective course of their choice provided they have fulfilled the eligibility conditions.
- KLEF reserves the right to cancel the registration of a student from a course or a semester or debar from the degree on disciplinary / plagiarism grounds.
- A student is solely responsible to ensure that all conditions for proper registration are satisfied. If, there is any clash in the timetable, it should be immediately brought to the notice of theDepartment Year coordinator for necessary corrective action. The registration may be cancelled for a course or the entire semester either by KLEF if any irregularity is found at a later stage.

Student Course Registration Process

To complete the student registration, student login to new ERP portal with their valid login credentials. After login student should click on Academic Registrations Student Course Registration. Now Student can view the courses and sections in dropdown menus. Student can select the sections against the courses on their own choice as mentioned in the following screen shot. Student can view the timetable on top of the selection of each course and section.

After completing the selection student need to click on Save to save the timetable. After duly verifying the timetable student needs to click on Submit to complete the Registration process. On successful completion of registration, a pop-up message, "Student Registration Successfully Completed" appears.

CHAPTER 5

PROGRAM CURRICULUM

BCA Program Curriculum

For an academic program the curriculum is the basic framework that will stipulate the credits, category, course code, course title, course delivery (Lectures / Tutorials / Practice / Skill/ Project/ Self Study / Capstone Design etc.), in the Choice Based Credit System. However, all such are essentially designed, implemented, and assessed in Outcome Based Education.

Program Structure

- An Academic Year is made of two semesters each is of, approximately 16±1 week duration and each semester is classified as:
    - Odd Semester (July–December)
    - Even Semester (December –May).
- KLEF may offer summer term between May and June.
- Students have the flexibility to choose courses of their own choice prescribed by the institution.
- Student can register for a maximum of 26 credits per semester. This is not applicable when student exercises the overloading option.

Course Structure

- Every course has a Lecture-Tutorial-Practice-Skill (L-T-P-S) component attached to it.
- Based upon the L-T-P-S structure the credits are allotted to a course using the following criteria.
    - Every 1 hour of Lecture / Tutorial session is equivalent to one credit.
    - Every 2 hours of Practical session is equivalent to one credit.
    - Every 4 hours of skill-based practice is equivalent to one credit.

Course Classification

Any course offered under BCA program is classified as:

- **Humanities Arts & Social Science Courses (HAS):** Humanities, arts, and social sciences (HAS) courses are a broad field of study that encompasses the study of human culture and society. These courses focus on developing students' critical thinking, problem-solving, and communication skills. These skills are valuable in a variety of careers, and they can also help students become more engaged citizens.
- **Humanities Arts & Social Science Elective Courses (HASE):** Humanities Arts & Social Science Elective Courses provides students an opportunity to complement their legal education in their chosen fields of interest.
- **Management Courses (MNG):** Management courses is a field of study that focusses on educating and preparing students with the needed knowledge and skills, analytical ability as well as a managerial perspective that is needed in the highly competitive business environment.
- **Professional Core Courses (PCC):** Professional core courses are a set of courses that are essential for all law students. These courses provide students with the knowledge and skills they need to be successful in their chosen legal discipline.

- **Professional Elective Courses (PEC):** Professional electives are a set of courses that are chosen by students to supplement their legal education. Professional electives are a great way for students to customize their legal education and prepare for their future careers. By choosing electives that are relevant to their interests and goals, students can gain the knowledge and skills they need to be successful in their chosen field.
- **Open Elective Courses (OEC):** Open electives are a set of courses that are not specifically related to law, but that can provide students with knowledge and skills that are valuable in a variety of fields. Open electives are a great way for students to broaden their horizons and explore their interests outside of law. By choosing electives that are relevant to their interests and goals, students can gain the knowledge and skills they need to be successful in a variety of fields.
- **Clinical Courses (CC):** Clinical courses are a set of courses that help students develop their practical skills, such as interviewing clients, drafting legal documents, dispute resolutions and professional etiquettes. These courses also provide students with hands-on experience in practicing law.
- **Skill Development Courses (SDC):** Skill courses can provide students with the knowledge and skills which would enhance their legal and managerial proficiency, especially for students who are interested in pursuing a career in a particular field.
- **Project Research & Internships (PRI):** Project, Research and Internships can help students gain a better understanding of their chosen field by giving them the opportunity to apply their knowledge and skills to real-world problems. These can help students explore their interests by giving them the opportunity to work on projects that they are passionate about.
- **Value-Added Courses (VAC):** Courses leading to certification and those which are conducted exclusively for employability are referred to as value added courses. Though "Satisfactory" completion of value-added courses doesn't acquire any credit but they are part of the graduation requirements.

Course Precedence

The following are the guidelines for registering into courses with pre-requisites.

- Every course may have one or more of its preceding courses(s) as pre- requisite(s).
- To register for a course, the student must successfully be promoted in these course(s) earmarked as pre-requisite(s) for that course.

REQUIREMENTS FOR THE AWARD OF DEGREE

The student is awarded a BCA degree provided she/he
- Must successfully earn 163 credits, as stipulated in the program structure.
- Must successfully earn 173 credits, as stipulated in the program structure with Honors Degree.
- Must successfully complete minimum three (3) certificate courses in discipline domain areas.
- Must successfully complete five (5) Internships, as stipulated in the program structure.
- Must have successfully obtained a minimum CGPA of 4.75 at the end of the program.
- Must have finished all the above-mentioned requirements in less than twice the period mentioned in the Academic structure for each program, which includes deceleration period chosen by the student, deceleration imposed by KLEF or debarred from the KLEF.

MAJOR FLEXIBILITY PROGRAM ADD-ON	NO MAJOR FLEXIBILITY			Major Flexibility - HONORS			Major Flexibility - HONORS through RESEARCH			Major Flexibility - HONORS through INNOVATION			Major Flexibility - HONORS through EXPERIENTIAL LEARNING		
	Sl No	Course Category	Min. Credits	Sl No	Course Category	Min. Credits	Sl No	Course Category	Min. Credits	Sl No	Course Category	Min. Credits	Sl No	Course Category	Min. Credits
NO PROGRAM ADD-ON	1	HAS	16	1	HAS	16	1	HAS	16	1	HAS	16	1	HAS	16
	2	BSC	8	2	BSC	8	2	BSC	8	2	BSC	8	2	BSC	8
	3	ESC	0	3	ESC	0	3	ESC	0	3	ESC	0	3	ESC	0
	4	PCC	39	4	PCC	61	4	PCC	61	4	PCC	61	4	PCC	61
	5	FCC	12	5	FCC	12	5	FCC	12	5	FCC	12	5	FCC	12
	6	SDC	10	6	SDC	16	6	SDC	16	6	SDC	16	6	SDC	16
	7	PEC	15	7	PEC	15	7	PEC	15	7	PEC	15	7	PEC	15
	8	PR	1	8	PRI	2	8	PRI	2	8	PRI	2	8	PRI	2

Y23 ACADEMIC STRUCTURE & FLEXIBILITIES FOR BACHELOR OF COMPUTER APPLICATIONS-SCHOOL OF COMPUTING(BCA)

#	Code	Val	#	Code	Val	#	Code	Val	#	Code	Val	#	Code	Val
	I	4			6			6			6			6
9	OEC	6	9	OEC	6	9	OEC	6	9	OEC	6	9	OEC	6
10	VAC	0	10	VAC	0	10	VAC	0	10	VAC	0	10	VAC	0
11	AUC	0	11	AUC	0	11	AUC	0	11	AUC	0	11	AUC	0
12	SIL	3	12	SIL	3	12	SIL	3	12	SIL	3	12	SIL	3
GRAD REQUIREMENTS		123	GRAD REQUIREMENTS		163	GRAD REQUIREMENTS		163	GRAD REQUIREMENTS		163	GRAD REQUIREMENTS		163

Program Add-On SPECIALIZATION

#	Code	Val	#	Code	Val	#	Code	Val	#	Code	Val	#	Code	Val
1	HAS	16	1	HAS	16	1	HAS	16	1	HAS	16	1	HAS	16
2	BSC	8	2	BSC	8	2	BSC	8	2	BSC	8	2	BSC	8
3	ESC	0	3	ESC	0	3	ESC	0	3	ESC	0	3	ESC	0
4	PCC	39	4	PCC	61	4	PCC	61	4	PCC	61	4	PCC	61
5	FCC	12	5	FCC	12	5	FCC	12	5	FCC	12	5	FCC	12
6	SDC	10	6	SDC	16	6	SDC	16	6	SDC	16	6	SDC	16
7	PEC	20	7	PEC	25	7	PEC	25	7	PEC	25	7	PEC	25
8	PRI	14	8	PRI	26	8	PRI	26	8	PRI	26	8	PRI	26
9	OEC	6	9	OEC	6	9	OEC	6	9	OEC	6	9	OEC	6
10	VAC	0	10	VAC	0	10	VAC	0	10	VAC	0	10	VAC	0
11	AUC	0	11	AUC	0	11	AUC	0	11	AUC	0	11	AUC	0
12	SIL	3	12	SIL	3	12	SIL	3	12	SIL	3	12	SIL	3
GRAD REQUIREMENTS		128	GRAD REQUIREMENTS		173	GRAD REQUIREMENTS		173	GRAD REQUIREMENTS		173	GRAD REQUIREMENTS		173

Program Add-On MINOR

#	Code	Val	#	Code	Val	#	Code	Val	#	Code	Val	#	Code	Val
1	HAS	16	1	HAS	16	1	HAS	16	1	HAS	16	1	HAS	16
2	BSC	8	2	BSC	8	2	BSC	8	2	BSC	8	2	BSC	8
3	ESC	0	3	ESC	0	3	ESC	0	3	ESC	0	3	ESC	0
4	PCC	3	4	PCC	6	4	PCC	6	4	PCC	6	4	PCC	6

		C	9			C	1			C	1			C	1			C	1
	5	FCC	12		5	FCC	12		5	FCC	12		5	FCC	12		5	FCC	12
	6	MIN	20		6	MIN	20		6	MIN	20		6	MIN	20		6	MIN	20
	7	SDC	10		7	SDC	16		7	SDC	16		7	SDC	16		7	SDC	16
	8	PEC	15		8	PEC	15		8	PEC	15		8	PEC	15		8	PEC	15
	9	PRI	14		9	PRI	26		9	PRI	26		9	PRI	26		9	PRI	26
	10	OEC	6		10	OEC	6		10	OEC	6		10	OEC	6		10	OEC	6
	11	VAC	0		11	VAC	0		11	VAC	0		11	VAC	0		11	VAC	0
	12	AUC	0		12	AUC	0		12	AUC	0		12	AUC	0		12	AUC	0
	13	SIL	3		13	SIL	3		13	SIL	3		13	SIL	3		13	SIL	3
	GRAD REQUIREMENTS		143		GRAD REQUIREMENTS		183		GRAD REQUIREMENTS		183		GRAD REQUIREMENTS		183		GRAD REQUIREMENTS		183
Program Add-On DOUBLE MAJOR	1	HAS	16		1	HAS	16		1	HAS	16		1	HAS	16		1	HAS	16
	2	BSC	8		2	BSC	8		2	BSC	8		2	BSC	8		2	BSC	8
	3	ESC	0		3	ESC	0		3	ESC	0		3	ESC	0		3	ESC	0
	4	PCC	39		4	PCC	61		4	PCC	61		4	PCC	61		4	PCC	61
	5	FCC	12		5	FCC	12		5	FCC	12		5	FCC	12		5	FCC	12
Approx	6	MAJOR II	40		6	MAJOR II	40		6	MAJOR II	40		6	MAJOR II	40		6	MAJOR II	40
	7	SDC	10		7	SDC	16		7	SDC	16		7	SDC	16		7	SDC	16
	8	PEC	15		8	PEC	15		8	PEC	15		8	PEC	15		8	PEC	15
	9	PRI	14		9	PRI	26		9	PRI	26		9	PRI	26		9	PRI	26
	10	VAC	0		10	VAC	0		10	VAC	0		10	VAC	0		10	VAC	0
	11	AUC	0		11	AUC	0		11	AUC	0		11	AUC	0		11	AUC	0
	12	SIL	3		12	SIL	3		12	SIL	3		12	SIL	3		12	SIL	3
	GRAD		1		GRAD		1		GRAD		1		GRAD		1		GRAD		1

	REQUIREMENTS	57		REQUIREMENTS	97		REQUIREMENTS	97		REQUIREMENTS	97		REQUIREMENTS	97	

Award of Degree

A student having cleared all the courses and met all the requirements for the award of degree with:

- 4.75 ≤ CGPA < 5.75 will be awarded Pass Class.
- 5.75 ≤ CGPA < 6.75 will be awarded Second-Class.
- 6.75 ≤ CGPA < 7.75 will be awarded First Class.
- CGPA ≥ 7.75 will be awarded First class with Distinction, provided the student has cleared all the courses in first attempt and must have fulfilled all the program requirements within the specified minimum years duration.

CHAPTER 7

ATTENDANCE RULES AND DETENTION POLICY

Attendance Policy for Promotion in a Course

A candidate shall be deemed to have eligibility to appear for end-semester exams in any course if the student has attended a minimum of 70% of classes held in the course concerned, including the moot-court exercises, tutorials and practical training conducted in the course. If any student for any exceptional reasons fails to attend 70% of the classes held in any course, the Principal of the College may allow the student to take the exam, if the student concerned attended at least 65% classes held in the course concerned and 70% of the classes in all the courses in entire semester taken together. In case of medical exigencies, the student/parent should inform the Principal of the College within a week by submitting necessary proofs and in such cases the attendance can be condoned up to an extent of 10% by Principal on the recommendation of the committee established for condonation.

- Attendance in a course shall be counted from the date of commencement of the classwork only and not from the date of his/her registration.
- Attendance for the students who are transferred from other institutes and for new admissions, attendance must be considered from the date of his/her admission.
- In case of attendance falling marginally below 75% due to severe medical reasons or any other valid reasons, the Principal / Program chair may bring such cases, along with valid and adequate evidence to the notice of the Dean Academics. The condonation board formed by Vice-Chancellor under the chairman ship of Dean-Academics will consider any further relaxation in attendance from the minimum attendance percentage requirement condition after going through case by case.

Attendance Condonation for Participation in KLEF / National / International Events

Only those students nominated / sponsored by the KLEF to represent in various forums like seminars / conferences / workshops / competitions or taking part in co- curricular / extra- curricular events will be given compensatory attendance provided the student applies in writing for such a leave in advance and obtain sanction from the Principal basing on the recommendations of the Head of the Department (HoD) for academic related requests; or from the Dean Student Affairs for extracurricular related requests. For participation in the KLEF's placement process the names of students will be forwarded by the placement cell in-charge to the respective Heads of the Departments. Students participating in KLEF/National/International events like technical fests, workshops, conferences etc., will be condoned for 10% of total classes conducted for each course in the semester.

Course Based Detention Policy

In any course, a student must maintain a minimum attendance as per the attendance policy for promotion in a course, to be eligible for appearing in the Sem-End examination. Failing to fulfill this condition, will deem such student to be detained in that course and become ineligible to take semester end exam.

Eligibility for Appearing in Sem-End Examination

A Student registered for a course and maintained minimum attendance of 70% is eligible to write the Semester-End Examination for that course unless found ineligible due to one or more of the following reasons:

- Shortfall of attendance
- Detained
- Acts of indiscipline
- Withdrawal from a course

CHAPTER 8

ASSESSMENT AND EVALUATION PROCESS

- **In-Semester Examinations Methods:**

  The assessment in each theory subject consists of two Sem-In Exams (Sem-in Exam-I and Sem-In Exam -II), in-class quizzes/tutorials/home-assignments/Active Learning Methods (continues assessment), and the Semester-End Exanimation (SEE). The distribution of weightage for each assessment step is listed below. The distribution of internal marks in the table below is only a guideline. Instructors at their discretion may apportion some marks for attendance beyond 75%. In such cases, the marks shown for quizzes and assignments will be accordingly be adjusted. Students are advised to refer the course handout to get more detailed information on assessment.

  > a. The Sem-In tests and the Semester-End Examinations will be conducted as per the Academic Calendar.

  > b. As per the necessity, the Supplementary examinations will be conducted at the discretion of Dean Academics with the approval of the Vice-Chancellor.

  > c. Students may have to take more than one examination in a day during Sem-In exams, Semester-End Examinations /Supplementary examinations.

- **In-Semester Evaluation**

  The following guidelines are followed for the Semester-In evaluation.

  a. The process of evaluation is continuous throughout the semester.

  b. The distribution of marks for Semester-In evaluation is 60% of aggregate marks of the course.

  c. The distribution of weightage for various evaluation components are decided and notified by the course coordinator through the course handout after approval by the Dean Academics, prior to the beginning of the semester.

  d. In order to maintain transparency in evaluation, answer scripts are shown to the students for verification, within one week of conduct of exam. If there is any discrepancy in evaluation, the student can request the course-coordinator to re-evaluate.

e. The solution key and scheme of evaluation for all examinations are displayed by the Course-Coordinator in the appropriate web portal of the course, on the day of the conduct of examination.

f. In case the student is unable to appear for any evaluation component owing to hospitalization, participation in extra/ co-curricular activities representing KLEF/ state/ country; the Dean Academics can permit to conduct of re- examination for such students.

g. In case a student has missed any of the two in-semester evaluations, S/he is eligible for and will be provided with an opportunity of appearing for re- examination.

- **Detention policy**

  The student must maintain a minimum attendance of 85% for all the courses of the program. In case of medical exigencies, the student/parent should inform the principal within a week by submitting necessary proofs and in such cases the attendance can be condoned up to an extent of 10%. by Principal on the recommendation of the Head of the Department.

  1. Attendance in a course shall be counted from the date of commencement of the classwork.

  2. Attendance for the students who are transferred from other institutes and for new admissions, attendance must be considered from the date of her/his admission.

  3. In case of attendance falling marginally below 75% due to severe medical reasons or any other valid reasons, the Principal/Program chair may bring such cases, along with valid and adequate evidence, to the notice of the Dean Academics. The condonation board formed by Vice-Chancellor under the chairman ship of Dean-Academics will consider any further relaxation in attendance from the minimum attendance percentage requirement condition after going through case by case.

- **Semester End Examination**

  a. The pattern and duration of such examination are decided and notified by the Course Coordinator through the Course handout, after approval from the Dean Academic.

  b. To maintain transparency in evaluation, answer scripts are shown to the students for verification. If there is any discrepancy in evaluation, the student can request the Controller of Examinations to re-evaluate.

c. If a student earns F grade in any of the courses of a semester, an instant supplementary exam (for only Semester End Exam component) will be provided within a fortnight of the declaration of the results.

- **Eligibility to Appear For Semester End Examination**

  A Student registered for a course and maintained minimum attendance is eligible to write the Semester-End Examination for that course unless found ineligible due to one or more of the following reasons:

  a. Shortfall of attendance

  b. Acts of indiscipline

  c. Withdrawal from a course

- Distribution of marks for Semester-In and Sem end Examinations.

  The course Coordinator will decide the evaluation plan and will include in the course Handout.

- **Assessment of Project/Research-Based Subjects**

  All project or research-based subjects must have a defined time-limit for completion. The specific time limits for completion and schedule for monitoring and evaluation of performance of students will be announced each term. The final project report, after getting the plagiarism certificate, only will be considered and evaluated by the panel of examiners. Student project reports must follow the guidelines prescribed by the office of Dean Academics.

A. Grading Process

At the end of all evaluation components based on the performance of the student, each student is awarded based on absolute/relative grading system. Relative grading is only applicable to a section of a course in which the number of registered students is greater than or equal to 25. Choice of grading system is decided by the Course-Coordinator with due approval of Dean Academics and is specified in the course handout.

Absolute Grading

The list of absolute grades and its connotation are given below.

Performance	Letter Grade	Grade Point	Percentage of marks
Outstanding	O	10	90-100
Excellent	A+	9	80-89
Very Good	A	8	70-79
Good	B+	7	60-69
Above Average	B	6	50-59
Average	C	5	46-49
Pass	P	4	40-45
Failed	F	0	0-39
Absent	AB	0	Absent

B. SGPA & CGPA

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses and the sum of the number of credits of all the courses undergone by a student, in a semester.

$$SGPA(S_i) = \frac{\sum C_i * G_i}{\sum C_i}$$

Where 'C_i' is the number of credits of the ith course and 'G_i' is the grade point scored by the student in the ith course.

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program,

$$CGPA(S_i) = \frac{\sum C_i * S_i}{\sum C_i}$$

Where 'S_i' is the SGPA of the ith semester and 'C_i' is the total number of credits in that semester.

a. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

b. CGPA can be converted to percentage of marks: 10 X CGPA -7.5

c. A student appearing for a course having lab integrated with theory and in case obtains less than 40% in either of lab or theory component of semester end examination, and in such case the student has to reappear for the component only in which he has secured less than 40%. Till successful attainment of minimum 40% of both components, the student remains in the F grade for that course.

d. Audit/Certificate courses are graded as satisfactory (S) or Non- Satisfactory (NS) only.

e. At the end of each semester, the KLEF issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if he/she has any outstanding dues.

