(DEEMED TO BE UNIVERSITY)

STUDENT handbook 2023-2024

Master of Computer Applications

Department of CSA

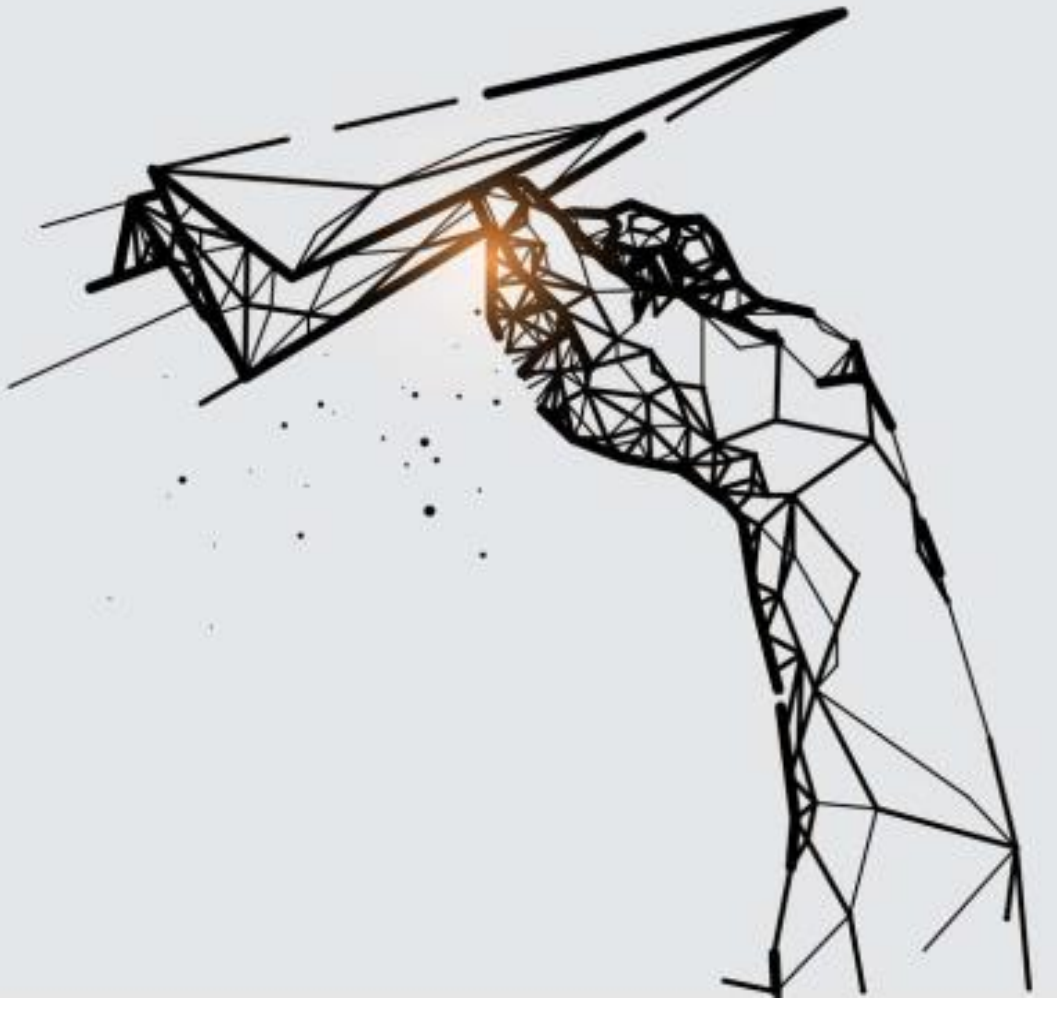
www.kluniversity.in

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 students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.




CATEGORY 1
UNIVERSITY
BY MHRD, Govt. of India
KL ACCREDITED BY
NAAC WITH A++
GRADE
nirf
2023
NATIONAL
INSTITUTIONAL
RANKING
FRAMEWORK
RANKED 28
AMONG ALL
UNIVERSITIES
43 YEARS OF
EDUCATIONAL
LEADERSHIP

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

CHAPTER 1

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.

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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 and32.98 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 24hrs, 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 Counsellor's, 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.

About the Department of Computer Science & Applications

The Department of Computer Science and Applications was established in the Academic Year 2015.

BCA at KLEF (Deemed to be University) University is an undergraduate program with the specializations "Cloud Technology and Information Security", "Artificial Intelligence, "Cyber Security" and "Data Science". These programs are designed with the main objective of imparting strong theoretical and practical foundation, and to provide exposure to latest technologies to bridge the industry gap in IT sector by abiding to social ethics.

With a strong team of faculties, a comprehensive study environment at KLEF (Deemed to be University) is assured. We are well equipped with extensive infrastructure for both online and offline conduction of classes. Since the need of the hour is to provide the new gene with advanced technological studies.