C. Course Based Detention Policy

In any course, a student must maintain a minimum attendance as per the attendance policy to be eligible for appearing in the Sem-End examination. Failing to fulfill this condition, will deem such student to be detained in that course and become ineligible to take semester end exam.

PROMOTION

1. Credit transfer

A. Credit transfer between KLEF and other institution

a. Credit transfer from other institutions to KLEF or vice versa is permitted only for undergraduate program.

b. Credit transfer from KLEF to other institutions: Student studying in KLEF can take transfer to another institution under the following conditions:

- KLEF has signed MOU with the institution.

- However, a student, after seeking transfer from KLEF can return to KLEF after a semester or year. Based on courses done in the other institution, equivalent credits shall be awarded to such students.

c. Credit transfer from another institution to KLEF: A student studying in another 90 institution can take transfer to KLEF under the following conditions:

- When a student seeks transfer, equivalent credits will be assigned to the student based on the courses studied by the student.

- The student, when transferred from other institutions, has to stick to the rules and regulations of KLEF.

- To graduate from KLEF, a student must study at least half of the minimum duration prescribed for a program at KLEF.

B. Credit Transfer Through MOOCs:

Undergraduate students can get credits for MOOCs courses recommended by KLEF up to a maximum of 20% of their minimum credits required for graduation. The discretion of allocation of MOOCs courses equivalent to the courses in the curriculum lies with the office of the Dean Academics.

A student may also be permitted to obtain 20 credits through MOOCs in addition to the minimum credits required for graduation. These 20 credits can also be utilized to acquire a Minor degree or an Honors degree if the courses are pronounced equivalent to those specified for the respective degrees by the office of the Dean Academics. These additional credits through MOOCs if to be considered for CGPA/Minor/Honors degree must be approved by Dean Academics prior to enrollment in the respective MOOCs.

Students acquiring additional credits for Honors/Minor degree must adhere to the rules governing the award of the respective degree, otherwise, a student applying for registering into additional credits through MOOCs must possess a minimum CGPA of 7.5 till that semester.

C. Course Credit

A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week or one tutorial hour per week or two hours per week of practical/ field work or four hours per week of skilling or one studio hour is equivalent to 1.5 credit during a semester.

D. Promotion Policy

A student shall be eligible for provisional promotion for registration of courses in the next semester irrespective of detentions/ backlogs.

E. Re-Evaluation

Students desirous of seeing their Semester-End Examination answer scripts have to apply online to the COE for the same within the timeframe as declared by the COE by paying the prescribed fee. Student applications must be forwarded by the Head of the Department and the Principal of the School and then re-evaluation fees are to be paid.

The application along with the attached fee receipt must be submitted to the office of the COE.

There is no provision for re-evaluation in case of Lab/Practical/skilling exams, student project, viva-voce exam or seminar/design/mini-project courses.

The final grades awarded to each course shall be announced by the COE and the same will be made available to students through the website/notice boards.

F. Academic Counseling Board (ACB)

Academic Counseling Board is constituted by the Dean Academics. This board shall comprise of the Chairman, Convener, Principal/Director, HOD and Professor/Associate Professor. A student will be put under Academic Counseling Board in the following circumstances:

- Has CGPA of less than 6.00.
- Has 'F' grade or 'Detained' in multiple courses.

The first level of Counseling such students will be done by the Mentor of the student and the HoD followed by the ACB and the list of students who have to undergo the ACB counseling be forwarded by the HoD to the Office of Dean Academics.

The students undergoing the Academic Counseling Board process may be allowed to register only for a few courses based on the recommendation of Academic Counseling Board.

i. Backlog Courses

A course is considered to be a backlog if the student has obtained 'F' grade in the course.

ii. Rustication

A student may be rusticated from the KLEF on disciplinary grounds, based on the recommendations of any empowered committee, by the Vice Chancellor.

G. Award of Medals

KLEF awards Gold and Silver medals to the top two candidates in each program after successful completion of their study. The medals are awarded based on their CGPA during the Annual Convocation with the following constraints:

i. The grade obtained through betterment/ supplementary will not be considered for this award.

ii. S/he must have obtained first class with distinction for the award of Gold or Silver-medal

CHAPTER 9

CREDIT TRANSFER

Credit Transfer between KLEF and other Institution

a. **Credit transfer from KLEF to other institutions:** Student studying in KLEF can take transfer to another institution under the following conditions:
i. KLEF has signed MOU with the institution.
ii. However, a student, after seeking transfer from KLEF can return to KLEF after a semester or year. Based on courses done in the other institution, equivalent credits shall be awarded to such students.
b. **Credit transfer from another institution to KLEF:** A student studying in another institution can take transfer to KLEF under the following conditions:
i. When a student seeks transfer, equivalent credits will be assigned to the student based on the courses studied by the student.
ii. The student, when transferred from other institutions, must stick to the rules and regulations of KLEF.
iii. To graduate from KLEF, a student must study at least half of the minimum duration prescribed for a program at KLEF.

Credit Transfer through MOOCs

Undergraduate students can get credits for MOOCs courses recommended by KLEF up to a maximum of 20% of their minimum credits required for graduation. The discretion of allocation of MOOCs courses equivalent to the courses in the curriculum lies with the office of the Dean Academics.

A student may also be permitted to obtain 20 credits through MOOCs in addition to the minimum credits required for graduation. These 20 credits can also be utilized to acquire a Minor degree or an Honors degree if the courses are pronounced equivalent to those specified for the respective degrees by the office of the Dean Academics. These additional credits through MOOCs if to be considered for CGPA/Minor/Honors degree must be approved by Dean Academics prior to enrollment in the respective MOOCs.

Students acquiring additional credits for Honors / Minor degree must adhere to the rules governing the award of the respective degree, otherwise, a student applying for registering into additional credits through MOOCs must possess a minimum CGPA of 7.5 till that semester.

STUDENT COUNSELLING AND FEEDBACK

1. Counselling:

Student counselling / mentoring service ensures that every student gets to know the academic structure of the University and utilize maximum opportunities that the institute offers to fulfil their career and personal life goals. The objective of "Student Counselling/Mentoring Service" is to provide friendly support to the students for their well-being during their stay in the campus and for their holistic development.

Counsellors offer individual counselling to help students resolve personal or interpersonal problems. They may also offer small group counselling to help students enhance listening and social skills, learn to empathize with others, and find social support through healthy peer relationships. Counsellors also provide support to faculty by assisting with classroom management techniques and the development of programs to improve quality or safety. When necessary, counsellors may also intervene in a disrupted learning environment.

However, the benefits of counsellor-student relationships are as follows:

- Maintain academic standards and set goals for academic success.

- Develop skills to improve organization, study habits, and time management.

- Work through personal problems that may affect academics or relationships.

- Improve social skills.

- Cope with university or community-related violence, accidents.

- Identify interests, strengths, and aptitudes through assessment.

2. Counselling Policy:

Student counselling takes great place in K L University. Counselling is designed to facilitate student achievement, improve student behaviour, subject analysis levels, attendance, and help students develop socially, professionals with bachelor's, master's degrees or beyond. Faculty counselors provide counseling and serve an educational role in K L University. We have Mentors, Academic, Career, Physiological, Co-Curricular & Extra Curricular activities counselors in order to support students who are experiencing personal or academic challenges, help students choose careers and plan for university and intervene when students face behavioral, physical, or mental health challenges.

3. **The duties of counselors:**

   A. Mentoring:

   Plan and design a system for student behavior, mental health and academic challenges, define structural and functional characteristics of the system in detail, plan provisions for academic mentoring apart from classroom interaction.

   B. Academic Counseling:

   Develop a systematic and process-oriented mechanism to improve academic counseling in relation to student attendance, punctuality, performance of students in internal and semester examinations, course / program to be enrolled based on the strength and weakness of the student

   C. Career Counseling:

   Conduct personality test (SWEAR) to find suitable career path, Create awareness on the job opportunities, career paths that exist in a specific discipline.

   D. Psychological Counseling:

   Organize and strengthen the student counseling services, engage qualified and experienced mentors and advisories for each class of students for providing psychological guidance as required.

   E. Guidance on Co-Curricular & Extra Curricular activities:

   Form student clubs to give train and encourages the students to improve their skills, physical fitness and mental strength.

   F. Early intervention:

   Counselors receive training about learning difficulties and psychological concerns that commonly manifest in children and adolescents. They may also provide referrals, recommendations, and suggestion to parents about mental health of their wards.

   G. Special needs services:

   Counselors often support the special needs of students and may oversee programs that address requirements or learning difficulties.

4. **Counseling Procedures:**

   The HOD will allot 20 Students once admitted into a program to a faculty with allocation priority commencing from professors and onwards. The faculty concerned will be called a counselor/mentor.

One hour per week will be allocated by the departments to enable the counselors to counsel the students on various aspects. The counselor will maintain a separate sheet to record student performance and also different kinds of counseling undertaken.

Counselor shall communicate with parents through mail, SMS and also through telephonic conversations. Student's atteandance, marks, placement etc. data must infrom to parents once in a month. The communication undertaken shall be recorded in a separate register.

The following are the various aspects of counseling that the counselors will address during their interaction.

A. Mentoring

1. Counselor shall counsel the students regularly when the performance of the student is found be un-satisfactory

2. Form a Student-Teacher-Group to share regular updates and events.

3. Form a Parent-Teacher-Association to share regular updates and events.

4. Conduct the feedback on counseling.

5. The counseling data sheet shall be submitted to the principal for verification and approval.

6. At the end of the semester a summary report and recommendations will be sent to Dean Academics Office.

B. Academic Counseling

1. Counselor shall acquire backlog data and record the same into the counseling sheets

2. Counselor will acquire data about the attendance and performance in the internal evaluation and record them into the counseling data sheet.

3. Counselors shall counsel the students regularly to track the performance of the students

4. The counseling data sheet shall be submitted to the principal for verification and approval.

5. At the end of the semester a summary report will be sent to Dean Academics Office.

C. Career Counseling

1. Counsellor has to take SWEAR analysis data in first year.

2. Counsellor shall acquire the data related to performance of the students in all the soft skills and other courses that contributes towards employability/ entrepreneurship/ career advancement the career counselling data sheets.

3. Counsellor will acquire data about the attendance and performance of the students during all the placement drives conducted by KLU and records the same into the counselling sheet.

4. Counsellors shall counsel the students regularly when the performance of the student is found be un-satisfactory.

5. The counselling sheet shall be verified by principal and corrective actions if any will be recommended to the respective departments.

6. At the end of the semester a summary report will be sent to Dean Academics Office.

D. Psychological Counselling

1. Counsellor shall acquire data pertaining to psychological status of the students and record the same into the counselling sheets.

2. Counsellor will acquire data about the attendance and performance in the internal evaluation and record them into the counselling sheet and see whether the performance is in any way related.

3. Counsellor shall counsel the students regularly when the performance of the student is found to be un-satisfactory.

4. Counsellor should identify the need of any therapy required.

5. Once it is identified, the counsellor will arrange the treatment according to the psychological status of the student.

6. Counsellor should maintain the progression level of the student periodically.

7. The counselling sheet shall be verified by principal and corrective actions if any will be recommended to the respective departments.

8. At the end of the semester a summary report will be sent to Dean Academics Office.

HODs must submit monthly /semester / Academic Year Counselling reports with necessary comments and proofs to Dean Academics office duly signed by concerned Principal/Director. Visit following link.

https://www.kluniversity.in/site/acadboard.htm

5. Feedback System

At KLEF, monitoring of feedback is a continuous process. Feedback is obtained from students and parents on various aspects. Feedback is taken through personal interaction with students, interaction with parents in addition to mid-semester and end-semester feedback. The institution assesses the learning levels of the students, after admission and organizes special programs for advanced learners and slow learners.

A. Feedback Types:

In first year SWEAR analysis is done for every student in such a way it identifies their interests, pre-existing knowledge, aspects to improve technical and logical skills based on their career choice. The following are the different types of feedback taken at regular intervals:

(i). Student General Feedback (Twice in a Sem.)

(ii). Student Satisfaction Survey (Once in a Sem.)

(iii). Student Exit Feedback (Once in a Year)

(iv). Academic Peers Feedback on Curriculum (Once in a Sem.)

(v). Parents Feedback on Curriculum (Once in a Sem.)

(vi). Alumni Feedback on Curriculum (Once in a Sem.)

(vii). Industry Personnel Feedback on Curriculum (Once in a Sem.)

(viii). Student Feedback on Curriculum (Once in a Sem.)

(ix). Faculty Satisfaction Survey (Once in a Sem.)

(x). Parent Teacher Association (Once in a Sem.)

B. Feedback Procedure:

General Feedback to be taken from the students on the aspects like Course Contents, Teaching Learning Process, Outcomes, Resources and Evaluation twice in every semester (Mid semester and End Semester Feedback) in a structured format floated by dean academics office.

Student Satisfaction Survey (SSS) to all innovative methods and approaches should be recorded at appropriate intervals and the process should be refined based on that. Students should be sensitized on the process and methods and their understanding of the same should be assured.

Exit survey feedback to be taken from the final year students on the aspects like entrance test, admission process, Course Contents, Teaching Learning Process, Outcomes, Resources and Evaluation, placements etc.

Structured feedback for design and review of syllabus – semester wise / year wise is received from Students, Alumni, Peers, Parent, Industry Personnel.

Satisfaction Survey to be taken from the existing faculty on Course Contents, Teaching Learning Process, Outcomes, Resources and Evaluation once in every semester in a structured format floated by dean academics office.

Parent Teacher Association (PTA) to develop the potential of parents and to strengthen their relationship with their children through planning and conducting a variety of developmental and recreational activities.

Online Feedback is collected from all the students once at the end of the semester using well designed questionnaire. Informal feedback will be collected in parallel from selected student representatives within 4-5 weeks of commencement of the semester by the Office of Dean Academics.

HODs have to submit monthly /semester / Academic Year Feedback reports with necessary comments and proofs to Dean Academics office duly signed by concerned Principal/Director. Visit following link https://www.kluniversity.in/site/feedsys.htm.

CHAPTER 11

PROGRAM STRUCTURE

			Koneru Lakshmaiah Education Foundation									
			Department of Computer Science and Applications									
			BCA 2023-24 Admitted Batch Course Structure									
#no	**SEM**	**Course Codes**	**Course Title**	**Name**	**Type**	**Mode**	**L**	**T**	**P**	**S**	**Cr**	**CH**	**PRE-REQUISITES**
1	1	23CA1101	Web and Social Media Technologies	WST	SDC	R	0	0	0	4	1	4	NIL
2	1	23CA1102	Mathematics for Computer Science(BS1)	MCS	BS	R	2	2	0	0	4	4	NIL
3	1	23UC1101	Integrated Professional English(HSS1)	IPE	HSS	R	0	0	4	0	2	4	NIL
4	1	23CA1103	Computer Organization & Architecture	COA	PC	R	2	2	0	0	4	4	NIL
5	1	23CA1104	Essentials of Information Technology	EIT	PC	R	2	0	2	0	3	4	NIL
6	1	23CA1105	Problem Solving through Programming	PSP	PC	R	2	0	2	4	4	8	NIL
7	2	23CA1206	Probability and Statistics(BS2)	PNS	BS	R	2	2	0	0	4	4	NIL
8	2	23UC1202	English Proficiency(HSS2)	EPF	HSS	R	0	0	4	0	2	4	NIL
9	2	23CA1207	Software Engineering	SEG	PC	R	3	0	0	0	3	3	EIT
10	2	23CA1208	Operating System	OPS	PC	R	3	0	2	0	4	5	COA
11	2	23CA1209	Data Structures	DST	PC	R	3	0	2	4	5	9	PSP
12	2	23CA1210	Object Oriented Programming	OOP	PC	R	3	0	2	4	5	9	PSP
13	3	22UC1203	Design Thinking & Innovation(HSS3)	DTI	HSS	R	0	0	4	0	2	4	NIL

14	3	23CA2111	Computer Networks	CN	PC	R	3	0	0	0	3	3	OPS
15	3	23CA2112	Database Management Systems	DMS	PC	R	3	0	2	4	5	9	MCS
16	3		PE1	PE1	PE	R	2	0	2	0	3	4	MCS
17	3	23CA2113	Web Development using Python	WDP	SDC	R	0	0	4	4	3	8	PSP
18	3	23CA2114	Continuous Delivery & DevOps	CDD	FCC	R	3	0	2	0	4	5	NIL
19	1S	23CA21N1	Technical Internship-1	TIP1	PR	R	0	0	0	4	1	4	NIL
20	4	22UC2103	Essential Skills for Employability(HSS4)	EFS	HSS	R	0	0	4	0	2	4	NIL
21	4	22UC0010	Universal Human Values & Professional Ethics(HSS5)	UHV	HSS	R	2	0	0	0	2	2	NIL
22	4	23CA2215	Object Oriented Analysis & Design	OOAD	PC	R/A	2	0	2	0	3	4	SEG
23	4		PE2	PE2	PE	R	2	0	2	0	3	4	PE1
24	4	23CA22E1	Minor Project	MIP	PR	R	0	0	8	8	6	16	WDP
25	4	23CA2216	Java Full Stack Development	JFSD	SDC	R	0	0	4	4	3	8	OOP
26	5	22FL3055	Foreign Language Elective (HSS6)	FLE	HSS	R/M	2	0	0	0	2	2	NIL
27	5	22UC2204	Corporate Readiness Skills (HSS7)	CRS	HSS	R	0	0	4	0	2	4	NIL
28	5		OE1	OE3	OE	R/M	3	0	0	0	3	3	NIL
29	5	23CA3117	Mobile Application Development	MAD	SDC	R	0	0	4	4	3	8	OOP
30	5		PE3	PE3	PE	R	2	0	2	0	3	4	PE1
31	5		PE4	PE4	PE	R	2	0	2	0	3	4	PE1
32	5	23CA3118	Visual Programming & HCI (UI/UX)	VPH	FCC	R	3	0	2	0	4	5	WDP

33	2S	23CA31N2	Technical Internship-2	TIP2	PR	R	0	0	0	4	1	4	NIL
34	6		PE5	PE5	PE	R/M	3	0	0	0	3	3	PE1
35	6		OE2	OE2	OE	M	3	0	0	0	3	3	NIL
36	6		Management Elective (HSS8)	ME	HSS	R	2	0	0	0	2	2	NIL
37	6	23CA3219	Network Security	NS	FCC	R	3	0	2	0	4	5	CN
38	6	23CA32E2	Major Project	MAP	PR	R	0	0	8	8	6	16	MIP

List of Professional Electives for 2023-24 admitted batch of BCA										
Sl No	Course Code	Course Title	Specialization	L	T	P	S	Cr	CH
1	23CA21C1	Cloud Architecture	CLOUD COMPUTING	2	0	2	0	3	4
2	23CA22C2	Cloud Web Services		2	0	2	0	3	4
3	23CA31C3	Cloud Serverless Computing		2	0	2	0	3	4
4	23CA31C4	Design and Development of Cloud Application		2	0	2	0	3	4
5	23CA32C5	Cloud Security		3	0	0	0	3	3
6	23CA21D1	Statistics for Data Science	DATA SCIENCE	2	0	2	0	3	4
7	23CA22D2	Data Warehousing & Mining		2	0	2	0	3	4
8	23CA31D3	Machine Learning		2	0	2	0	3	4
9	23CA31D4	Big Data Analytics		2	0	2	0	3	4
10	23CA32D5	Data Visualization		3	0	0	0	3	3
11	23CA21A1	Artificial Intelligence	ARTIFICIAL INTELLIGENCE	2	0	2	0	3	4
12	23CA22D2	Data Warehousing & Mining		2	0	2	0	3	4
13	23CA31D3	Machine Learning		2	0	2	0	3	4
14	23CA31A4	Deep Learning		2	0	2	0	3	4
15	23CA32A5	Perception and Computer Vision		3	0	0	0	3	3
16	23CA21S1	Fundamentals of Cyber Security and Ethical Hacking	CYBER SECURITY	2	0	2	0	3	4
17	23CA22S2	Cyber Forensics		2	0	2	0	3	4
18	23CA31S3	Malware Analysis		2	0	2	0	3	4
19	23CA31S4	E-Governance		2	0	2	0	3	4
20	23CA32C5	Cloud Security		3	0	0	0	3	3

CHAPTER 12

ARTICULATION MATRIX

Program Articulation Matrix

S.NO	COURSE CODE	COURSE TITLE	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
1	23UC1101	Integrated professional English									2	3
2	23UC1202	English Proficiency									2	3
3	23UC2103	Essential Skills for Employability					3	3				
4	22UC2203	Corporate Readiness Skills				1			2	3	1	1
5	22FL3055	Foreign Language(GERMAN LANGUAGE)										3
6	23CA1101	Web and Social Media Technologies	2	2	2		2			2	2	2
7	23CA1102	Mathematics for Computer Science(BS1)		2								
8	23CA1103	Computer Organization & Architecture	2	2	2			3				
9	23CA1104	Essentials of Information Technology	2	2	3		3					
10	23CA1105	Problem Solving	3	2	3	3	3					

S.No	Course Code	Course Name											
		through Programming											
11	23CA1206	Probability and Statistics(BS2)	2	2	2								
12	23CA1207	Software Engineering	2	3	3	3			3				
13	23CA1208	Operating System		2	3	2	3						
14	23CA1209	Data Structures	2	2	2	2	2						
15	23CA1210	Object Oriented Programming	2	2	3		3				3		
16	23CA2111	Computer Networks	3	2		3							
17	23CA2112	Database Management Systems	1	2	2	3	3						
18	23CA2113	Web Development using Python	2	2		3	3						
19	23CA2114	Continuous Delivery & DevOps	2				2						
20	23CA2215	Object Oriented Analysis & Design	2	2	2	3		3	2				
21	23CA2216	Java Full Stack Development			2		3						
22	23CA3117	Mobile Application Development	2				3						

S.No	Course Code	Course Name											
23	23CA3118	Visual Programming & HCI (UI/UX)	1	2	2		3			2			
24	23CA3219	Network Security	2	3	2	3							
25	23CA21C1	Cloud Architecture	2	2	2	2							
26	23CA22C2	Cloud Web Services		2	3	2	2	3					
27	23CA31C3	Cloud Serverless Computing		2	2	2							
28	23CA31C4	Design and Development of Cloud Application	2	2	3					3			
30	23CA21D1	Statistics for Data Science	2	2	2			2					
31	23CA22D2	Data Warehousing & Mining	2	2	2	2	3						
32	23CA31D3	Machine Learning	2	2	3	2	3			3			
33	23CA31D4	Big Data Analytics	2	2	2	2	2		2				
34	23CA32D5	Data Visualization	2	2	2	2	3						
35	23CA21A1	Artificial Intelligence	2	2			3	1					
36	23CA31A4	Deep Learning							2	3			
37	23CA32A5	Perception and Computer Vision	2		2		2						

SL NO	COURSE CODE	COURSE TITLE	1	2	3	4	5	6	7	8	9	10
38	23CA21S1	Fundamentals of Cyber Security and Ethical Hacking	2		2	2	2					
40	23CA22S2	Cyber Forensics	2	2	3	3	2					
41	23CA31S3	Malware Analysis	2	2	3	2	2	2	2			

Course Articulation Matrix

SL NO	COURSE CODE	COURSE TITLE	CO. No.	Course Outcome	POs									
					1	2	3	4	5	6	7	8	9	10
1	23UC1101	Integrated professional English	1	Understanding the language Mechanics in Basic Grammar & Interactive Listening & Speaking									2	
			2	Applying Integrated Reading skills & Techniques of Writing										3
2	23UC1202	English Proficiency	1	Understanding Language Mechanics in advanced Grammar and advanced Communicative Listening & Speaking									2	
			2	Apply the basic functionality of Clocks and Calendars to find the solutions for the problems.										3
3	23UC2103	Essential Skills for Employability	1	Developing basic grammar Identify and organize sentence structures based on grammar and apply in writing skills						2				
			2	Develop effective interpersonal skills, cultivate a positive attitude, apply positive self-talk techniques, and use SWOC analysis to enhance employability.							3			

S.No	Course Code	Course Title	CO	Course Outcome	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
			3	Develop drafting skills through Cloze Test, Passage completion, E-mail writing, Paragraph writing, Essay writing						3					
			4	Develop effective communication skills through JAM and extempore, describing products and processes through JAM and extempore, demonstrating proper email and phone etiquette, and improving listening skills to enhance personal and professional relationships.					2						
4	22UC2203	Corporate Readiness Skills	1	Understanding word power for developing effective speaking and writing skills and Interpret Interpersonal Skills									2		
			2	Applying general reading skills and Demonstrate necessary skills to be employable										3	
			3	Understanding word power for developing effective speaking and writing skills and Interpret Interpersonal Skills									1		1
			4	Applying general reading skills and Demonstrate necessary skills to be employable				1							1
5	22FL3055	Foreign Language (GERMAN LANGUAGE)	1	Understand the German language Basic Proficiency: Students will develop and apply a solid foundation in German, allowing them to introduce themselves, engage in basic conversations, and understand everyday expressions.											2
			2	Determine the German Vocabulary and Grammar: Students will learn essential vocabulary and grasp German grammar rules, enabling them to construct simple sentences accurately.											2
			3	Comprehensive Reading and Listening practices: Students will comprehend basic written and spoken German, understanding short texts, signs, and following straightforward conversations.											3
			4	Examining and interpreting the German Cultural Awareness: Students will gain insights into German-speaking countries' culture, enhancing their ability to communicate respectfully and appreciate the customs and traditions.											3
6	23CA1101	Web and Social Media Technologies	1	Understand semantics of web page, its elements and attributes.	2										
			2	Outline the basic concepts of CSS and utilize them for making of static web pages.		2	2		2						

S.No	Course Code	Course Name	CO	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
			3	Demonstrate the various social media platforms and their usages		2	2							2	2	2	
			4	Understand the usage of outcasts of social media		2								2	2	2	
			5	Develop web pages using HTML, CSS and makes use of social media platforms for creating accounts.		2	2		2					2	2		
7	23CA1102	Mathematics for Computer Science (BS1)	1	Understand fundamental concepts to solve problems of matrices		2											
			2	Demonstrate differential calculus, differentiation rules and identify a method for solving and interpreting the results.		2											
			3	Develop physical laws and relations mathematically in the form of second/higher order differential equations and identify a method for solving and interpreting the results.		2											
			4	Apply partial differential equations and identify method for solving PDE's		2											
8	23CA1103	Computer Organization & Architecture	1	Understanding the fundamental concepts and techniques used in digital electronics and applying the K-Maps simplification	2	2					3						
			2	Model the basic concepts of computer organization: structure and operation of computers and their peripherals.	2	2					3						
			3	Analyse the design of the functional units of a digital computer system.		2	2				3						
			4	Classify the working of the Central Processing Unit. Design and evaluate the performance of memory systems		2	2	3									
9	23CA1104	Essentials of Information Technology	1	Understand the architectural design of a computer, hardware peripherals and various concepts of Operating systems	2												
			2	Outline Programming fundamentals and User interface designs	2	2	2										
			3	Summarize the fundamentals of Computer networks.	2												

No	Code	Course	CO	Description	1	2	3	4	5	6	7
			4	Construct Software attributes, Specifications and Software Requirement Specification Document	2	2	3				
			5	Analyze and Explore data through Word Processing, Spreadsheet applications and Presentations	2	2			3		
10	23CA1105	Computational Thinking for Structured Design	1	Outline different concepts of C programming constructs for creating programs.	2	2	3				
			2	Discuss about different control structures	2	2		3			
			3	Demonstrate the working of functions, arrays, and pointers	2	2		3			
			4	Identify the working of structures and different file handling methods	2	2		3			
			5	Evaluate solutions for programs using basic and advanced concepts of C language, can solve the programming challenges using C.		2	2	3			
			6	Develop Applications using C Programming.		2	2	3			
11	23CA1206	Probability and Statistics(BS2)	1	Identify the types of random variables and also apply discrete distributions to analyze various rela-world situations	2						
			2	Construct the probability distribution of a continuous random variable based on a real-world problems, and also predict the linear and non-linear relationship between the two variables			2				
			3	Apply statistical tests for large and small samples to test the hypothesis.			2				
			4	Testing the hypothesis to analyze the variance by applying suitable design			2				
12	23CA1207	Software Engineering	1	Demonstrate the requirement of software development for various applications.	2	3					
			2	Utilize some of the Process Models in software engineering for software development.		2	3				
			3	Identify stakeholders' requirements, multiple viewpoints, eliciting requirements pts, Extreme Programming, SAFe Methodology		2	3				3

#	Code	Course	CO	Course Outcome	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
			4	Examine various testing techniques				2	3							
13	23CA1208	Essentials of Operating System	1	Understand fundamental operating system abstractions such as processes, memory management, functionalities of operating system				2								
			2	Analyse algorithms of scheduling and process virtualization, memory management algorithms				2	3							
			3	Categorize the operating system's resource management techniques, dead lock management techniques, paging, segmentation				2	3							
			4	Understand and analyse theory and implementation of synchronization, concurrency, Semaphores, Threads API.				2	3							
			5	Implement various programs and Unix commands through Unix platform		2	3									
14	23CA1209	Data Structures	1	Explain various data structures and memory management of different types of data structure.	2											
			2	Summarize the working of linear data structure like Link list, Stack and Queue	2	2	3									
			3	Compare linear and non-linear data structure	2	2	3									
			4	Summarize the working of different searching technique and sorting technique and their application	2	2	3	2								
			5	Evaluate programs to demonstrate the functionality of different data structures.			2		3							
			6	Evaluate programs to demonstrate the functionality of sorting algorithms, searching algorithms, etc.			2		3							
15	23CA1210	Object Oriented Programming	1	Understanding the basic OOP concepts	2		3									
			2	Apply concepts of class &object		2			3							

S.No	Course Code	Course Name	CO	Course Outcome										
			3	Analyse and Implement interfaces, Packages		2		3						
			4	Analyse Multi-Threading and Exceptions		2		3						
			5	solve varies problem using oops techniques	2	2		3						
		3	6	Experiment the various design techniques and the Object Oriented Programming concepts		2							3	
16	23CA2111	Computer Networks	1	Understand the fundamentals of computer networks and data communication.		2								
			2	Understand and Analyze the fundments of Data Communication	2									
			3	Analyze the IEEE Standards, Data Link Layer and Evaluate design issues in networks.	3									
			4	Analyze Internet Transport Protocols and Evaluate different types of protocol, Evaluate various types of Network Devices and different types of Networks.			2							
17	23CA2112	Database Management Systems	1	Remembering Database and File System and Applying different kinds of data models with functional components of DBMS	1									
			2	Applying design, SQL, PL/SQL and corelating appropriate strategies for optimization of queries with Tuple Relational Calculus and Domain Relational Calculus		2		3						
			3	Analysing normal forms based on functional dependency and Apply normalization techniques to eliminate redundancy with the ACID properties	2			2						
			4	Applying concurrency techniques to demonstrate the organization of Databases with log mechanism and check pointing techniques for system recovery.			2	3						

No	Code	Course	CO	Course Outcome												
			5	Analysing and apply in Identifying variety of methods for effective processing of given queries			2	3								
			6	Choose a MongoDB and implement SQL queries and PL/SQL programs to do various operations on data..			2		3							
18	23CA2113	Web Development using Python	1	Understand the basic programming skills in core Python			2									
			2	Build python application to connect with the database and perform CRUD operations	2			2	3							
			3	Develop Web forms and Application in Django				2		3						
19	23CA2114	Continuous Delivery & DevOps	1	Identify the Need of DevOps in SDLC and Cloud Infrastructure in DevOps, Apply Version Control System to track the latest version of Software	2											
			2	Analyse Continuous Integration and Continuous Deployment using Infrastructure as Code, Build in Cloud native Applications using Pipeline and Examine the Software and Automation Testing Frameworks							2					
			3	Analyze need of Containerization in SDLC and Examine the Kubernetes Pod Configuration.							2					
			4	Inspect Configuration Management using Infrastructure as Code, Analyze Continuous Monitoring and Container Orchestration process.							2					
			5	Build and Inspect the Tools associated to DevOps Life Cycle.							2					
20	23CA2215	Object Oriented Analysis & Design	1	Illustrate the fundamentals of object modelling.	2											
			2	Build static and dynamic UML diagrams.	1		2	2								
			3	Make use of design patterns for Software design				2	3					2		
			4	Analyse various Object-Oriented Methodologies.				2	2			3				

#	Code	Course	CO	CO Description	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
			5	Evaluate different types of UML Diagrams			2	2						
21	23CA2216	Java Full Stack Development	1	Apply JDBC API, JUnit Testing Framework and XML Concepts to build Console and Web Applications, Solve Servlets, JSP, Hibernate, Spring and Spring Boot to build web applications and Enterprise Level applications.			2		3					
			2	Analyze the design of linear data structures for real world problems, Apply the java full stack concepts and implement the practicals on Spring Boot MVC, google maps, 2 step verification, sending mail and sms, captcha generation, bar code and qr code scanning, Spring Cloud and Spring Microservices.			2		2					
			3	Analyze alternate algorithm techniques to solve optimization related problems in the real-world scenario.,Apply the Java Concepts like Hibernate, Spring, Spring Boot, Spring Cloud and Microservices to Develop the Feature Rich Java Full Stack Application.			2		3					
22	23CA3117	Aspects of Mobile Application	1	Understand the basics of object-oriented programming language & Activity life Cycle Methods in Android.	2				3					
			2	Apply the concepts of Android development and Designing of different widgets for android, Views, Layouts, and Navigation on Android	2				3					
			3	Apply the concepts of the database and Memory storage concept to build the dynamic Android applications, Design and develop the Mobile application real-time case studies	2				2					
23	23CA3118	Visual Programming & HCI (UI/UX)	1	Illustrate the basic physiological, perceptual, and cognitive components of human learning and memory will learn by the students.	1	2	2							
			2	Design the fundamental aspects and implementing user interfaces, the students will gain theoretical knowledge and practical experience.	1	2	2							
			3	Implement about multimodal displays for conveying and presenting information, students will gain.	1	2						2		

S.No	Course Code	Course Name	CO	Course Outcome	1	2	3	4	5	6	7	8	9	10	11	12
			4	Analyze the interaction problems from a technical, cognitive, and functional perspective, will learn by the student.	2		2					2				
			5	Choose to develop an awareness of the range of general human-computer interaction issues that must be considered when designing information systems.	2		2		3							
			6	Choose Practiced, a variety of simple methods for designing and evaluating the quality of user interfaces and spatial display	2		2		2							
24	23CA3219	Network Security	1	Acquire the concept of physical layer and various transmission media	2		2									
			2	Understand the architecture of router, mechanism of packet forwarding and policy for internet routing	2		3									
			3	Understand the importance of distributed algorithms, multicast routing and various threats in network	2	3										
			4	Understand types of vulnerabilities and attacks in web applications and algorithm designed against them	2	3										
			5	Apply Security concepts and analyse their performance using networking tools.	2			3								
25	23CA21C1	Cloud Architectures	1	Classify cloud computing importance and services	2											
			2	Relate cloud services & models.	1	2										
			3	Explain Virtualization and its applications			2									
			4	Apply cloud services using web services Cloud to utilize cloud resources.			2									
			5	Measure various cloud services using web services Cloud for building and deploying applications.				2								
26	23CA22C2	Cloud Web Services	1	Summarize the model of Cloud Computing As A Service				2								
			2	Illustrate the Networking Basics required for cloud services					2							

S.No	Course Code	Course Title	CO	Course Outcome	1	2	3	4	5	6	7	8	9	10
			3	Demonstrate the Control of workflow in cloud services	2	2	3							
			4	Explain the method of fault tolerance in cloud	2	2	2	3	3					
			5	Experiment with the AWS Cloud		2	2	3						
27	23CA31C3	Cloud Serverless Computing	1	Defining Cloud computing and cloud service scheduling hierarchy.	2									
			2	Describing the Functions-as-a-service and Event-driven programming. Develop Scalable Models Using Serverless Architectures.	2									
			3	Demonstrating the application functionalities using Serverless runtimes and Serverless databases		2								
			4	Apply Serverless Programming Practices and Patterns. Architect, Build, and Operate the serverless applications		2								
			5	Analyse a real-world and scalable full-stack application using Serverless technologies			2							
28	23CA31C4	Design and Development of Cloud Application	1	Understand the basic concept of hybrid cloud	1	2								
			2	Understand the management of hybrid cloud in terms of development and deployment	2	2	3							
			3	Plan the establishment of hybrid plan	2	2						3		
			4	Apply the usage of Azure as a platform for hybrid cloud	2	2						2		
			5	Evaluate Applications using AWS cloud	2	2	3							
30	23CA21D1	Statistics for Data Science	1	Explain the basic concepts of statistics and explains the various methods of descriptive data collection and analysis	2									

No	Course Code	Course Name	CO	Course Outcome	1	2	3	4	5	6	7	8	9
			2	Show the probability distribution of a random variable, based on real-world situation, and use it to compute expectation and variance			2						
			3	Construct the linear and non-linear regression lines for the given data.	2								
			4	Apply basic concepts of statistics and explains the various methods of descriptive data collection and analysis		2							
			5	Measure Statistical data using SPSS or Minitab tools						2			
31	23CA22D2	Data Warehousing & Mining	1	Demonstrate Data preprocessing in knowledge Discovery Process	2								
			2	construct various multidimensional model with OLAP operations	1	2							
			3	Infer knowledge pattern using Association and Clssification methods		2	2						
			4	Discover knowledge pattern from different clustering methods		2		2					
			5	Examine data preprocessing task and discover Knowledge pattern using various Data mining methods.		2		3					
32	23CA31D3	Applied Mahine Learning	1	Demonstrate the types of machine learning and model representation	2	2	3						
			2	Implementing Linear Regression model for supervised learning			2	2	3				
			3	Experimenting Multiple Linear Regression model			2	2		2			
			4	Estimating various Regression coefficient			2	2					3
			5	Evaluate applications using linear regression techniques			2	2					3
33	23CA31D4	Introduction to Big Data Analytics	1	understand how to store and maintain of Big Data	2								
			2	understand architecture and ecosystem of Hadoop		2							
			3	Outline Processing and Storage Layer of Hadoop, internal concept of Map Reduce		2		2		2			
			4	understand YARN Architecture and Execution of job in Hadoop cluster			2	2					

No	Code	Course	CO	Description								
			5	Evaluate cluster management using YARN				2	2			
34	23CA32D5	Data Visualization Techniques	1	Understand the brief history of data visualization, its importance, and the challenges involved in visualizing data	2							
			2	Apply static graphical techniques such as bar graphs to represent data, including grouping bars, customizing colors, sizes, titles, and axis units		2		2				
			3	Analyze multivariate statistical visual representations, such as dendrograms, scree plots, QQ plots, and PP plots.		2	2	2 2				
			4	Examine the visualizations by adding annotations such as text, mathematical expressions, lines, arrows, shaded shapes, and error bars.				2	3			
35	23CA21A1	Applied Artificial Intelligence	1	Understand about intelligence, knowledge and artificial Intelligence, techniques of AI as a State space search, production systems.	2	2			3			
			2	Implement problem solving by search, Heuristic search, Randomized search techniques and Finding optimal paths	2	2			2			
			3	Experiment with the appropriate methodologies for problem decompositions, planning and constraint data constraint satisfactions.	2	2			3			
			4	Implement knowledge representation using Predicate Logic, representing knowledge using rules, Semantic Nets, Frames and conceptual dependencies	2	2			2			
			5	Evaluate the theoretical concepts to conduct various experiments on Search Techniques and Language Representation and processing using AI .						1		
36	23CA31A4	Applied Deep Learning	1	Illustrate Sigmoid Neurons, Feedforward Neural Networks, Gradient Descent (GD), Dimensional Reduction							2	
			2	Experiment with the Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO						1		
			3	Build the concepts of , Deep Dream, LSTM, GRU and Neural style transfer							2	

No	Course Code	Course Name	CO	Course Outcome	1	2	3	4	5	6	7	8	9	10	11
			4	Organize the concepts of Markov models, Markov networks, Markov chains, Variational autoencoders, Autoregressive Models: NADE, MADE, PixelRNN									3		
			5	Evaluate Neural Networks, optimization algorithms, engine vector decomposition, various types of auto encoders, batch normalization, convolutional neural network											
37	23CA32A5	Perception and Computer Vision	1	Understand Image representation and modelling	2										
			2	Apply Image transformation methods			2								
			3	Implement image processing algorithms					2						
			4	Design of face detection and recognition algorithms.			2								
38	23CA21S1	Fundamentals of Cyber Security and Ethical Hacking	1	Understand the need for cyber security	2										
			2	Analyze various types of security threats and electronic payment systems				2	2						
			3	Analyze the security issues involved in developing secure information systems				2	2						
			4	Compare different ethical hacking methods				2	2						
			5	Analyze various cyber security threats					2	2					
	23CA22S2	Cyber Forensics	1	Understand Forensic Science and Recovery methods	2	2									

#	Course Code	Course Name	CO	Course Outcome	1	2	3	4	5	6	7	8	9	10	11	12
40			2	Analyze Digital Evidence, Network Forensics and Mobile Device Forensics		2	3									
			3	Analyze Web Forensics and Email Forensics		2	2	3								
			4	Analyze the security policies, standards and cyber laws			2	2								
			5	Design an application for cyber forensics using the concepts.			2	2	2							
41	23CA31S3	Malware Analysis	1	Understand the basics of Malware analysis	2											
			2	Organize the concept of dynamic analysis		2	3									
			3	Build the concept of Virtual machines in Malware analysis	2		2	2								
			4	Analyze the Exception handling in malware analysis				2	2							
			5	Analyze the Exception handling in malware analysis					2	2	2					

CHAPTER 13

Syllabus

GENDER AND SOCIAL EQUALITY(GSE)

| COURSE CODE | 22UC0011 | MODE | OFFLINE | LTPS | 2-0-0-0 | PRE-REQUISITE | |

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Students will have developed a better understanding of important issues related to gender in contemporary India	2	PO2
CO2	Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through group discussions.	3	PO4
CO3	Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.	4	PO6
CO4	Students will acquire insight into the gendered division of labour and its relation to politics and economics.	4	PO10