We have a 2-year MCA course with fields of specialization: Data science, Artificial Intelligence and Cloud Technology and Information Security. Thus, you may entrust us with your wonderful career at KLEF (Deemed to be University).

Vision

To impart knowledge and quality skills in computing at par with global industry requirements.

Mission

To impact strong theoretical foundation, practical knowledge and to provide exposure to latest technologies to inculcate ideas which bridge the industry gap in IT sector by bounding to social ethics.

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
MCA	2 years	10+2+3	45%	240

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	The Graduate will exhibit a great sense of leadership with competent knowledge, innovation and creativity in their field of specialization
2	The Graduate will exhibit professionalism, ethical attitude communication skills and team work in their profession and adapt to current trends by engaging in lifelong learning

Program Outcomes (POs)

PO	DESCRIPTION
1	**Computational Knowledge**: Acquire knowledge of advanced programming practices, computing skills, and domain knowledge for developing application software to solve real world problems
2	**Problem Analysis**: Ability to identify computing problem and analyse the component of problem using principles of mathematics, specialized computing and application strategies.
3	**Design and Development**: Design and develop efficient solutions for complex problems across different domains.
4	**Research:** Apply research-based knowledge and methodologies to analyse, design, validate result and interpret it into optimized conclusions
5	**Modern Tool Usage**: Create, select, adapt and apply appropriate techniques, resources and modern IT tools to solve complex computing problems
6	**Project Management**: Demonstrate knowledge on project management principles, interpersonal skill and communicate in the team effectively to deliver solutions and operational procedures
7	**Communication**: Communicate effectively in the team and the user to deliver solution and operational procedures with professional standards and ethics

CHAPTER 4

ACADEMIC REGULATIONS

This document supplements the University‘s rules and regulations to provide assistance to MCA program. It is mandatory that every student shall abide by these academic regulations.

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 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 analysed. 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..

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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

GENERAL BEHAVIOUR

- 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 quarrelling 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 behaviours 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 has to undertake the registration process prior to commencement of the course-work, based on the following conditions;

- Registration into a course will be permitted only for such courses, which are offered by the program in that particular semester.
- In case a course has pre-requisites, all of them must be fulfilled.
- The University has the right to refuse registration process if a student does not turn up on the day of registration.
- Registration shall not be permitted after the fifth working day from the scheduled date of commencement of classes.
- Students can register for a maximum number of courses of the semester as prescribed by BOS of the program.
- Students, who have opted for specialization, can register for special set of courses
- The University reserves the right to withdraw any elective course offered within one week of the commencement of the semester if sufficient numbers of students have not registered or for any other 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. In case of electives 30% of total strength shall opt to offer that elective in that semester
- The University reserves the right to cancel the registration of a student from a course or a semester or debar from the degree on disciplinary grounds.
- Within one week of the commencement of the semester, a student is permitted to substitute an elective course subject to availability with prior approval from Head/ Dean-Academics. However, a student is not permitted to withdraw from compulsory course and substitute the same with an elective course.
- A student is solely responsible to ensure that all conditions for proper registration are satisfied, and there are no timetable clashes. The registration may be cancelled for a course or the entire semester either by the student or by the University 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

MCA 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:

- Every course may/may not have one or more of its preceding course(s) as prerequisite(s).
- To register for a course, the student must successfully complete the course(s) earmarked as pre-requisite(s) in case specified for that course.
- In any course if a student appears for semester end exam or is declared eligible for the same, s/he is deemed to have met the prerequisite.
- The Dean Academics after consulting with Department concerned has the prerogative to waive the prerequisite (if it is satisfied through a test) if the student has gained sufficient proficiency to take up the course.
- Compulsory core courses can be chosen by the students of the respective disciplines only. However, the students of a particular discipline can register for specialization/discipline / interdisciplinary minor / compulsory discipline courses of other disciplines provided they have met the pre-requisite or when pre requisite is waived by Dean Academics.

CHAPTER 6

REQUIREMENTS FOR THE AWARD OF DEGREE

The student is awarded MCA degree provided she/he

- Must successfully earn 80 credits, as stipulated in the program structure.
- Must have successfully obtained a minimum CGPA of 5.25 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.

Department of Computer Science & Applications-MCA
Admitted Category wise Courses, Credits and Contact hours Count

Sl No	Course Category	Short Name	#courses	Minimum Credits	Contact Hours
1	Audit	**AUD**	**1**	**0**	**4**
1	Skill Development	**SDC**	1	2.0	8
2	Basic Sciences	**BS**	0	0.0	0
3	Engineering Sciences	**ES**	0	0.0	0
4	Professional Core	**PC**	9	37.0	55
5	Flexi Core	**FC**	0	0.0	0
6	Professional Electives	**PE**	5	20.0	29
7	Project Courses	**PR**	2	15.0	30
8	Open Electives	**OE**	2	6.0	6
Total			**20**	**80**	**132**

Award of Degree

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

- $5.25 \leq$ CGPA < 5.75 will be awarded Pass Class.
- $5.75 \leq$ CGPA < 6.75 will be awarded Second-Class.
- $6.75 \leq$ 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.