Syllabus

Module 1	UNDERSTANDING GENDER: Socialization: Making Women, Making Men, Preparing for Womanhood, Growing up Male, First lessons in Caste, Different Masculinities. GENDER AND BIOLOGY: Missing Women: Sex Selection and Its Consequences, Declining Sex Ratio. Demographic Consequences. Gender Spectrum: Beyond the Binary Two or Many? Struggles with Discrimination.
Module 2	GENDER AND LABOUR: Housework: The Invisible Labor, Women's work: Its politics and Economics, Fact and Fiction. Unrecognized and Unaccounted work.Additional Reading: Wages and Conditions of Work.
Module 3	ISSUES OF VIOLENCE: Sexual Harassment: Say No! Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment, Domestic Violence: Speaking Out, Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence.
Module 4	GENDER: CO - EXISTENCE : Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	A World of Equals: A Textbook on Gender	*Edited by: Susie Tharu; A. Suneetha; Uma Maheswari Bhrugubanda*	Orient BlackSwan	
2	Seeing Like A Feminist	Menon Nivedita, Nivedita Menon	Penguin Zubaan	
3	Gender Sensitization: Issues and Challenges	Dr Raj Pal Singh, Dr Anupama Sihag	Raj Publications	

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Global Gender Policy Certificate	The George Washington University				https://elliott.gwu.edu/global-gender-policy

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1			
2			

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	HOME ASSIGNMENTS	10	
In-Sem Summative	IN SEM-1	20	40
	IN SEM-2	20	
End-Sem Summative	END SEMESTER	40	40

INTEGRATED PROFESSIONAL ENGLISH(IPE)

COURSE CODE	23UC1101	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding the language Mechanics in Basic Grammar & Interactive Listening & Speaking	2	PO9 & PO10 PSO 1
CO2	Applying Integrated Reading skills & Techniques of Writing	3	PO9 & PO10 PSO 1

Syllabus

Module 1	A. Discuss people you admire (review of tenses, Character adjectives) Discuss a challenge questions) B.Discuss a challenge (Questions, Trying and succeeding)C. Explain what to do and check understanding (Rapid Speech)D. Give advice on avoiding danger (Future time clauses and conditionals) Breaking off a conversation, Explaining and checking understanding.E. Discuss dangerous situations (Narrative tenses, Expressions with 'get')F. Give and respond to compliments (Intonation in Question Tags, Agreeing using question tags; giving compliments and responding)
Module 2	Discuss ability and achievement (Multi-word verbs, Ability and achievement) Discuss sports activities and issues (present perfect and present perfect continuous, words connected with sports). C. Make careful suggestions (Keeping to the topic of the conversation; Making careful suggestions) D. Discuss events that changed your life (used to and would, cause and result)
Module 3	A. Discuss choices, discuss changes (infinitives and ing forms, the passive) B. Introduce requests and say you are grateful (Consonant sounds) C. Discuss living in cities (too / enough; so / such, Describing life in cities) D. Discuss changes to a home (Causative have / get Film and TV; Houses) E. Imagine how things could be (Stress in compound nouns) F. Discuss personal finance (First and second conditionals)
Module 4	A. Discuss moral dilemmas and crime (Third conditional; should have + past participle), Stressed and unstressed words; Sound and spelling B. Discuss new inventions (Relative clauses), Discuss people's lives and achievements Reported speech; Reporting verbs, verbs describing thought and knowledge. C. Express uncertainty (Linking and intrusion, Clarifying a misunderstanding) D. Speculate about the past (Past modals of deduction Adjectives with prefixes) E. Discuss life achievements (Wishes and regrets, Verbs of effort) F. Describe how you felt (Consonant clusters, describing how you felt; Interrupting and announcing news)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	EMPOWER	Andrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones	Cambridge University Press	2022
2	PRACTICAL ENGLISH USAGE, 4TH EDN: Michael Swan's guide to problems in English (Practical English Usage, 4th edition)	Michael Swan	OXFORD	2022
3	Word Power Made Easy	Norman Lewis	OXFORD	2022

Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Linguaskills	Canbridge University	y	Online	Cambridge University	https://www.cambridgeenglish.org/exams-and-tests/linguaskill/
2						

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Padlet		OPEN SOURCE
2	Lexipedia		OPEN SOURCE

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	12.5	25
	Project Continuous Evaluation	12.5	
In-Sem Summative	Sem-in 1	17.5	35
	Sem-in 2	17.5	
End-Sem Summative	Closed Book Exam/Paper Based		40

ENGLISH PROFICIENCY (EP)

COURSE CODE	23UC1202	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding Language Mechanics in advanced Grammar and advanced Communicative Listening & Speaking	2	PO9,10 PSO 1
CO2	Applying the advanced Reading techniques and Advanced Techniques of Writing	3	PO9,10 PSO 1

Syllabus

Module 1	A. Talk about learning a second language (adverbs and adverbial language learning noun forms, word stress and noun forms with – *tion* and *-ity*) B. Describe extreme sensory experiences (Comparison, multi-word verbs, C. Talk about crime and punishment (relative clauses) D. Talk about using instinct and reason (noun phrases); Express yourself in an inexact way. E. Describe photos and hobbies (simple and continuous verbs and adjectives) F. Idioms: body parts, movement, landscapes, crime and feelings
Module 2	A. Talk about plans, intensions, and arrangements (intensions and arrangements, verbs of movement); Give advice (advising a friend about a problem) B. Emphasis positive and negative experiences by describing journeys and landscapes; architecture and buildings (future in the past, narrative tenses, ellipsis, and substitutions) C. Listen to Job Profiles. Talk about job requirements and fair pay (obligation, necessity, and permission) D. Listen to/Tell a descriptive narrative – a personal story (participle clauses) E. Emphasis opinions about the digital age- explain how you would overcome a hypothetical problem. F. Describe sleeping habits, routines, lifestyles and life expectancy (gerunds, infinitives and conditionals)
Module 3	A. Paraphrasing and summarising B. Read and talk about memories and remembering (structures with have and get) C. Speculate about inventions and technology (compound adjectives) D. City life and urban space (reflexive and reciprocal pronouns, verbs with re-) E. Superstitions and rituals (passive reporting verbs) F. Read a review, report, and recommendation of a committee.
Module 4	A. Write a web forum post (expressing opinions) B. Write a report and travel review. C. Write a profile article (read an Interview of a celebrity and write an article) D. Write an essay: opinion essay and discussion essay. E. Write an application e-mail. F. Write promotional material using persuasive language.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Empower 3rd Edition	Andrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones	Cambridge	2022
2	The Cambridge Guide to English Usage	Pam Peters	Cambridge	2020
3	Academic English	Letty Chan	Hong Kong : Hong Kong University Press ; London : Eurospan distributor	2021

Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Lingua Skills Business	Cambridge university	y	online	Cambridge university	https://www.cambridgeenglish.org/exams-and-tests/linguaskill/information-about-the-test/test-formats-and-task-types/
2						

Mapped Global Certifications:

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	padlet		Open source
2	lexipedia		Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	12.5	25
	Project continuous evaluation	12.5	
In-Sem Summative	Sem in 1	17.5	35
	Sem in 2	17.5	
End-Sem Summative	Closed book/paper based exam		40

ESSENTIAL SKILLS FOR EMPLOYABILITY(ESE)

COURSE CODE	22UC2103	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NA

Course Outcomes

CO#	CO Description	BTL	PO Mapping

CO1	Developing basic grammar Identify and organize sentence structures based on grammar.	2	PO10
CO2	Develop effective interpersonal skills, cultivate a positive attitude, apply positive self-talk techniques, and use SWOC analysis to enhance employability.	2	PO9
CO3	Develop drafting skills through Cloze Test, Passage completion, E-mail writing, Paragraph writing, Essay writing	3	PO10
CO4	Develop effective communication skills through JAM and extempore, describing products and processes through JAM and extempore, demonstrating proper email and phone etiquette, and improving listening skills to enhance personal and professional relationships.	2	PO 12

Syllabus

Module 1	Grammar: Tenses, Voice, Reported Speech, Spotting Errors, Sentence Improvement, Sentence Rearrangement
Module 2	SWOC, Self-awareness, Attitude, Self-Confidence & Positive Self-Talk, Grooming, Intrapersonal skills, and Interpersonal Skills.
Module 3	Writing Skills: Cloze Test, Passage completion, E-mail writing, Paragraph writing, Essay writing
Module 4	Speaking from the script through JAM & Extempore, Product & Process Description through JAM & Extempore, Transactional Analysis, Persuasion & Negotiation, Etiquettes (E-Mail & Phone), Listening Skills.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Objective English for Competitive Examination	Hari Mohan Prasad and Uma Sinha.	McGraw Hill	2017
2	English Language Communication Skills, C	Cengage		2014
3	Bridging the Softskills Gap	Bruce Tulgan	Jossey-Bass	2015
4	The Soft skills Book-The Key Difference to Becoming Highly Effective & Valued	Dan White	LID Publishing	2121
5				

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		LINGUA	yes	online	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams

		SKILLS				-and-tests/qualifications/business/
2		IELTS	yes	online	BRITISH COUNCI	https://www.britishcouncil.in/teach/teacher-training/masterclass-ielts-trainers

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	LINGUA SKILLS INTERMEDIATE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2	LINGUA SKILLS VANTAGE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Lab weekly exercise	12.5	25
	Group Discussion (CO2)	6.25	
	Quiz (CO4)	6.25	
In-Sem Summative	Project Evaluation	8.75	35
	Sem in -1	8.75	
	Exercise	8.75	
	Semester In Exam II	8.75	
End-Sem Summative	End Semester Exam (online MCQ)	40	40

CORPORATE READINESS SKILLS (CRS)

COURSE CODE		MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	ESE

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Extend word power for developing effective speaking and writing skills	3	PO10, PO12
CO2	Apply Interpersonal Skills in day-to-day life	3	PO10, PO12
CO3	Differentiate and enhance critical and general reading skills	3	PO10, PO12
CO4	Demonstrate necessary skills to be employable	3	PO10, PO12

Syllabus

Module 1	Verbal Ability: Synonyms and Antonyms, Sentence Completion, Idioms & Phrases, One Word Substitutes, Analogies, Spellings, Selecting words, Sentence Formation.
Module 2	Life Skills: Goal Setting, Team Building, Leadership, Time Management, Managing Stress, Work Ethics.
Module 3	Reading Skills: Reading Comprehension and Types of Questions and Critical Reading .
Module 4	Employability Skills: Empathy, Assertiveness, Group Discussion, CV, Video Resume and Interview Skills.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The 7 Habits of Highly Effective College Students: Succeeding in College...and in Life	Covey, Stephen R.	Franklin Covey	2014
2	The Complete Guide to Mastering Soft Skills for Workplace Success	Adams, John	Adams Media	2019
3	Objective English for Competitive Examination	Hari Mohan Prasad, Uma Sinha	McGraw Hill Education	2017
4	The Business Student's Handbook: Skills for Study and Employment	Fisher, Julie and Bailey, Peter	Cengage Learning	2017
5	Writing Tools: 55 Essential Strategies for Every Writer	Roy Peter Clark	Little, Brown and Company	2006

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		LINGUA SKILLS	YES	ONLINE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2		IELTS	YES	ONLINE	BRITISH COUNCIL	https://www.britishcouncil.in/teach/teacher-training/masterclass-ielts-trainers

Tools used in Practical / Skill:

S. No.	Tool Name	Parent Industry	Open Source/ Commercial
1	LINGUA SKILLS INTERMEDIATE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2	LINGUA SKILLS VANTAGE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Lab Weekly Exercise/ Continuous Evaluation	12.5	25
	Project Continuous Evaluation	12.5	
In-Sem Summative	Semester in Exam-I	17.5	35
	Semester in Exam-II	17.5	
End-Sem Summative	Viva	7	32
	Exercise	20	
	Report	5	

Web and social media Technologies (WSMT)

COURSE CODE	23SDCA01	MODE	R	LTPS	**0-0-0-4**	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand semantics of web page and concepts of HTML and CSS, its elements, and attributes.	2	PO1
CO2	Demonstrating creation and usage of LinkedIn, Facebook & Twitter accounts and explaining various outcasts of social media platforms.	3	PO2, PO3, PO5

Syllabus

Module 1	**HTML:** Syntaxes, HTML structure, Basic Text Markup Language, HTML styles, Element Attributes, Heading, Layouts, I-frame Images, Hypertext Links, List, tables, forms, GET and POST method, Frames.**CSS:** Introduction to CSS, Levels, Style Specification formats, Selector forms, the box model, Conflict resolution, CSS3.**Social Media:** Definition of Social Media, Evolution of Social Media, types of social media, positive and negative influence of social media on individuals, businesses and society as a whole, identifying the uses of social media platforms.
Module 2	**LinkedIn:** Opening accounts in LinkedIn, Authentication and Security issues, strategically build network on LinkedIn, searching connections and developing tracking sheet for network connection, adding recruiter and people from the company to work, review and update profile, achieving academic and professional realms strategies for LinkedIn Platform. **Facebook & Twitter:** Introduction, Evolution of Facebook & Twitter, Uses of the platforms in personal, academic and professional realms, creating accounts in each platform, Guidelines and security features for each platform, strategies for achieving academic and professional goals using Facebook and Twitter. **The Outcasts of social media: Blogs, Videos, Wikis and more:** Introduction to various outcasts of social media platforms, history and evolution of each social media outcasts – its usage- implementation, overall impact of social media outcasts on academics, professions and society in general.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Social Networks and the Semantic Web	Peter Mika	Springer	2007
2	Web Technologies	Uttam K Roy	Oxford	2010
3	An Introduction to Web Design, Programming	Paul S Wang, Sanda S Katila	Cengage	2003

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification

| 1 | Microsoft Technology Associate (MTA) HTML5 Application Development Fundamentals | Microsoft | Y | OBJECTIVE | Microsoft works with various testing providers worldwide to offer exam delivery services both in-person at testing centers and online. | https://www.miosoft.com/en-us/learning/certication-overview.aspx |
| 2 | CIW (Certified Internet Web Professional) Site Development Associate | CIW (Certified Internet Web Professional) | Y | OBJECTIVE | Certiport | https://www.certiport.com/. |

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Visual Studio Code	Microsoft	Open Source
2	WebStorm	JetBrains	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Lab Exercise	12.5	25
	Project	12.5	
In-Sem Summative	In Semester Exam-I	17.5	35
	In Semester Exam-II	17.5	
End-Sem Summative	Review for Project	15	30
	Report	10	
	Presentation	5	
End-Sem Formative	Exercise	5	10
	Questions &Answers	5	

Computer Organization And Architecture (COA)

| COURSE CODE | 23CA1103 | MODE | R | LTPS | 2-2-0-0 | PRE-REQUISITE | NIL |

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding the fundamental concepts and techniques used in digital electronics and using K-Maps for Boolean Expression simplification	2	PO1,PO2,PO6
CO2	Model the building blocks of Combinational and Sequential circuits and explaining registers and its usage.	3	PO1,PO2,PO6
CO3	Analyze the basic concepts of computer organization: structure and operation of computers and their peripherals the design of the functional units of a digital computer system.	4	PO2,PO3,PO6
CO4	Classify the working of the Central Processing Unit. Design and evaluate the performance of memory systems	4	PO2,PO3,P PO6,

Syllabus

Module 1	Number Systems: Representation of numbers in different radix ,Conversions from one radix to another, Integer - unsigned, signed (sign magnitude, 1's complement, 2's complement).Boolean Algebra: Logic Gates-OR, AND, NOR, NAND, XOR & XNOR, Truth Tables, Demogran's theorms(2&3 Variable), Boolean laws, Circuit designing techniques: Karnaugh Map- 2, 3 and 4 Variable K Maps. Minimization Techniques – Min-terms and Max-terms, Sum of Product (SOP), Product of Sum (POS).
Module 2	Combinational Building Blocks: Adders and Subtracters, Multiplexers, Decoders. Sequential Circuits – Flip Flops, Types of Flip Flop – SR Flip Flop, J K Flip Flop, D flip flop, T Flip flop. Basic Structure of Computers: Computer Types, Functional Units. Register Transfer & Micro -Operations: Register Transfer Language, Register Transfer, Bus & memory Transfers, Arithmetic Micro-operations, Logic Micro Operations, Shift Micro-operation, Arithmetic Logic Shift Unit.
Module 3	Basic Computer Organization and Design: introduction codes, Computer Registers, Computer instructions, Timing and Control-Hardwired & Micro Programmed control, Instruction Cycle, Memory-Reference Instruction, Input-Output and interrupt, Design of Basic Computer, Design of accumulator Logic. Micro Programmed Control Unit-Address Sequencing, Micro-Program example
Module 4	Central Processing Unit: General registers Organization, Stack Organization-types, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced instruction Set Computer (RISC). Memory Organization: Memory Hierarchy, Main Memory, Associative Memory, Cache Memory, Virtual Memory.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Computer System Architecture	Morris Mano	Pearson/PHI	3rd Edition, 2007
2	Computer Organization and Architecture	William Stallings	Prentice Hall of India	6th edition,2006
3	Digital Logic and Computer Design	M. Morris Mano	Pearson	2nd Edition
4	Computer Organization	Carl Hamacher	Tata McGraw Hill	5th Edition

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Information Systems Security Professional (CISSP)	International Information System Security Certification Consortium. (ISC)²	Y	multiple-choice question format./ Single Best Answer	International Information System Security Certification Consortium, commonly known as (ISC)²	https://www.icdl.org/
2	ICDL Foundation	ICDL Foundation	Y	Objective	Authorized test centers around the world are responsible for delivering the ICDL exams and issuing the certification upon successful completion. approved by the ICDL Foundation.	https://www.icdl.org/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	6	26
	Tutorial	15	
	Home Assignment and Book. (Min. 4 Assignments etc.)	5	
In-Sem Summative	In-Sem Exam-I	17	34
	In-Sem Exam-II	17	
End-Sem Summative	End Semester Exam	40	40

COURSE CODE	23CA1102	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Summarize the architectural design of a computer, hardware peripherals and various concepts of Operating systems	2	PO1
CO2	Implementing Programming fundamentals and User interface designs	3	PO1, PO2, PO3
CO3	Understand the fundamentals of Computer networks.	2	PO1
CO4	Construct Software attributes, Specifications and Software Requirement Specification Document	3	PO1, PO2, PO3, PO10
CO5	Analyze and Explore data through Word Processing, Spreadsheet applications and Presentations	4	PO1, PO2, PO5, PO10
CO6	<CO for Skill – can be deleted otherwise>		

Syllabus

Module 1	Summarize the architectural design of a computer, Hardware Essentials Fundamentals of Computers, block diagram of Computer, Central Processing Unit (CPU), Memory, Input/output devices, System Software types, Operating System concepts, Process management and Scheduling.
Module 2	Implementing Programming fundamentals, Essentials Problem solving with algorithms, flowchart, programming styles, Programming Fundamentals, Testing and Debugging, Coding Standards and Best practices, User Interface Design introduction, Elements of UI design & report.
Module 3	Understand the fundamentals of Computer networks, Network Types, Network terms, Network models, Network Architectures, Network Topologies, Transmission media, WWW and Protocols, Email, Telnet, DNS Software Development
Module 4	Construct Software attributes, Software and its types, Software development Life Cycle, Problem identification and Feasibility analysis, Requirement's determination, Requirement's Specifications, Software Requirement Specification Document, System design, System implementation, System evaluation, System modification, Role of systems analyst and administrator.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Computer Fundamentals	Pradeep K. Sinha & Priti Sinha	BPB publishing	2004
2	Design and Analysis of computer algorithms	Alfred V Aho, EHoproft, Jeffrey D Ullman	Addison Wesley publishing Co.	1998
3	Structured Computer Organization,	Andrew S. Tanenbaum	PHI,3rd ed.,	1991

| 4 | Operating System Concepts | Siberschatzand Galvin | 4th ed., Addision-Wesley | 1995 |

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Microsoft Office	Microsoft	Commercial
2	Open Office	Sun Microsystems	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	8	30
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	In Semester Exam	8	
	Lab Weekly exercise	7	
In-Sem Summative	In-Sem Exam-I	15	30
	In-Sem Exam-II	15	
End-Sem Summative	Lab End Exam	16	40
	End Semester Exam	24	

Computational Thinking for Structured Design(CTSD)

COURSE CODE	23CA1105	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding different concepts of C programming constructs for creating programs.	2	PO1,PO2,PO3
CO2	Illustrate about different control structures and Arrays.	2	PO1,PO3,PO5
CO3	Experiment with functions and pointers for solving real world problems.	3	PO1,PO3,PO5
CO4	Analysing the working of structures and different file handling methods	4	PO1,PO3,PO5
CO5	Evaluate solutions for programs using basic and advanced concepts of C language, can solve the programming challenges using C.	5	PO2,PO3,PO5
CO6	Develop Applications using C Programming.	5	PO2,PO3,PO5

Syllabus

Module 1	**Overview of Programming**: Introduction, Program design and implementation, Flowcharts & Algorithms, Types of Programming Languages, Assemblers, Compilers, Interpreters. **Fundamentals of C programming**: Overview of C, Data Types, Constants & Variables, Operators & Expressions. **Basic I/O**-formatted and Unformatted I/O, Type modifiers ,Type casting, type conversion.
Module 2	**Decision Making-Branching & Looping:** Decision making with IF statement, switch statement, While statement, do-while statement, for statement, Jump Statements. **Arrays** : Concepts, Using array in C, One dimensional array, two dimensional array, multi-dimensional array. **Strings**: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions
Module 3	**User-defined Functions**: Purpose of functions, Definition, types, Structure of User-defined Functions, Return Values, Categories of User-defined Functions, Passing Arrays to Functions, argc and argv, Recursion, The Scope, Visibility and Lifetime of variables. **Pointers:** Introduction, Declaring Pointer Variables, Initialization of Pointer variables, accessing Variables, Pointer expression and Arithmetic , pointer to pointers, dynamic memory allocation, storage class specifiers.
Module 4	**Enumerated, Structure, and Union**: The Type Definition (Type def), Enumerated Types, Structure Introduction, Defining a structure, declaring structure variables, accessing structure members, structure initialization, nested structures, array of structures, passing structures to functions, Unions. **Additional features**: File Handling – Introduction, Defining and opening a file, closing a file, Input/output and Error Handling on Files, C Preprocessor commands, Conditional compilation directives, C standard library and header files.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The C programming Language by Richie and Kenninghan, 2004, BPB Publication	Brian W. Kernighan Dennis M. Ritchie	BPB	2004
2	Programming in ANSI C	Balaguruswamy	Tata McGraw Hill.	1992
3	Let us C	Yashwant Kanetkar	BPB	2004
4	Programming in C	Reema Thereja	Cengage	2011
5	programming in c a practical approach	ajay mittal	Pearson Education India	2010

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	C Programming Language Certified Associate	C++ institute	Yes	Online/Multiple Choice	Pearson Vue	https://cppinstitute.org/cla-exam-syllabus

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Eclipse	IBM	Open Source
2	Visual Studio	Microsoft	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	7	24
	Quiz	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem1	12	36
	In-Sem2	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

PROBABILITY AND STATISTICS (P&S)

COURSE CODE	23MT1213	MODE	R	LTPS	2-2-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply central tendency and dispersion measures to statistical inference.	2	PO1,PO2,PO6
CO2	Apply correlation and regression in real-world scenarios, such as business forecasting or scientific research.	3	PO1,PO2,PO6
CO3	Apply probability rules to solve problems involving simple and compound events. Calculate probabilities for different types of probability distributions (e.g., binomial, normal).	4	PO2,PO3,PO6
CO4	Apply the steps of hypothesis testing to different scenarios. Describe the difference between Type I and Type II errors.	4	PO2,PO3,P PO6,

Syllabus

Module 1	Measures of Central tendency: Mean, Median, Mode, Geometric Mean, Harmonic Mean, relation between mean, median and mode. Measures of dispersion: Quartile Deviation, Variance and Standard Deviation, coefficient of variation.
Module 2	Correlation and Regression: Types of Correlation, Karl Pearson's coefficient of correlation, Rank correlation tied and without tied observations. Regression coefficients -regression lines-Method of least squares-Straight line-parabola-Exponential curves.
Module 3	Probability and Distribution: Basics of Probability, Addition theorem, Conditional probability, and Baye's Theorem. Discrete and Continuous random variables - Binomial, Poisson, and Normal distribution.
Module 4	Statistical Inference: Basic of sampling distributions, introduction to Hypothesis, Level of significance. Large and small sample test – single and two sample case, Test for Attributes. Statistical Inference: Basic of sampling distributions, introduction to Hypothesis, Level of significance. Large and small sample test – single and two sample case, Test for Attributes.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Statistics for Management;	Ricard I.Levin,David S.Rubin, Masood H.Siddiqui, Sanjay Rastogi	Pearson	2017
2	Fundamentals of Business Statistics	Sharma J.k.	Vikas Publishing House	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Probability and Statistics	NPTEL		Online exam	Swayam	https://onlinecourses.nptel.ac.in/noc21_ma74/preview

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	8	24
	Tutorial	8	
	Home Assignment and Book. (Min. 4 Assignments etc.)	8	
In-Sem Summative	In-Sem Exam-I	18	36
	In-Sem Exam-II	18	
End-Sem Summative	End Semester Exam	40	40

| COURSE CODE | 23CA1204 | MODE | R | LTPS | 3-0-0-0 | PRE-REQUISITE | EIT |

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Demonstrate the requirement of software development for various applications.	2	PO1,PO2
CO2	Utilize some of the Process Models in software engineering for software development.	3	PO2,PO3,PO7
CO3	Identify stakeholders requirements, multiple viewpoints, eliciting requirements pts, Extreme Programming, SAFe Methodology	3	PO2,PO3,PO7
CO4	Analyze various testing techniques	4	PO3,PO4

Syllabus

Module 1	Software and Software Engineering: Nature of software, software application domains, unique nature of web applications, software engineering, software process, software engineering practice, software myths.
Module 2	Process Models: Generic process model, prescriptive process models, specialized process models, unified process, personal and team process models, product and process, Reverse Engineering: Reverse Engineering to Understand Data, Reverse Engineering to Understand Processing, Reverse Engineering User Interfaces.
Module 3	Understanding Requirements: Identify stakeholders, recognizing multiple viewpoints, eliciting requirements, Building requirement model, negotiating requirements, validating requirements, SRS Vs User Stories. Agile Modeling, Extreme Programming, Scrum, Kanban, SAFe Methodology.
Module 4	Test Driven Development: Basics, A strategic approach to software testing, strategic issues, test strategies for conventional software, Black-Box and White-Box testing, validation testing, system testing.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Software Engineering – A Practitioner's Approach"	Roger S.Pressman	Mc Graw Hill	2014
2	"Software Engineering"	Ian Sommerville	Pearson Education	2015
3	Agile and Iterative Development: A Manager's Guide	Craig Larman	Addison-Wesley	2015
4	"Applying UML and Patterns: An introduction to OOAD and design and interface deployment"	Craig Larman	Pearson	2005
5	"Software Engineering"	Stephen R.Schach	Tata McGraw-Hill Publishing Company	2012

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Google Project Management: Professional Certificate	Google	Y	Online	Google	https://grow.google/intl/en_in/certificates/

Evaluation Components:

CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
In – Sem FORMATIVE	Active Learning		25
	Home Assignments	10	
	Quiz	15	
In – Sem SUMMATIVE	In-Sem 1	17.5	35
	In-Sem 2	17.5	
	End-Sem Exam (Paper Based)	40	40

ESSENTIALS OF OPERATING SYSTEM(EOS)

COURSE CODE	23CA1205	MODE	R	LTPS	3-1-0-0	PRE-REQUISITE	COA

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Explain the fundamental operating system abstractions such as processes, memory management, functionalities of operating system	2	PO1
CO2	Illustrate algorithms of scheduling and process virtualization, theory and implementation of synchronization.	3	PO1, PO2
CO3	Apply the operating system's resource management techniques, dead lock management techniques, paging, segmentation	3	PO1, PO2
CO4	Demonstrate page replacement algorithms and handling file systems.	3	PO1, PO2

Syllabus

Module 1	**Introduction**: Operating System Functionalities, Types of Operating Systems, Operations, Services, System Calls, System Programs, **Process Virtualization:** Process States, 5 States Model, Process Scheduling, PCB and its Components, Threads.

Module 2	**Scheduling:** Concepts, Types of Schedulers, CPU Scheduling Algorithms, **Process Synchronization:** Critical Section Problem, Classic problems of synchronization- Readers/Writers, Dining Philosophers, Monitors.
Module 3	**Deadlocks:** System Model, Necessary conditions for a deadlock, Methods for handling Deadlocks-Prevention and Avoidance Algorithms, Semaphores. **Memory Virtualization:** Introduction to Paging, Swapping Contiguous Allocation, Single Partition, Multiple Partition-First Fit-Best Fit-Worst Fit, Internal and External Fragmentation.
Module 4	Demand Paging, Page Replacement Algorithms, Thrashing. **File Systems:** Files Introduction, Different types of files, File System and Issues Handled by file system **Directories:** Single Level, Two Level, Tree Structured, File Allocation Methods, **Secondary-Storage Structure:** Overview of disk structure, RAID structure**.**

Textbooks:

Sl No	Title	Author(s)	Publisher	Year
1	Operating System Concepts	Abraham Silberschatz,Galvin	PearsonEducation.	2008

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The Design of the Unix Operating System, PHI Publishing	Maurice J. Bach,	PHI Publishing	2013
2	UNIX internals: the new frontiers. Pearson Education India	Vahalia, U	Pearson Education India	2008
3	Operating systems: internals and design principles. Pearson	Stallings, W. and Manna, M.M	Pearson	2015
4	Operating system -A Concept based approach.	2E,D.M.Dhamdhere	Tata McGraw-Hill Education,	2006

Data Structures(DS)

COURSE CODE	**22CA1206**	MODE	Regular	LTPS	3-0-2-4	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	**Understand** basic concepts of Arrays,Linked List,Stack,Trees and Graphs	2	PO1
CO2	**Apply** the Basic operations sorting, searching, insertion and deletion of data for arrays and linked list	3	PO2,PO3,PO5
CO3	**Analyse** real time problems and design solutions using Trees and Graphs.	4	PO3,PO4
CO4	**Test for** searching and sorting techniques and their performance in solving real world problems.	4	PO3,PO4,PO5
CO5	**Evaluate** programs to demonstrate the functionality of different data structures, sorting algorithms, searching algorithms, etc.	5	PO3,PO4,PO5

Syllabus

Module 1	**Introduction to Data structures**: Definition, Classification of data structures, Time and space complexity, Static and Dynamic memory management, Dynamic Memory allocation functions. Pointers ,Array and its type. **Linked List**: Definition, Representation, Types of linked lists, creation, insertion, deletion, search and display
Module 2	**Stack and Queue**: Stack – Definition, Array Operations on stack: PUSH, POP, peek Applications of stacks- Infix, prefix and postfix notations and recursion. **Queue:** Definition, enqueue and dequeue operation, Types of queue: Simple queue, Circular queue, Double ended queue (deque),Priority queue, Application of queue
Module 3	**Trees and Graph**: Definition, Binary tree and its terminology, Traversal of Binary Tree, Binary search tree, AVL Tree, **Graphs:** Definition, Graph terminology, Depth First search, Breadth First search, Application of Graphs.
Module 4	**Searching and Sorting**: Sequential and binary search. Sort: Classification of sorting technique Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Heap sort.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data Structures Through C-4TH Edition:Learn the Fundamentals of Dta Structures ThrouGh C	Yashvanth Kanetkar	BPB Publications	2022
2	Data Structures	E. Balagurusamy	McGraw Hill Education	2017
3	Data structures	Tata McGraw-Hill	McGraw Hill Education	2014
4	Algorithms II	Robert Sedgewick and Kevin Wayne	Pearson Education	2014
5	Design and Analysis of Algorithms	S.Sridhar	Oxford Unioversity Press	2014

Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
		Mapped Global Certifications:				
1	Codechef Certified Data Structure and Algorithms Programme	Codechef	Y	Problem solving	Codechef	https://www.codechef.com/ certification/data-structures-and-algorithms/prepare
2	C certified Professional Programmer Certification(CLP)	Credly	Y	Problem solving	Pearson -VUE	https://www.credly.com/org /openedg/badge/clp-12-01-clp-c-certified-professional-programmer

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	**Eclipse**	IBM	Open Source
2	**Visual Studio**	Microsoft	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	7	24
	ALM	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

OBJECT ORIENTED PROGRAMMING(OOP)

COURSE CODE	23CA1207	MODE	R	LTPS	3-0-2-4	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic concepts of Object-Oriented Programming, Datatypes, Operators and Type Conversion.	2	PO1,PO3
CO2	Design and implement programs using standard design patterns to solve general problems.	3	PO2,PO5
CO3	Choose the best type of Inheritance, creation of packages and interfaces to implement multiple inheritance.	4	PO3,PO5
CO4	Build and Analyze Java applications using exceptions, formatted and unformatted I/O Streams	4	PO2,PO5
CO5	Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs that solve real-world problems.	4	PO2, PO5
CO6	Develop Small programs for the problems using the principles of abstraction, encapsulation, inheritance, and polymorphism	4	PO3, PO5

Syllabus

Module 1	Introduction: Object-Oriented Programming, OOP Principles, Encapsulation, Inheritance and Polymorphism Java as a OOP, The Byte code, Data types, Variables, Dynamic initialization, scope and life time of variables, Arrays, Operators, Control statements, Type Conversion and Casting, Compiling and running of simple Java program
Module 2	Classes and Objects: Concepts of classes and objects, Declaring objects, Assigning Object Reference Variables, Methods, different types of Constructors, Access Control, Garbage Collection, Usage of static keyword with data and methods, usage of final with data, Overloading methods and constructors, parameter passing - call by value, recursion, Nested classes
Module 3	Inheritance: Inheritance Basics, member access rules,Usage of super key word, forms of inheritance, Method Overriding, Abstract classes, Dynamic method dispatch, Using final with inheritance, String handling functions. Packages and

	Interfaces: Packages, Classpath, Importing packages, differences between classes and interfaces, Implementing ,Applying interface.
Module 4	Exception handling: Benefits of exception handling, the classification of exceptions - exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception subclasses. Multithreading – Differences between multiple processes and multiple threads, thread life cycle, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer problem.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The Complete Reference Java"	Herbert Schildt	TMH	2020
2	An Introduction to Object-Oriented Programming"	Timothy A. Budd	Pearson	3/e 2021
3	JAVA for Beginners"	Joyce Farrell, Ankit R. Bhavsar	Cengage Learning	2020
4	"Core Java: An Integrated Approach"	R. Nageswara Rao:	dreamtech	2008 edition
5	Java in a Nutshell"	Benjamin	O'Reilly Media	7 th edition

Global Certifications:

Mapped Global Certifications:						
Sl N o	Ti tl e	Certification Provider	Procto red (Y/N)	Format of the Exam	Exam Provi der	URL of the Certification
1	J A V A	Oracle Certified Professional, Java EE 7 Application Developer	y	OBJECT IVE	ORA CLE	https://education.oracle.com/oracle-certification-path/pFamily_48
2	J A V A	Spring Professional Certification	y	OBJECT IVE	SPRI NG	https://d1fto35gcfffzn.cloudfront.net/academy/Core-Spring-5.0-Certification-Study-Guide.pdf

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Eclipse IDE	Eclipse Foundation	Open Source
2	NetBeans IDE	Apache Software Foundation	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	7	24
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
	Home Assignments	7	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

COMPUTER NETWORKS (CN)

COURSE CODE	23CA2108	MODE		LTPS	3-0-0-0	PRE-REQUISITE	EOS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the fundamentals of computer networks and data communication.	2	PO2
CO2	Understand and Analyze the fundaments of Data Communication	2,3	PO1
CO3	Analyze the IEEE Standards, Data Link Layer and Evaluate design issues in networks.	4,5	PO1
CO4	Analyze Internet Transport Protocols and Evaluate different types of protocol, Evaluate various types of Network Devices and different types of Networks.	4,5	PO4

Syllabus

Module 1	Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models, Data Communication Services & Network Examples, Internet Based Applications, Data Communications: Transmission Media, Wireless Transmission, Multiplexing, Switching, Transmission in ISDN, Broad Band ISDN, ATM Network. Data Link Control, Error Detection & Correction, Sliding Window Protocols
Module 2	LANs &MANs: IEEE Standards for LANs & MANs-IEEE Standards 802.2, 802.3, 802.4, 802.5,802.6, High Speed LANs. Design Issues in Networks: Routing Algorithms, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.

Module 3	Internet Transport Protocols: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues. Overview of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, World Wide Web, Firewalls.
Module 4	Network Devices: Overview of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, routers, Hubs, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies. Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback)	Pearson	3 Edition (Paperback)	2003
2	Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback)	Pearson		
3	CCNA Exploration Course Booklet: Routing Protocols and Concepts	Pearson	Version 4.0	
4	CCNA Cisco Certified Network Associate: Study Guide (With CD)	Todd Lammle, Wiley India,		

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Advanced Networking - Specialty	AWS	Y	Online	Pearson VUE testing center	https://aws.amazon.com/certification/certified-advanced-networking-specialty/?trk=5faa865f-0158-4dc0-8133-e63280765ce5&sc_channel=ps&ef_id=EAIaIQobChMIu_mZvN_g_wIVkh5yCh3whQC0EAAYBCAAEgKzSPD_BwE:G:s&s_kwcid=AL!4422!3!616960532546!p!!g!!network%20certification%20classes!11138243480!106933383542
2	Network Associate	Cisco	Y	Online	Pearson VUE testing center	https://www.cisco.com/c/en/us/training-events/training-certifications/certifications/associate/ccna.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	10	20
	Home Assignment and Book. (Min. 4 Assignments etc.)	10	
In-Sem Summative	In-Sem Exam-I	20	40
	In-Sem Exam-II	20	

End-Sem Summative	End Semester Exam	40	40

DATABASE MANAGEMENT SYSTEM(DBMS)

COURSE CODE	23CA2109	MODE	Regular	LTPS	3-0-2-4	PRE-REQUISITE	MCS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Remembering Database and File System and Applying different kinds of data models with functional components of DBMS	3	PO1
CO2	Applying design, SQL, PL/SQL and corelating appropriate strategies for optimization of queries with Tuple Relational Calculus and Domain Relational Calculus	4	PO2,PO4
CO3	Analysing normal forms based on functional dependency and Apply normalization techniques to eliminate redundancy with the ACID properties	4	PO1,PO4
CO4	Applying concurrency techniques to demonstrate the organization of Databases with log mechanism and check pointing techniques for system recovery.	3	PO3,PO4
CO5	Analysing and apply in Identifying variety of methods for effective processing of given queries	4	PO4,PO5
CO6	Choose a MongoDB and implement SQL queries and PL/SQL programs to do various operations on data..	5	PO3,PO5

Syllabus

Module 1	Database Fundamentals: DBMS Characteristics & Advantages, Database Environment, Database Users, Database Architecture, Data Independence, Languages, Tools and Interface in DBMS, DBMS types. Data Modeling: ER Model, Notation used in ER Diagram, Constraint, Types, Relationships in ER Model and other considerations in designing ER diagram. Enhanced, ER data Model, EER Diagram
Module 2	Relational Model: concepts, constraints, schemas, ER to Relational Model. SQL & Relational Algebra: Data Definition and other languages in SQL, Creating tables and Data types, Constraints, DML statements, Functions and writing SQL statements using nested sub queries, complex queries, joining relations, views, compound statements, user defined functions, user defined procedures, cursors, Triggers, Relational Algebra :Operators in relational algebra, Database Design: Guidelines for good database design
Module 3	Normalization- Normal Forms, First, Second, Third Normal Forms, BCNF, Multi value and join dependencies, 4th and 5th normal forms. Decomposition algorithms for normalization. File and Storage Structures: File storage, Index structures, Indexing and hashing, Query processing and optimization.
Module 4	Transaction Management: Transaction processing issues, Transaction states, problems during multiple transactions processing, ACID properties, system log and concurrency control Techniques: Lock based techniques, and Timestamp based techniques, Multiversion based Techniques. Recovery Techniques: Recovery concepts, shadow paging, ARIES

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Database System Concepts	Abraham Silberschatz, Yale University Henry, F. Korth Lehigh University, S. Sudarshan Indian Institute of Technology, Bombay.	tata mcgraw hill books	1991
2	Fundamentals of Database Systems	RamezElmasri, University of Texas at Arlington, Shamkant B. Navathe, University of Texas at Arlington.	Pearson	2011
3	An Introduction to Database Systems	Bipin C. Desai	Galgotia Publications Pvt Ltd	2014
4	Principles of Database Systems	Jeffrey D. Ullman	Galgotia Publications	2014
5	Database Management Systems	Raghu RamaKrishnan, Johannes Gehrke	Tata McGraw Hill.	2014

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	MongoDB	MongoDB University	Y	Online	Monogo-DB	https://learn.mongodb.com/pages/certification-program
2	Azure Database Administrator Associate - Global Certification	Microsoft	Y	Online	Azure	https://learn.microsoft.com/en-us/certifications/azure-database-administrator-associate/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	**Orcle**	Orcle	Open Source
2	MongoDB	Microsoft	Open Source
3	Ms sql	Micro Soft	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	4	24
	Quiz	8	
	Practical Continuous Evaluation	8	
	Skill Continuous Evaluation	4	
	MOOCs Review		
In-Sem Summative	In-Sem 1	10	36
	In-Sem 2	10	
	Practical In-Sem	6	
	Skill In-Sem	5	
	MOOCs Exam	5	
End-SemSummative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

Web development using Python (WDP)

COURSE CODE	23SDCA02	MODE	R	LTPS	0-0-4-4	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic programming skills in core Python	2	PO2
CO2	Build python application to connect with the database and perform CRUD operations	3	PO1, PO3, PO4
CO3	Develop Web forms and Application in Django	6	PO3, PO5

Syllabus

Module 1:	Introduction to Python Environment : History and development of Python, Introduction , Features ,Syntax, Comments, Variables, Data Types, Booleans, Operators, Lists, Tuples, Sets, Dictionaries , Conditional and iterative statements, Functions , Lambda , Arrays
Module 2:	Advanced Python: Classes/Objects , Inheritance , Scope , Modules , Dates , Math , JSON , Regular Expressions , PIP , Exception Handling , User Input , String Formatting, Dictionaries ,File handling, Libraries: SciPy, NumPy, Scikit-learn, matplotlib.
Module 3:	Web Applications in Python: Introduction to Web Key features and key terms in Web, Client-Server Architecture, Python connectivity with Databases SQLite and MYSQL, Accessing Data from Relational Databases, MongoDB CRUD operations.
Module 4:	Django Web Application Framework: Features of Django framework, Characteristics of Django framework, Installation in Virtual Environment Django commands, Phases in Django Project Creation, Create a Project, Creation of Apps and their Structure, Working with ADMIN, Console, Creating Views, URL Mapping, Template System, Working with Models, Page Re-directions, Set-up E-Mails, Types of Views, Form Processing, static, media files handling, Advanced Features of Django, Pagination, Page Restrictions using decorators, Cookies, Sessions, Caching, Migrations, Deployment free web Hosting Domains.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Python Cookbook	David Beazley and Brian K. Jones.	O'Reilly Media	Third edition
2	Mastering Django	Nigel George	Packt Publishing	
3	Fluent Python: Clear, Concise, and Effective Programming	Luciano Ramalho	O'Reilly Media	Second edition
4	Core Python Programming	R. Nageswara Rao	Wiley Publisher	2nd edition
5	Django for Beginners: Build Websites with Python & Django	William S Vincent	Amazon Digital Services LLC	Volume 1

Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	PCAP™ – Certified Associate in Python Programming	pythoninstitute		Y	Single- and multiple-select questions | Python 3.x	https://www.pythoninstitute.org/pcap
2	PCAP	Open EDG Python Institute		y	online	https://pythoninstitute.org/pcap

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	PyCharm	JetBrains	Open Source
2	Django web framework	Django Software Foundation (DSF)	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	12.5	25
	Skill Continuous Evaluation	12.5	
In-Sem Summative	In-Sem 1	17.5	35
	In-Sem 2	17.5	
End-Sem Summative	Lab End-Sem Exam	16	40
	Skill End-Sem Exam	16	
	Oral Examination	8	

Continuous Delivery and Deployment with DevOps(CDDD)

COURSE CODE	23CA2121	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Identify the Need of DevOps in SDLC and Cloud Infrastructure in DevOps, Apply Version Control System to track the latest version of Software	3	PO1
CO2	Analyse Continuous Integration and Continuous Deployment using Infrastructure as Code, Build in Cloud native Applications using Pipeline and Examine the Software and Automation Testing Frameworks	4	PO5
CO3	Analyze need of Containerization in SDLC and Examine the Kubernetes Pod Configuration.	4	PO5
CO4	Inspect Configuration Management using Infrastructure as Code, Analyze Continuous Monitoring and Container Orchestration process.	4	PO5
CO5	Build and Inspect the Tools associated to DevOps Life Cycle.	4	PO5

Syllabus

Module 1	Introduction to DevOps: Introduction to DevOps, Overview of DevOps, Relationship Between Agile and DevOps, Principles of DevOps, DevOps Tools, Best Practices for DevOps. Version Control Systems: Role of Version Control System in DevOps Environment, GitHub, Deploy the files to Bitbucket via Git. Need of Cloud in DevOps: Popular Cloud Providers, CI/CD in AWS and Azure, CI/CD Services in AWS.
Module 2	Continuous Integration and Continuous Deployment: Continuous Integration and Continuous Deployment using Jenkins, Continuous Integration with Jenkins, Git, and Maven, Build Applications using Pipeline on azure platform. Software and Automation Testing Frameworks: Popular Testing Tools, Test Driven Development Cycle, Behavior driven development is an extension of test driven development, Automated Testing using Cucumber.
Module 3	Docker as Containerization: Virtualization, Docker on Windows Desktop, Creating an Account in Docker Hub, MySQL in Docker. Kubernetes: Components, Kubernetes Architecture, Minikube, Pod Configuration on Windows.
Module 4	Configuration Management: Configuration Management Process, Role of Infrastructure as Code in DevOps Environment, Puppet. Continuous Monitoring: Role of Monitoring Systems, Types of Monitoring, Popular Monitoring Tools: Nagios.Orchestrating application deployment.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	1. DevOps for Web Development	MiteshSoni,	PACKT Publishing	2016

2	Migrating a Two-Tier Application to Azure_ A Hands-on Walkthrough of Azure Infrastructure, Platform, and Container Services	Peter De Tender	Apress	2021
3	A Complete DevOps Cookbook_ Build and manage your applications, orchestrate containers, and deploy cloud-native services	Murat Karslioglu - Kubernetes	Packt Publishing	2020
4	Docker for Developers_ Develop and run your application with Docker containers using DevOps tools for continuous delivery	Richard Bullington-McGuire, Andrew K. Dennis, Michael Schwartz	Packt Publishing	2020
5	Beginning DevOps with Docker	oseph Muli,	ACKT Publishing	2018

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	AWS Certified DevOps Engineer - Professional	AWS	y	Online	*Pearson VUE*	https://aws.amazon.com/certification/certified-devops-engineer-professional/
2	Docker Certified Associate	Cloud Academy	y	Online	*Pearson VUE*	https://cloudacademy.com/learning-paths/docker-certified-associate-dca-exam-preparation-1-1393/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Version Control Tool: Git (GitLab, GitHub, Bitbucket)	GIT	OPEN SOUCE
2	Container Platforms: Kubernetes	Kubernetes	OPEN SOURCE

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	22
	Home Assignment and Book	7	
	Lab Weekly exercise	7	

In-Sem Summative	In-Sem Exam-I	15	38
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	Lab End Exam	16	40
	End Semester Exam	24	

Object Oriented Analysis and Design (OOAD)

COURSE CODE	23CA2210	MODE	R/A	LTPS	2-0-2-0	PRE-REQUISITE	SE

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the fundamentals of object modelling.	2	PO1
CO2	Build static and dynamic UML diagrams.	3	PO1,PO2,PO3
CO3	Make use of design patterns for Software design	3	PO3,PO4,PO8
CO4	Analyse various Object-Oriented Methodologies.	4	PO3,PO4,PO7
CO5	Evaluate different types of UML Diagrams	5	PO3,PO4

Syllabus

Module 1	UNIFIED PROCESS AND USE CASE DIAGRAMS: Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases.
Module 2	STATIC AND DYNAMIC UML DIAGRAMS: Class Diagram–– Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams, UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling –When to use State Diagrams - Activity diagram – When to use activity
Module 3	DESIGN PATTERNS: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design to code
Module 4	TESTING: Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	A. Craig Larman	Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development	Pearson Education	Third Edition,2005
2	B. Ali Bahrami	Object Oriented Systems Development	McGraw Hill International	1999
3	Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides	Design patterns: Elements of Reusable Object-Oriented Software	Addison-Wesley	1995
4	Martin Fowler	UML Distilled: A Brief Guide to the Standard Object Modeling Language	Addison Wesley	Third Edition,2003

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Object-Oriented Analysis, Design, and Programming with UML	Infosys	N	Online	Infosys	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0133013020752199686190_shared/overview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Smart Draw - https://www.smartdraw.com/uml-diagram/	Smart Draw	Open Source
2	Star UML	Star UML	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	Lab End-Sem Exam	16	40
	End-Sem Exam (Paper Based)	24	

JAVA FULL STACK DEVELOPMET(JFSD)

COURSE CODE	23SDCA03	MODE	R/A	LTPS	0-0-4-4	PRE-REQUISITE	OOP

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply JDBC API, JUnit Testing Framework and XML Concepts to build Console and Web Applications,Solve Servlets, JSP, Hibernate, Spring and Spring Boot to build web applications and Enterprise Level applications.	3	PO3, PO5
CO2	Analyze the design of linear data structures for real world problems,Apply the java full stack concepts and implemte the practicles on Spring Boot MVC, google maps, 2 step verification, sending mail and sms, captcha generation, bar code and qr code scanning, Spring Cloud and Spring Microservices.	3	PO3, PO5
CO3	Analyze alternate algorithm techniques to solve optimization related problems in the real-world scenario.,Apply the Java Concepts like Hibernate, Spring, Spring Boot, Spring Cloud and Microservices to Develop the Feature Rich Java Full Stack Application.	3	PO3, PO5

Syllabus

Module 1	Introduction Introduction to JDBC API, Type of Drivers in JDBC, Statement, Prepared Statement, Callable Statement, ResultSet MetaData, Database MetaData, Scrollable & Updatable ResultSet, Transaction Management in JDBC. JUnit - Introduction to JUnit framework, JUnit Environment Setup, Features of to JDBC API, Type of Drivers in JDBC, Statement, Prepared Statement, Callable Statement, ResultSet MetaData, Database MetaData, Scrollable & Updatable ResultSet, Transaction Management in JDBC. JUnit - Introduction to JUnit framework, JUnit Environment Setup, Features ofJunit Framework, Junit Framework and its Implementation. XML - Introduction to XML, Advantages of XML, XML Tree, XML Attributes, XML DOM, DTD, XSD, XML with CSS, XSLT. Servlets - Introduction to Servlets, Lifecycle, Init and context parameters, Servlet Collaboration, Session Tracking Techniques, Servlet CRUD Operations. JSP – Servlets Vs JSP, JSP Architecture and Lifecycle, JSP Scripting Elements, Session Tracking Techniques, JSP Implicit Objects, JSP Directive Elements, JSP Action Tags, JSP MVC Architecture, JSP CRUD Operations
Module 2	Hibernate – JDBC Vs Hibernate, Introduction to Hibernate Framework, Advantages, XML & Annotation based Hibernate CRUD Operations, Generator Classes in Hibernate, HQL, HCQL. Spring and Spring Boot – Introduction to Spring, Spring Architecture, Spring Vs Spring Boot, Maven Repository, Introduction to Spring Boot, Advantages of Spring Boot over Spring, Dependency Injection (DI), Inversion of Control (IoC), Creating Spring starter project, Hello World Application using Spring Boot, Spring Boot Autowire, Web Application MVC using Spring Boot, Spring Boot CRUD Operations with Spring MVC, Spring Boot with RESTful Web Service, Spring Boot and RESTful API Vs REST API with JSON, Spring Boot and Hibernate CRUD Operations, Microservices with Spring – monolithic vs micro-service Architecture, SOA vs Microservices, Spring Boot Microservices with Spring Cloud.

Module 3	Implement the Feature Rich Project with the Concepts - Hibernate, Spring, Spring Boot, Spring Cloud and Microservices

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Web Technologies: Concepts, Methodologies, Tools, and Applications	Arthur Tatnall	Information Science Reference	2015
2	Microservices with Spring Boot and Spring Cloud: Build resilient and scalable microservices using Spring Cloud	Istio and Kubernetes	Packet Publishing LTD	2011
3	Spring and Hibernate	Santosh Kumar k K. Siva Prasad Reddy	Tata McGraw-Hill Education	2009
4	Beginning Spring Boot 2 Applications and Microservices with the Spring Framework	K. Siva Prasad Reddy	Apress	2009
5	Java EE 8 Application Development	David R.	Heffelfinger.	2008

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1						

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Jvm,jdk,maven,apache tomcat	Apache foundation	Apache foundation

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	12.5	25
	Skill Continuous Evaluation	12.5	
In-Sem Summative	In sem-1(ERP / Paper Based, Open Book Exam / Closed Book Exam)	17.5	35
	In sem-2(ERP / Paper Based, Open Book Exam / Closed Book Exam)	17.5	
End-Sem Summative	Lab End-Sem Exam(Open Book Exam / Closed Book Exam)	16	40
	Skill End-Sem Exam(Open Book Exam / Closed Book Exam	16	
	Oral Examination	8	

Aspects of Mobile Application(AMA)

COURSE CODE	23SDCA04	MODE		LTPS	0-0-4-4	PRE-REQUISITE	OOP

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basics of object-oriented programming language & Activity life Cycle Methods in Android.	2	PSO1,PO1,PO5
CO2	Apply the concepts of Android development and Designing of different widgets for android, Views, Layouts, and Navigation on Android	3	PSO1,PO1,PO5
CO3	Apply the concepts of the database and Memory storage concept to build the dynamic Android applications, Design and develop the Mobile application real-time case studies	3	PSO1,PO1,PO5

Syllabus

Module 1	Mobile Application Development - Mobile Applications and Device Platforms - Alternatives for Building Mobile Apps -Comparing Native vs. Hybrid Applications - The Mobile Application Development Life cycle-The Mobile Application Front-End-The Mobile Application Back-End-Key Mobile Application Services-What is Android-Android version history-Obtaining the Required Tools- Launching Your First Android Application-Exploring the IDE-Debugging Your Application-Publishing Your Application
Module 2	Understanding Activities-Linking Activities Using Intents-Fragments-Displaying Notifications- Understanding the Components of a Screen-Adapting to Display Orientation Managing Changes to Screen Orientation- Utilizing the Action Bar-Creating the User Interface Programmatically Listening for UI Notifications ,Multithreading.
Module 3	Using Basic Views-Using Picker Views -Using List Views to Display Long Lists Understanding Specialized Fragments - Using Image Views to Display Pictures - Using Menus with Views-Using WebView- Saving and Loading User Preferences-Persisting Data to Files-Creating and Using Databases. Sharing Data in Android-Creating Your Own Content Providers -Using the Content Provider- SMS Messaging -Sending Email-Displaying Maps- Getting Location Data- Monitoring a Location.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Head First Android Development: A Brain-Friendly Guide	Dawn Griffiths, David Griffiths	2nd edition	Wiley Publisher
2	Android Studio 3.0 Development Essentials: Android	Neil Smyth	8th Edition	Apress
3	Android Application Development (With Kitkat Support)", Black Book	Pradeep Kothari	2019	Wiley Publisher

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Associate Android Developer global	Google	Y	Muliple choice with project submission	Pearson	https://developers.google.com/certification/associate-android-developer

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Android Studio	Google	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	12.5	30
	Skill Continuous Evaluation	12.5	
	MOOCs Review	5	
In-Sem Summative	Practical In-Sem	10	30
	Skill In-Sem	10	
	Global Challenges - Leaderboard	5	
	MOOCs Exam	5	
End-Sem Summative	Lab End-Sem Exam	10	40
	Skill End-Sem Exam	10	
	Global Challenges - Rating/Points	10	
	Global Certification	5	
	MOOCs Exam	5	

Visual Programming & HCI (UI/UX) – VP&HCI

COURSE CODE	23CA3122	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE		WDP

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the basic physiological, perceptual, and cognitive components of human learning and memory will learn by the students.	2	PO1,PO2,PO3

CO2	Design the fundamental aspects and implementing user interfaces, the students will gain theoretical knowledge and practical experience.	3	PO1,PO2,PO3
CO3	Implement about multimodal displays for conveying and presenting information, students will gain.	4	PO1,PO3,PO8
CO4	Analyze the interaction problems from a technical, cognitive, and functional perspective, will learn by the student.	4	PO1,PO3, PO8
CO5	Choose to develop an awareness of the range of general human-computer interaction issues that must be considered when designing information systems.	5	PO1,PO3, PO5
CO6	Choose Practiced, a variety of simple methods for designing and evaluating the quality of user interfaces and spatial display	5	PO1,PO3, PO5

Syllabus

Module 1	Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.
Module 2	Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions. Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design. Windows – New and Navigation schemes selection of window, selection of devices based and screen- based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.
Module 3	HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction
Module 4	Cognitive models Goal and task hierarchies Design Focus: GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities Ubiquitous computing applications research Design Focus: Ambient Wood – augmenting the physical Virtual and augmented reality Design Focus: Shared experience Design Focus: Applications of augmented reality Information and data visualization Design Focus: Getting the size right.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition)	Shneiderman, Plaisant, Cohen, and Jacobs	Addison Wesley	2005
2	Introduction to Human Factors Engineering (2nd Edition)	Wickens, Lee, Liu, and Gordon-Becker	Pearson	2004

3	Human-Computer Interaction (3rd Edition)	Dix, Finlay, Abowd and Beale.	Pearson Education	2003
4	The essential guide to user interface design	Wilbert O Galitz	Wiley Dream Tech	2005
5	User Interface Design	Soren Lauesen	Pearson Education	2005

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Google UX Design Certificate	Google UX Design	Y	Objective	Google UX Design	https://learndigital.withgoogle.com/digitalworkshop-eu/course/gccs-ux-design
2	Certified User Experience Analyst (CXA)	Human Factors International Certified Usability Analyst (CUA)	Y	Objective	Human Factors International Certified Usability Analyst (CUA)	https://hfi.training/na/certifications/cua

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Microsoft Access, Sybase Power Designer, DOTNET, JAVA, PHP	Software	Open Source
2	Macromedia Director, TcllTk, Microsoft MFC Eclipse, Borland JBuilder Microsoft Visual Studio	Software	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	**ALM (Quiz)**	6	22
	Home Assignment and Book. (Min. 4 Assignments etc.)		
	Review / Viva—Voce (Conduct Review/ Viva-Voce After completion of Course / getting MOOCs certificate)	8	
	Lab Weekly exercise	8	
In-Sem Summative	In-Sem Exam-I	15	38
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	End Semester Exam (Paper Based)	24	40
	Lab End Exam	16	

Network Security(NS)

| COURSE CODE | 23CA3223 | MODE | R | LTPS | 3-0-2-0 | PRE-REQUISITE | CN |

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Acquire the concept of physical layer and various transmission media	2	PO1, PO3
CO2	Understand the architecture of router, mechanism of packet forwarding and policy for internet routing	3	PO1, PO3
CO3	Understand the importance of distributed algorithms, multicast routing and various threats in network	3	PO1,PO2
CO4	Understand types of vulnerabilities and attacks in web applications and algorithm designed against them	4	PO1,PO2
CO5	Apply Security concepts and analyse their performance using networking tools.	5	PO1, PO4

Syllabus

Module 1	Physical Network Security: Physical layer security, Copper and Optical Media, Data Centre and Enterprise network: LAN Security and Resilient Network Topologies
Module 2	Router Mechanisms for security: Router and Switch Architectures, Lookup and Classification Algorithms, Packet scheduling and fair queuing, Queuing and Scheduling Algorithms, Network configuration security: Internet Policy Routing
Module 3	Securing Distributed and networked systems: Securing Distributed Algorithms, Big picture: Physical Security, Wireless Media, Malware, QoS and Multicast.
Module 4	Current topics in Network security: Web and DNS security, Wireless Security, Covert Channels in Networks, Quantum Cryptography/ Communication, Security of Internet Architectures, Secure Multiparty Computation, Anomaly Detection and Traffic Analysis, Operational Network Security, Intrusion Detection Algorithms, Data Mining for Intrusion Detection, Traffic Anomaly Detection and DHT Security.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
Book 1:	Network security: the complete reference.	Taylor, Art, and Ben Rothke.	McGraw-Hill, Inc.	2003.
Book 2:	"Network Security Essentials"	William Stallings	Pearson Education 6th Edition,	2017
Book 3	"Cryptography and Network Security"	William Stallings	Prentice Hall, 5th edition	2005
Book 4	Network security: the complete reference.	Taylor, Art, and Ben Rothke	McGraw-Hill, Inc., 2003.	2003
Book 5	"Cryptography and Network Security,"	Forouzon B	Indian Edition	2010

Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
						Mapped Global Certifications:
1	NETW ORK SECU RITY	COUR SERA	Y	ONLI NE MCQ	COU RSER A	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&sourc e=web&cd=&cad=rja&uact=8&ved=2ahUKEwiwqOLx1OL
2	NETW ORK SECU RITY	MICR OSOF T	Y	ONLI NE MCQ	MS	https://www.coursera.org/learn/network-security

Tools used in Practical / Skill:

SL NO	SOFTWARE REQUIREMENTS	TOOLS	Required Bandwidth
1	Virtual machine, NMAP, NESSUS, WIRESHARK, NESSUS	Windows and Linux: Intel 64/32 or AMD Athlon 64/32, or AMD Opteron processor	NA
2	Kali Linux, Ubuntu, Window Xp, Window 10	16 GB RAM 256 GB hard disk space	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	7	24
	Home Assignment and Book	7	
	Lab Weekly exercise	5 + 5	
In-Sem Summative	In-Sem Exam-I	12	36
	In-Sem Exam-II	12	
	Lab In Semester Exam and Skilling	6 + 6	
End-Sem Summative	Lab End Exam and Skilling	8 + 8	40
	End Semester Exam	24	

CLOUD TECHNOLOGY

Cloud Architectures (CA)

COURSE CODE	23CA21C1	MODE		LTPS	**2-0-2-0**	PRE-REQUISITE	MCS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Classify cloud computing importance and services	2	PO1
CO2	Relate cloud services & models.	2	PO1, PO2
CO3	Explain Virtualization and its applications	2	PO3
CO4	Apply cloud services using web services Cloud to utilize cloud resources.	3	PO3
CO5	Measure various cloud services using web services Cloud for building and deploying applications.	5	PO4

Syllabus

Module 1	**Overview of Cloud Computing** - Brief history and Evolution of Cloud Computing, Traditional vs. Cloud Computing, Importance of Cloud Computing, Benefits and Challenges of Cloud Computing.
Module 2	**Cloud Computing Architecture:** Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services Service Models (XaaS) Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS) Deployment Models Public cloud, Private cloud, Hybrid cloud, Community cloud.
Module 3	Infrastructure as a Service(IaaS): Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) **Platform as a Service(PaaS):** Introduction to PaaS What is PaaS, Service Oriented Architecture (SOA) Cloud Platform and Management Computation Storage. **Software as a Service (SaaS:)** Introduction to SaaS, Web services, Web 2.0, Web OS
Module 4	**Overview of Multi-Cloud Management Systems** - Explain concept of multi- cloud management, Challenges in managing heterogeneous clouds, benefits of multi-cloud management systems.**Overview of Cloud Security -** Security concerns in Traditional IT, Challenges in Cloud Computing in terms of Application, Server, and Network Security.**Service Management in Cloud Computing:** Service Level Agreements (SLAs).

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Cloud Computing: Principles and paradigms.	Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski		2011
2	Cloud Security, A comprehensive Guide to Secure Cloud Computing.	Krutz, Ronald L.; Vines, Russell Dean		
3	Cloud Computing Bible,	Barrie Sosinsky	Wiley. -Anthony T	2011

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Google Certified Professional Data Architect	Google Cloud Platform	YES	OBJECTIVE	Google Cloud Platform	https://cloud.google.com/learn/certification/guides/professional-cloud-architect
2	Amazon Web Services (AWS) Certified Solutions Architect-Associate	Amazon Web Services (AWS)	Yes	OBJECTIVE	Amazon Web Services	https://www.knowledgehut.com/cloud-computing/aws-solution-architect-certification-training

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Google App Engine	Google Maps Platform	Free cloud features and trial offer | Google Cloud Free Program
2	Cloud shell	Google Maps Platform	Free cloud features and trial offer | Google Cloud Free Program

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	8	22
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	7	
	In - S e m E x a m -I	15	38

In-Sem Summative	In - S e m E x a m -II	15	
	In Semester Exam	8	
End-Sem Summative	Lab End Exam	16	40
	E n d S e m e s t e r E x a m	24	

Cloud and Serverless Computing (CSC)

| COURSE CODE | 23CA31C3 | MODE | R | LTPS | 2-0-2-0 | PRE-REQUISITE | PE1 |

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Describe Cloud computing and cloud service scheduling hierarchy.	2	PO1,PO2
CO2	Describing the Functions-as-a-service and Event-driven programming. Develop Scalable Models Using Serverless Architectures.	2	PO2,PO3
CO3	Demonstrating the application functionalities using Serverless runtimes and Serverless databases	3	PO2,PO3
CO4	Apply Serverless Programming Practices and Patterns. Architect, Build, and Operate the serverless applications	3	PO2,PO3
CO5	Analyse a real-world and scalable full-stack application using Serverless technologies	4	PO3,PO4

Syllabus

Module 1	Overview of cloud computing, Resource scheduling for cloud computing, Serverless AWS. Serverless Programming Practices and Patterns, building serverless applications using Java and AWS. Lambda.
Module 2	Building Serverless REST APIs with API Gateway. DynamoDB, Amazon Cognito, Web Hosting with S3, Route53, and CloudFront.
Module 3	Postman, Domain name services, Serverless Amazon Athena and the AWS Glue Data CatLog, Real-Time Data Insights Using Amazon Kinesis, Messaging and Notifications with SQS and SNS.
Module 4	Your first Serverless application on Azure, Google Cloud Platform, Example: Serverless Sensor Data Collector. Building Effective Serverless Applications with Kubernetes and OpenShift.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Learn AWS Serverless Computing_ A beginner's guide to using AWS Lambda, Amazon API Gateway, and services from Amazon Web Services	Scott Patterson	Packt Publishing	2019
2	Cookbook_ Building Effective Serverless Applications with Kubernetes and OpenShift	BurrSutter, Kamesh Sampath - Knative	O'Reilly Media	2020

Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
						Mapped Global Certifications:
1	AWS Certified sysops ps Administrater	AWS	Y	Online	AWS	https://aws.amazon.com/certification/certified-sysops-admin-associate/?ch=tile&tile=getstarted
2	Serverless Technology on Alibaba	Alibaba	y	online	Alibaba	https://edu.alibabacloud.com/certification/clouder_serverless

Tools used in Practical:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	AWS Lambda Fubnction	AWS	Open
2	Google cloud Function	Google	Open

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	24
	Home Assignment and Book	6	
	Lab Weekly exercise	10	
In-Sem Summative	In-Sem Exam-I	14	36
	In-Sem Exam-II	14	
	Lab In Semester Exam	8	
End-Sem Summative	Lab End Exam	16	40
	End Semester Exam	24	

Design of Distributed Applications on Cloud (DDAC)

COURSE CODE	23CA31C4	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	PE1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic concept of hybrid cloud	2	PO1,PO2,PO3
CO2	Understand the management of hybrid cloud in terms of development and deployment	2	PO1,PO2,PO3
CO3	Plan the establishment of hybrid plan	3	PO1,PO3,PO8
CO4	Apply the usage of Azure as a platform for hybrid cloud	3	PO1,PO3, PO8
CO5	Evaluate Applications using AWS cloud	5	PO1,PO3, PO5

Syllabus

Module 1	**Compute, Storage, Database:** Compute: EC2, Lightsail, Lamba, batch, EBS,S erverless, AWS Outposts, Storage: S3,EFS,FSx,S3 Glacier, Storage gateway, AWS Backup, Database: RDS, DynamoDB, ElasticCache, Neptune, Amazon QLDB, Amazon Document DB, Keyspaces, Timestream.
Module 2	**Services: Migration and Transfer, Network, IAM:** Migration and transfer: AWS Migration Hub, Database & Server Migration service. Network & Content Delivery: VPC, CloudFront, Route53, API Gateway, Direct Connect, Global Accelerator. Management & Governance: AWS organizations, CloudWatch, AWS Auto Scaling, CloudFormation, Config. Security, Identity & Compliance: IAM, Resource Access manager, AWS Single Sign-on, Key Management Services.
Module 3	**Identity access Management & S3:** Identity access management, S3 Bucket, S3 pricing Tire, S3 Security and encryption, Versioning control, S3 lock policies and vault lock, S3 Performance, AWS Organizations, Sharing s3 buckets between accounts, Cross region Replication, Transfer Acceleration, Data sync overview, CloudFront, Snowball, Storage gateway.
Module 4	**Amazon EC2 & Network Security:**EC2, Security group, Elastic Bean Stalk (EBS), Volumes and Snapshots, AMI Types, ENI vs ENA vs EFA, Encrypted Root Device volumes & Snapshots, EC2 Hibernate, Cloud Watch, AWS Command line, IAM roles with EC2, Bootstrap Scripts, Elastic File System, FSx for Windows and FSx for Lustre, EC2 Placement Groups, HPC on AWS, AWS Web Application Firewall, VPC's, HA Architecture, Security and Serverless.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Hybrid Cloud for Dummies	Judith Hurwitz , Marcia Kaufman , Fern Halper , Daniel Kirsch	John Wiley & Sons Inc., 2nd Edition	2012

2	Cloud Computing Explained	John Rhoton	Wiley Dream Tech	2009
3	Windows Azure Hybrid Cloud	Danny Garber	John Wiley & Sons Inc	2013
4	Amazon Web Services for Beginners	STEVE M.BURNETT	Printed in the United States of America	2005
5	Amazon Web Services For Dummies	Bernard Golden	John Wiley & Sons, Inc	2011

Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
Mapped Global Certifications:						
1	AWS Solutions Architect	Amazon	Y	Descriptive	Amazon	https://aws.amazon.com/certification/exams/?nc2=sb_ce_exm
2	Cloud Security Architect	Amazon	Y	Descriptive	Amazon	https://aws.amazon.com/certification/exams/?nc2=sb_ce_exm

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	CloudSim (Amazon Web Services)	Software	Open Source
2	CloudAnalyst (Google App Engine)	Software	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	**ALM (Quiz)**	6	22
	Home Assignment and Book. (Min. 4 Assignments etc.)		
	Review / Viva—Voce (Conduct Review/ Viva-Voce After completion of Course / getting MOOCs certificate)	8	
	Lab Weekly exercise	8	
In-Sem Summative	In-Sem Exam-I	15	38
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	Project Demonstration		40
	End Semester Exam (Paper Based)	24	
	End-Sem Exam (MCQ based)		
	Lab End Exam	16	

DATA SCIENCE

Data Science Methodologies (DSM)

COURSE CODE	23CA21D1	MODE		LTPS	2-0-2-0	PRE-REQUISITE	MCS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand Data science, Exploratory Data Analysis, Data Extraction, Wrangling	2	PO1, PO2
CO2	Understanding Probability and Probability distribution	2	PO1, PO3
CO3	Analyse the linear and logistic regression solutions for real world problems	3	PO4, PO5
CO4	Applying classification and clustering algorithms on select open source data sets	3	PO4, PO5
CO5	Execute data science algorithms using Python	5	PO11

Syllabus

Module 1	Introduction to data science, Big Data Overview, State of the Practice of Analytics, Big Data Analytics in Industry Verticals, Overview of Data Analytics Lifecycle, Discovery, Data Preparation, Model Planning, Model Building, Communicating Results and Findings, Operationalizing.
Module 2	Introduction to Probability & Random Variables: Definitions of probability, Sample space, Axioms of probability, Conditional probability, Addition, Multiplication, Baye's theorem and Naïve Bayes, Probability distributions: Binomial, Poisson, Exponential and Normal distributions, Applications of the above distributions.
Module 3	Correlation & Regression: Concept of correlation, Correlation vs Regression, Univariate and multivariate linear regression, Model assessment using R2value, adjusted R2, estimating error, Cost function of linear regression.
Module 4	Supervised and unsupervised Learning: Importance of Machine learning, types of learning, classification algorithms (Naive Bayes, Decision tree) and clustering algorithm (K means clustering, KNN).

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Data Science & Big Data Analytics: Discovering, Analysing, Visualizing and Presenting Data	EMC	Willey publisher	2015
2	Probability and Statistics for Engineers and Scientists	Ronald E. Walpole, Sharon L. Myers and Keying Ye	Pearson	2007
3	Python Data Science Handbook: Essential Tools for Working with Data	Jake VandarPlas	O'Reilly Media	2017
4	Data Science from Scratch: First Principles with Python	Joel Grus	O'Reilly Media	2015

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	AWS Certified Data Analytics - Specialty	AWS	Yes	Objective	AWS	AWS Certified Data Analytics - Specialty Certification (amazon.com)
2	Microsoft Certified: Azure Data Scientist Associate	Microsoft	Yes	Objective	Microsoft	Microsoft Certified: Azure Data Scientist Associate - Certifications	Microsoft Learn

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python & Numpy	Python Software Foundation	Open Source
2	Pandas	PyData	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	15
	Home Assignment and Book	7	
In-Sem Summative	In Sem Exam 1	15	45
	In Sem Exam 2	15	
	Lab In Sem Exam	8	
	Lab Weekly Exercise	7	
End-Sem Summative	End Semester Exam	24	40
	Lab End Exam	16	

Data warehousing and Data Mining(DWDM)

COURSE CODE	21CA22D2	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	PE1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Demonstrate Data preprocessing in knowledge Discovery Process	2	Po1, po2
CO2	construct various multidimensional model with OLAP operations	3	Po1, po2, po3
CO3	Infer knowledge pattern using Association and Clssification methods	4	Po1, po2, po4
CO4	Discover knowledge pattern from different clustering methods	4	Po2, po3, po5
CO5	Examine data preprocessing task and discover Knowledge pattern using various Data mining methods.	4	Po2, po3, po5

Syllabus

Module 1	KDD Process, Introduction to Data Warehouse, Data Preprocessing- Data Cleaning methods, Descriptive Data Summarization, Data Reduction, Data discretization and Concept hierarchy generation
Module 2	Overview of ETL and OLAP OLTP integration – comparison of OLAP with OLTP systems, ROLAP, MOLAP and DOLAP, Data Cube Computation methods, Advanced SQL support for OLAP, multi-dimensional modeling, Attribute-oriented Induction, Data Warehouse architecture and implementation - Parallel execution, Materialized views
Module 3	Data Mining Techniques: Basic concepts of Association Rule Mining, Frequent Item set mining, Mining various kinds of association rules. Classification by decision tree induction, Bayesian Classification, Rule-based Classification, Classification Back-propagation, Associative Classification, Lazy Learners, Rough set approach
Module 4	Clustering methods, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity Partitioning-Based Clustering Methods; Hierarchical Clustering Methods; Density Based and Grid-Based Clustering Methods

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Data Mining: Concepts and Techniques	Han J &Kamber M	Elsevier	2011

2	Introduction to Data Mining	PangNing Tan, Michael Steinback, Vipin Kumar	Pearson Addison-Wesley	2008
3	Data Warehousing: Architecture and Implementation	M.Humphires, M.Hawkins, M	Pearson Education	2009
4	Data Warehousing in the Real World	Anahory, Murray	Pearson Education,	2008

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	**Professional Machine Learning Engineer**	Google	Y	MCQ	Google	https://cloud.google.com/learn/certification/guides/machine-learning-engineer
2	AWS certified Machie learning	AWS	y	**Format:** 65 questions; either multiple choice or multiple response. **Delivery method:** Pearson VUE testing center or online proctored exam.	AWS	https://aws.amazon.com/certification/certified-machine-learning-specialty/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Weka	University of Waikato in New Zealand	Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment	7	
	Practical continuous evaluation	7	
In-Sem Summative	In sem-1	15	38
	In-sem-2	15	
	Practical insem	8	
End-Sem Summative	End sem exam	24	40
	Lab end sem	16	

Applied Machine Learning(AML)

COURSE CODE	23CA31D3	MODE		LTPS	2-0-2-0	PRE-REQUISITE	AI

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Demonstrate the types of machine learning and model representation	2, BTL (<=3)	Max. of 3 Pos(PO1,PO2,PO3)
CO2	Implementing Linear Regression model for supervised learning	3, BTL (<=4)	Max. of 3 Pos(PO1,PO2,PO3)
CO3	Experimenting Multiple Linear Regression model	3, BTL (>=3)	Max. of 3 Pos(PO3,PO4,PO5)
CO4	Estimating various Regression coefficient	4, BTL (>=4)	Max. of 3 Pos(PO3,PO4,PO8)
CO5	Evaluate applications using linear regression techniques	4, BTL (>=3)	Max. of 3 Pos(PO4,PO5,PO8)

Syllabus

Module 1	Introduction to Machine Learning Algorithms Introduction to Machine learning – Statistical Learning – types of Machine Learning –learning models: geometric, probabilistic and logistic models, introduction to supervised, unsupervised and reinforcement learning – model evaluation – model implementation – model accuracy indicators.
Module 2	Supervised Learning – Simple Linear Regression Analysis Introduction to parametric machine learning method, assumptions of parametric machine learning methods, linear model and its assumptions, simple linear regression, scatter diagram, Simple linear Regression parameter estimation, properties of regression parameters, testing the significance of regression parameters using ANOVA and t test, estimation of , Interval Estimation of the Mean Response, R Square, Adjusted R Square, Normality of response variable, prediction of new observations
Module 3	Supervised Learning – Multiple Linear Regression Analysis I Multiple linear regression model, assumptions of Multiple linear regression variables – multicollinearity, homoscedasticity, autocorrelation, effects of multicollinearity, effect of homoscedasticity and auto autocorrelation in parameter estimation, Least - Squares Estimation of the Regression Coefficients, Performance metrics in regression

Module 4	Classification Problem with Python,Data Visualization,Statistical Summary,Create Training and Test Sets and Apply Scaling,Build Models, predicting new observations, residual analysis, model adequacy and validation.
Module-5	Supervised Learning – Logistic Regression,Decision Tree,K-Nearest Neighbors,Linear Discriminant Analysis,Gaussian Naive Bayes,Support Vector Machine,Decision Boundary plots

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Introduction to Linear Regression Analysis	DOUGLAS C. MONTGOMERY, ELIZABETH A. PECK, G. GEOFFREY VINING	A JOHN WILEY & SONS, INC., PUBLICATION	Fifth Edition
2	Introduction to Machine Learning	EthemAlpaydm	MIT Press	Third, 2014
3	Python Machine Learning	Sebastian Raschka	PACKT Publishing	Second
4	Using Multivariate Statistics	Barbara G. Tabachnick, Linda S. Fidell	Pearson Education Inc	Sixth
5	Introduction to machine learning with Python	Andreas Muller	Shroff/O'Reilly	First

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Kaggle	Leader Board	N	Leader Board	Kaggale.com	https://www.kaggle.com/
2	Towardsdata science	Conference Publication	N	Conference Publication	NA	https://towardsdatascience.com/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Anaconda-Jupyter notebook	Anaconda foundation	Opensource

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	

	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Sem	16	

Introduction to Big Data Analytics (BDA)

COURSE CODE	**23CA31D4**	MO DE	R	LTPS	2-0-2-0	PRE-REQUISITE	PE1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	understand how to store and maintain of Big Data	2	PO1
CO2	understand architecture and ecosystem of Hadoop	2	PO3
CO3	Outline Processing and Storage Layer of Hadoop, internal concept of Map Reduce	3	PO2,PO3PO 5 , PO7
CO4	understand YARN Architecture and Execution of job in Hadoop cluster	2	PO4, PO5
CO5	Evaluate cluster management using YARN	5	PO4, PO5

Syllabus

Module 1	**Understanding Big Data:** Define Big Data, Types of Big Data, , How Big data being Generated, Different source of Big Data Generation, Rate at which Big Data is being generated, Different V's, How single person is contributing towards Big Data, Significance for Big Data, Reason for Big Data, Understanding RDBMS and why it is failing to store Big Data. Future of Big Data, Big Data use cases for major IT Industries
Module 2	**Introduction to Hadoop:** What is Hadoop, Apache Community, History of Hadoop ,Commodity Hardware, Rack Awareness, Need for Hadoop, How is Hadoop Important, Apache Hadoop Ecosystem, Different Hadoop offering , Hadoop Architecture, Difference between Hadoop 1.x and 2.x Architecture, Apache Hadoop Framework, Master- Slave Architecture, Advantages of Hadoop.
Module 3	**Storage Unit:** Hadoop Distributed File System, Design of HDFS, HDFS Concepts, How files are stored in HDFS, Hadoop File system, HDFS federation, HDFS High availability Architectural description for Hadoop Cluster, When to use or not to use HDFS, Block Allocation in Hadoop Cluster, Read and Write operation in HDFS, Hadoop Archives, Data Integrity in HDFS, Compression & Input Splits. **Processing Unit:** What is Map Reduce, History of Map Reduce, How does Map Reduce works, Input files, Input Format types& Output Format Types, Text Input Format, Key Value Input Format, Sequence File Input Format, Input split, Record Reader, Map

	Reduce overview, Mapper Phase, Reducer Phase, Sort and Shuffle Phase, Importance of Map Reduce Data Flow, Counters, Combiner Function, Partition Function, Joins, Map Side Join, Reduce Side Join, Map Reduce Web UI, Job Scheduling, Task Scheduling, Fault Tolerance, Writing Map Reduce Application, Driver Class, Mapper Class, Reducer Class, Serialization, File Based Data Structure, Writing a simple Map Reduce program to Count Number of words, Map Reduce Work Flows
Module 4	**YARN &Hadoop Cluster:** YARN, YARN Architecture, YARN Components, Resource Manager, Node Manager, Application Master, Concept of Container, , Execution of Job in Yarn Cluster, Comparing and Contrasting Hadoop with Relational Databases Cluster Specification, Cluster Setup and Installation, Creating Hadoop user, Installing Hadoop, SSH Configuration, Hadoop Configuration, Hadoop daemon properties, Different modes of Hadoop, Standalone Mode, Pseudo Distributed Mode, Fully Distributed Modes

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Hadoop: The Definitive Guide	Tom White	O'REILLY	2015
2	Hadoop for Dummies	Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, and Roman B. Melnyk	A Wiley brand	2014
3	Hadoop in Action	Chuck Lam	Manning Publications	2010
4	Big Data Analytics with Hadoop 3.0	Sridhar Alla	Packt Publishing	2018
5	Professional Hadoop Solutions	Boris Lublinsky, Kevin T Smith, Alexey Yakubovich	Wrox	2013

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	SAS Certified Big Data Professional	SAS Institute	Y	Online	Pearson VUE testing center	https://www.sas.com/en_us/certification/credentials/big-data-professional.html

Sl No							
2	IBM Certified Data Engineer - Big Data	IBM		Y	Online	Pearson VUE testing center	https://www.ibm.com/certify/cert?id=08002111 or https://home.pearsonvue.com/ibm

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Apache Hadoop	Apache Software Foundation	open-source
2	IBM Open Platform with Apache Hadoop (IOP)	IBM	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	8	22
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem Exam-I	15	38
	In-Sem Exam-II	15	
	In Semester Lab Exam	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Exam	16	

<h1 style="text-align:center">Data Visualization Techniques (DV)</h1>

COURSE CODE	23CA32D5	MODE		LTPS	**3-0-0-0**	PRE-REQUISITE	PE1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the brief history of data visualization, its importance, and the challenges involved in visualizing data	2	PO1
CO2	Apply static graphical techniques such as bar graphs to represent data, including grouping bars, customizing colors, sizes, titles, and axis units	3	PO2,PO4
CO3	Analyze multivariate statistical visual representations, such as dendrograms, scree plots, QQ plots, and PP plots.	4	PO2,PO3,PO4
CO4	Examine the visualizations by adding annotations such as text, mathematical expressions, lines, arrows, shaded shapes, and error bars.	4	PO4,PO5

Syllabus

Module 1	**Introduction to Data Visualization: B**rief history of data visualization, scientific design choices in data visualization- choice of graphical form, grammar of graphical techniques of large amount of data, crucial need of visualization techniques, challenges in visualization techniques, classification of visualization techniques for qualitative and quantitative data, power of visualization techniques.
Module 2	**Static Graphical Techniques – 1 :**Introduction to bar graph, basic understanding of making basic bar graph, grouping bars together, bar graphs on counts, customization of bar graphs by changing colour, size, title, axis units, changing width and spacing of the bar chart, adding labels to bar graph, application of bar graph in business.
Module 3	**Multivariate Graphical Techniques :**Introduction to correlation matrix, application of correlation matrix in the multivariate analysis, network graph, basics of heat map, difference between heat map and tree map, introduction to higher dimensional scatter plot, axis adjustment in the higher dimensional scatter plot.
Module 4	**Graphical Validation :** Basics of multivariate statistical visual representations and its results, dendrogram, importance of dendrogram in grouping (cluster analysis), Scree Plot, QQ plot, PP plot .**Customization:** Introduction to annotations – adding : text, mathematical expression , lines, arrows, shaded shapes, highlighting the texts and items, adding error bars, introduction to axis, swapping x and y axis

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Visualization Analysis and Design	Munzner	A K Peters/CRC Press	2014
2	Information Visualization: Perception for Design	Colin Ware	Morgan Kaufmann	2012
3	Visualizing Data.	Ben Fry	O'Reilly Media	2008

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Data Visualization Professional (CDVP)	Data Visualization Society	Y	OBJECTIVE	Data Visualization Society(DVS)	https://iccp.org /certified-data-professional-cdp.html
2	Microsoft Certified: Data Analyst Associate	Microsoft	Y	OBJECTIVE	Microsoft	https://docs.microsoft.com/en-us/learn/certifications/data-analyst-associate

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Tableau	Salesforce	Commercial
2	D3.js	Data-Driven Documents	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignment and Book	10	20
	ALMs	10	
In-Sem Summative	In Semester Exam-I	20	40
	In Semester Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

ARTIFICIAL INTELLIGENCE

Applied Artificial Intelligence(AAI)

COURSE CODE	23CA21A1	MODE		LTPS	2-0-2-0	PRE-REQUISITE	MCS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand about intelligence Ve, knowledge and artificial Intelligence, techniques of AI as a State space search, production systems.	2	PO1, PO2, PO5
CO2	Implement problem solving by search, Heuristic search, Randomized search techniques and Finding optimal paths	3	PO1, PO2, PO5
CO3	Experiment with the appropriate methodologies for problem decompositions, planning and constraint data constraint satisfactions.	3	PO1, PO2, PO5
CO4	Implement knowledge representation using Predicate Logic, representing knowledge using rules, Semantic Nets, Frames and conceptual dependencies	3	PO1, PO2, PO5
CO5	Evaluate the theoretical concepts to conduct various experiments on Search Techniques and Language Representation and processing using AI .	5	PO1, PO2, PO5

Syllabus

Module 1	Introduction: Overview and Historical Perspective, Turing test, Physical Symbol Systems and the scope of Symbolic AI, Agents. State Space Search: Depth First Search, Breadth First Search,
Module 2	Heuristic Search: Best First Search, Hill Climbing, Beam Search, Tabu Search. Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony optimization. Finding Optimal Paths: Branch and Bound, A*, IDA*, Divide and Conquer approaches, Beam Stack Search.
Module 3	

	Problem Decomposition: Goal Trees, AO*, Rule Based Systems, Rete Net. Game Playing: Planning and Constraint Satisfaction: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graph plan, Constraint Propagation
Module 4	Logic and Inferences: Propositional Logic, First Order Logic, Soundness and Completeness, Forward and backward chaining.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligence'	Russel and Norvig	PHI	3rd edition.2022
2	Artificial Intelligence'	Elaine Rich & Kevin Knight	Tata Mc Graw Hill	3rd edition..2017
3	Artificial Intelligence'	Patrick Henry Winston,	Pearson Education	3rd edition..1992
4	Artificial Intelligence'	G. Luger, W. A. Stubblefield	Addison wesley	3rd edition..2016
5	Programming in Prolog	William F. Clocksin, Christopher S. Mellish	Springer	5th edition 2012

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Kaggale.com	Leader Board	N	Leader Board	Kaggale.com	https://www.kaggle.com/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Anaconda-Jupyter notebook	Anaconda foundation	Opensource

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End Sem	16	

APPLIED DEEP LEARNING (ADL)

23CA31A4	23CA31A4	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	PE1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate Sigmoid Neurons, Feedforward Neural Networks, Gradient Descent (GD), Dimensional Reduction	2	PO1,PO2, PSO1
CO2	Experiment with the Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO	3	PO1,PO2, PSO1
CO3	Build the concepts of , Deep Dream, LSTM, GRU and Neural style transfer	3	PO1,PO2,PO5,PSO1
CO4	Organize the concepts of Markov models, Markov networks, Markov chains, Variational autoencoders, Autoregressive Models: NADE, MADE, PixelRNN	3	PO4,PO8 ,PSO1
CO5	Evaluate Neural Networks, optimization algorithms, engine vector decomposition, various types of auto encoders, batch normalization, convolutional neural network	5	PO3,PO5 ,PSO1
CO6	Evaluate GANs.	5	PO3,PO5 ,PSO1

Syllabus

Module 1	History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptron's, Perceptron Learning Algorithm and Convergence, Multilayer Perceptron's (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feedforward Neural Networks, Backpropagation, Gradient Descent (GD), Momentum Based GD, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Principal Component Analysis
Module 2	Autoencoders, Denoising autoencoders, Sparse autoencoders, Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input.
Module 3	Ensemble methods, Batch Normalization, Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet
Module 4	Long Short Term Memory (LSTM) Restricted Boltzmann Machines, Deep Dream, GRU, Neural style transfer, Deep learning for computer vision, text and sequences.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Deep learning with python	Francois Chollet	Manning publishers	2018, ISBN9781617294433
2	Grokking deep learning	Andrew w Trask-2019	Manning publishers	2019, ISBN9781617293702

3	Deep Learning	Ian Goodfellow and Yoshua Bengio and Aaron Courville	MIT Press	2016

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Deep Learning	IITM	Y	Assignments+Quiz	IITR	https://onlinecourses.nptel.ac.in/noc23_cs110/preview
2	Python for Deep Learning: Build Neural Networks in Python	Udemy	Y	Assignments+Quiz	Udemy	https://www.udemy.com/course/deep-learning-basics-with-python/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	TensorFlow, Keras, PyTorch, Theno		Open Source
2			

PERCEPTION AND COMPUTER VISION(PCV)

| COURSE CODE | 23CA32A5 | MODE | R | LTPS | 3-0-0-0 | PRE-REQUISITE | PE1 |

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand Image representation and modelling	2	PO1
CO2	Apply Image transformation methods	3	PO3
CO3	Implement image processing algorithms	3	PO5
CO4	Design of face detection and recognition algorithms.	4	PO3

Syllabus

Module 1	Cameras: Sensing, Sources, Shadows, and Shading: Qualitative Radiometry, Sources and their effects, Local shading models, Application: photometric stereo, Inter-reflections: global shading models Color: The physics of color, Human color Perception, Representing color, A Model for image color, Surface color from image color.
Module 2	Linear Filters: Linear filters and convolution, Shift Invariant linear systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Technique: Scale and Image Pyramids, Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture: Representing Texture, Analysis Using Oriented Pyramids, Application: Synthesizing Textures for Rendering, Shape from Texture The Geometry of Multiple Views: Two Views, Three Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering
Module 3	Rendering, Shape from Texture The Geometry of Multiple Views: Two Views, Three Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: Human Vision: Grouping and Gestalt, Applications: shot boundary detection and background subtraction, Image segmentation by clustering p33ixels, Segmentation by Graph-Theoretic Clustering Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Robustness, Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in practice, Model selection: best Fit, Model-Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses Using Invariants, Verification
Module 4	Application: Registrations in Medical Imaging Systems, Curved Surfaces and Alignment Finding Templates Using Classifiers: Classifiers, Building Classifiers from Class Histograms, Feature selection, Neural Networks, The Support Vector Machine Recognition by Relations between Templates: Finding objects by voting on relations between templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Technique: Hidden Markov Models, Applications: Hidden Markov Models and Sign Language Understanding Geometric Templates from Spatial Relations: Simple Relations between object and image, Primitives, Templates, and Geometric Inference, Object Recognition.

Reference Books:

., , , (2011) 2.,. 3,.

Sl No	Title	Author(s)	Publisher	Year
Book 1:	"Computer Vision – A Modern Approach"	Forsyth David A and Ponce J	Pearson Publication	2003
Book 2:	"Computer Vision: Algorithms and Applications"	R. Szeliski	Springer Verlag	2011
Book 3	"Digital Image Processing and Computer Vision"	Milan Soanka, Vaclav Hlavac and Roger Boyle	Cengage Learning	2011
Book 4	"Digital Image Processing"	R.C. Gonzalez and R.E. Woods	Pearson Education	2003

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	COMPUTER VISION	COURSERA	Y	ONLINE MCQ	COURSERA	https://www.coursera.org/learn/introduction-computer-vision-watson-opencv
2	IMAGE PROCESSING	COURSERA	Y	ONLINE MCQ	COURSERA	https://www.coursera.org/learn/introduction-image-processing

Tools used in Practical / Skill:

SL NO	SOFTWARE REQUIREMENTS	TOOLS	Required Bandwidth
1	MAT LAB	IMAGE PROCESSING	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Book	10	
In-Sem Summative	In-Sem Exam-I	20	40
	In-Sem Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

COURSE CODE	23CA21S1	MODE	Regular	LTPS	2-0-2-0	PRE-REQUISITE	MCS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the need for cyber security	2	PO1
CO2	Analyze various types of security threats and electronic payment systems	4	PO3, PO4
CO3	Analyze the security issues involved in developing secure information systems	4	PO3, PO4
CO4	Compare different ethical hacking methods	5	PO3, PO4
CO5	Analyze various cyber security threats	4	PO4,PO5

Syllabus

Module 1	Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.
Module 2	Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software.
Module 3	Digital Signature, public Key Cryptography. Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management.
Module 4	Introduction to Ethical Hacking: Hacking Methodology, Process of Malicious Hacking, Foot printing and Scanning: Foot printing, Scanning. Enumeration: Enumeration. System Web and Network Hacking: SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Analysing Computer Security "	Charles P. Pfleeger, Shari Lawerance Pfleeger,	Pearson Education India.	2012
2	"Cryptography and information Security"	V.K. Pachghare	PHI Learning Private Limited, Delhi	2004

3	"Introduction to Information Security and Cyber Law"	Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla	Willey Dreamtech Press	2008
4	" Information Assurance for the Enterprise"	Schou, Shoemaker	Tata McGraw Hill	2006
5	Hacking Exposed 7th Edition	Stuart McClure, Joel Scambray, George Kurtz	Tata McGraw Hill	2009

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	CEH	EC - Council	Y	Multiple Choice	EC - Council	https://www.eccouncil.org/train-certify/certified-ethical-hacker-ceh/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Nmap (Network Mapper)	Github.com	Open Source
2	Metasploit	Rapid7	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	7	22
	ALM	8	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

Cyber Forensics   (CFS)

COURSE CODE	23CA22S2	MODE	REGULAR	LTPS	2-0-2-0	PRE-REQUISITE	PE1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand Forensic Science and Recovery methods	2	PO1, PO2
CO2	Analyze Digital Evidence, Network Forensics and Mobile Device Forensics	4	PO2, PO3
CO3	Analyze Web Forensics and Email Forensics	4	PO2,PO3, PO4
CO4	Analyze the security policies, standards and cyber laws	4	PO3, PO4
CO5	Design an application for cyber forensics using the concepts.	5	PO3,PO4, PO5

Syllabus

Module 1	Computer Forensics : Introduction to Computer Forensics, Forms of Cyber Crime, First Responder Procedure- Non-technical staff, Technical Staff, Forensics Expert and Computer Investigation procedure, Case Studies Storage Devices & Data Recover Methods : Data Acquisition, Data deletion and data recovery method and techniques, volatile data analysis, Case Studies
Module 2	Forensics Techniques I : Windows forensic, Linux Forensics, Network forensics – sources of network-based evidence, other basic technical fundamentals, Network forensic investigative strategies, technical aspects, statistical flow analysis, packet analysis, forensics of wireless networks, network intrusion detection analysis, event log aggregation and correlation analysis, switches, routers and firewalls, Case Studies, Mobile Forensics – data extraction & analysis, Steganography, Password cracking, Case Studies.
Module 3	Forensics Techniques II : Cross-drive analysis, Live analysis, deleted files, stochastic forensics, Dictionary attack, Rainbow attack, Email Tacking – Header option of SMTP, POP3, IMAP, examining browsers, Case Studies
Module 4	Cyber Law: Corporate espionage, digital evidence handling procedure, Chain of custody, Main features of Indian IT Act 2008 (Amendment), Case Studies, Incident specific procedures

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Computer Forensics: Computer Crime Scene Investigation	John Vacca	Laxmi Publications	2015
2	Digital Forensic: The Fascinating World of Digital Evidences	Nilakshi Jain	Wiley	2016
3	Hacking Exposed Computer Forensics	Aaron Philipp, David Cowen	McGraw Hill	2009
4	Mastering Mobile Forensics	SoufianeTahiri	Packt Publishing	2016
5	Computer Forensics: A Beginners Guide	David Cowen	McGraw Hill	2013

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	MASTER CFI	Mile2	Y	MCQ'S	Mile2	https://mile2.com/product/cmcfi-certified-master-cyber-forensics-investigator/
2	C|HFI	EC-COUNCIL	Y	MCQ'S	EC-COUNCIL	https://www.eccouncil.org/train-certify/computer-hacking-forensic-investigator-chfi/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Metasploit	Rapid7	Open Source
2	Nmap (Network Mapper)	Github.com	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	22
	Home Assignment and Book	7	
	Lab Weekly exercise	7	
In-Sem Summative	In-Sem Exam-I	15	38
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	Lab End Exam	16	40
	End Semester Exam	24	

COURSE CODE	23CA31S3	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	PE1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basics of Malware analysis	2	PO1
CO2	Organize the concept of dynamic analysis	3	PO2,PO3
CO3	Build the concept of Virtual machines in Malware analysis	3	PO1,PO3,PO4
CO4	Analyze the Exception handling in malware analysis	4	PO4,PO5
CO5	Analyze the Exception handling in malware analysis	5	PO5,PO6

Syllabus

Module 1	Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing
Module 2	Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots, Creating fake networks. X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithematic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing,
Module 3	The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism. Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing,
Module 4	Exception Handling, Patching. Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection, YARA rule based detection.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware	Monnappa KA	Packt Publishing Ltd	2018 Jun 29
2	Practical malware analysis: the hands-on guide to dissecting malicious software	Sikorski M, Honig A	no starch press	2012 Feb 1

3	Cuckoo malware analysis	Oktavianto D, Muhardianto I	Packt Publishing Ltd	2013 Oct 16
4	Windows malware analysis essentials	Marak V	Packt Publishing Ltd	2015 Sep 1
5	Malware Analysis and Detection Engineering	Mohanta A, Saldanha A	Apress, New York, NY	2020

Global Certifications:

Mapped Global Certifications:					
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	GIAC Reverse Engineering Malware Certification	CyberLive	N	Online	GREM	https://exams.giac.org/pages/attempts
2	MALWARE ANALYSIS-CYBERSECURITY AWARNESS SERIES	EGS-CSA	N	Online	EGS-CSA	Malware Analysis - EC-Council Global Services (EGS) (eccouncil.org)

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	YARA	VIRUS TOTAL	Open Source
2	ROOTKIT	Sourceforge	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	22
	Home Assignment and Book	7	
	Lab Weekly exercise	7	
In-Sem Summative	In-Sem Exam-I	15	38
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	Lab End Exam	16	40
	End Semester Exam	24	

SECURITY GOVERNANCE AND MANAGEMENT(23CA31S4)

L-T-P-S: 2-0-2-0   **Credits:3**   **Prerequisite: PE1**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	Introduction to E-Government and E-Governance; Models of E-Governance	PO1,PO2	2
CO 2	E-Government Infrastructure Development	PO2,PO3,PO7	3
CO 3	Security for e-Government; Applications of Data Warehousing and Data Mining in Government	PO3,PO4	3
CO 4	Case Studies	PO1,PO2,PO3,PO4,PO5	4,5
CO 5	Implementing e-governance models and systems using suitable platform.	PO5	5

Course Description:

This course familiarizes students with different concepts of E-Government and E-Governance, different E-Governance models and infrastructure development, E-government security,.

Course Objectives:

- ❖ To develop knowledge of e-governance and e-government
- ❖ To know different e-governance models and infrastructure development
- ❖ To implement security and e-governance models and systems using suitable platform.

Syllabus:

Introduction to E-Government and E-Governance:
Difference between E-Government and E-Governance; E-Government as Information System; Benefits of E-Government; E-Government Life Cycle; Online Service Delivery and Electronic Service Delivery; Evolution, Scope and Content of E-Governance; Present Global Trends of Growth in E-Governance

Models of E-Governance : Introduction; Model of Digital Governance: Broadcasting / Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive – Service Model / Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Towards Good Governance through E-Governance Models

E-Government Infrastructure Development: Network Infrastructure; Computing Infrastructure; Data centers; E-Government Architecture; Interoperability Framework; Cloud Governance; E-readiness; Data System Infrastructure; Legal Infrastructural Preparedness; Institutional Infrastructural Preparedness; Human Infrastructural Preparedness; Technological Infrastructural Preparedness

Security for e-Government: Challenges and Approach of E-government Security; Security Management Model; E- Government Security Architecture; Security Standards

Applications of Data Warehousing and Data Mining in Government: Introduction; National Data Warehouses: Census Data, Prices of Essential Commodities; Other Areas for Data Warehousing and Data Mining: Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors

Case Studies: E-Government Initiatives in Nepal, Cyber Laws, Implementation in the Land Reform, Human Resource Management Software, NICNET, Collectorate , Computer-aided Administration of Registration Department (CARD), Smart Nagarpalika, National Reservoir Level and Capacity Monitoring System, Computerization in Andra Pradesh, Ekal Seva Kendra, Sachivalaya Vahini, Bhoomi, IT in Judiciary, E-Khazana

, DGFT, PRAJA, E-Seva, E- Panchyat, General Information Services of National Informatics Centre, E-Governance initiative in USA, E-Governance in China, E-Governance in Brazil and Sri Lanka

TEXT BOOKS:
1. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Second Edition, PHI Learning, 2012.
2. Strategic Planning and Implementation of E-Governance, P.K.Suri and Sushil, Springer, 2019.
3. A Study of the Practice of E-governance in the Developing Countries: A Qualitative Approach In Measuring The Maturity of E-government, Kazi Hassan Robin and Md. Mahmudul Hasan Rafee, 2012.
4. Implementing and managing e-Government, Richard Heeks, 2006.
5. E-Business and E-Commerce, Chaffey, Dave, Prentice-Hall, London,2002
6. E-GOVERNMENT: THE SCIENCE OF THE POSSIBLE Kindle Edition 2004
7. E-Government Implementation, Adoption and Synthesis in Developing Countries. Bwalya, Kelvin J. / Mutula, S.2014
8. E-Business, Takriti, Sa'dand Allaq, Bashir, Dar el-Manahej , Amman,2002

Evaluation Components:

CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
In – Sem FORMATIVE	Home Assignments	7	
	Quiz	7	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	24
In – Sem SUMMATIVE	In-Sem 1	12	
	In-Sem 2	12	
	Practical In-Sem	6	36
	Skill In-Sem	6	
End Sem SUMMATIVE	End-Sem Exam (Paper Based)	24	
	Lab End-Sem Exam	8	40
	Skill End-Sem Exam	8	