Name of the program	PC	PE	HSS	BS	ES	FC	OE	PR	FL	Skill	TBL	Certificate on	Certificate on	ITR/PS/PR/term Paper	Total Credits	Minimum CGPA required
MCA	**37**	**20**	**0**	**0**	**0**	**0**	**6**	**15**	**-**	**0**	**2**	**-**	**-**	**-**	**80**	**5.25**

CHAPTER 7

ATTENDANCE RULES AND DETENTION POLICY

a)Attendance Policy for Promotion in a Course

- Attendance Based Marks
- Attendance Waiver
- Attendance Condonation for Participation in KLEF /National/ International Events
- Eligibility For Appearing in Sem –End Examination
- Absence in Assessment &Examination
- Remedial Classes
- In any course, a student must maintain a minimum of 75% attendance and must secure a minimum of 40% marks in In-Semester Examinations to be eligible for appearing to the Semester End Examination, failing to fulfil these conditions will deem such student to have been detained in that course.

b) How ever the following are the special cases where the lack of attendance can be condoned:

i. Up to a maximum of 10% on medical grounds, in which case the student must submit the medical certificate from any recognized medical practitioner.

ii. Up to a maximum of 10% if the student represents the University / State / Country in any extra / co-curricular activities.

iii. The maximum extent to which a student can be condoned is 10%, and any student with less than 65% is deemed to be detained.

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

The assessment in each theory subject consists of Sem-In Exams, in-class quizzes/tutorials/home assignments/Active Learning Methods (continuous 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 accordingly be adjusted. Students are advised to refer to 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.

Semester-In Evaluation

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

- The process of evaluation is continuous throughout the semester.
- The distribution of marks for Semester-In evaluation is 60% of aggregate marks of the course.

Sl No.	**College / School Name**	**Semester-In Evaluation (Weightage %) (A)**	**Sem End Examination (Weightage %) (B)**	**Minimum requirement for pass %**	
				(A+B)	**B**
1	Master of Computer Applications	60	40	40	40

a. 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.

b. 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.

c. 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.

d. 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.

e. 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.

f. 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.

g. 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.

h. 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.

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.

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
Fail	F	0	0 – 39
Absent	AB	0	Absent

Relative Grading

The following table lists the grades and its connotation for relative grading:

Letter Grade	Grade Point	Grade Calculation
O	10	total marks >= 90% and total marks >= mean + 1.50σ
A^+	9	μ+0.50σ <= total marks < μ+1.50σ
A	8	μ <= total marks < μ+0.50σ
B^+	7	μ-0.50σ <= total marks < μ
B	6	μ-1.00σ <= total marks < μ-0.50σ
C	5	μ-1.25σ <= total marks < μ-1.00σ
P	4	μ-1.50σ <= total marks < μ-1.25σ or ≥40
F	0	total marks <μ-1.50σ or total marks <=39
AB	0	Absent

μ is the mean mark of the class excluding the marks of those students who scored ≥ 90% and ≤ 40% after rounding the percentages to the next highest integer. σ is the standard deviation of the marks.

A student may reappear for semester end examination for betterment only in the theory part of the course for improving the grade, subject to the condition that, the student has passed the course, his/her CGPA is ≤ 6.75 and the grade in the respective course to be equal to or lower than "C". In the case of reappearing for a course, the best of the two grades will be considered.

A Student can re-register in any course in any semester during the program for improvement of grade if the current grade in the course is lower than B^+ and with due approval from Dean Academics in accordance with academic regulations.

A student cannot reappear for semester end examination in courses like Industrial Training, courses with their L-T/ST-P-S Structure like 0-0-X-X, Project, Practice School and Term Paper.

A student is not eligible for award of B.Tech. Degree with Honors, and any Program Degree with distinction, in case s/he takes up the betterment option.

Course Based Detention Policy

In any course, a student must maintain a minimum attendance as per the attendance policy referred to Chapter 9, 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.

CHAPTER 9

PROMOTION

A student admitted to a particular Branch of the B.Tech. Program will normally continue studying in that branch until the completion of the program. However, in special cases the KLEF may permit a student to change from one branch to another after the second semester, provided s/he has fulfilled admission requirement for the branch into which the change is requested.

The rules governing change of branch are as listed below:

- Top 1% (based on CGPA until 2nd semester) students will be permitted to change to any branch of their choice within the program discipline.
- Apart from students mentioned in clause (a) above, those who have successfully completed all the first and second semester courses and with CGPA ≥ 8 are also eligible to apply, but the change of Branch in such case is purely at the discretion of the KLEF.
- All changes of Branch will be effective from third semester. Change of branch shall not be permitted thereafter.
- Change of branch once made will be final and binding on the student. No student will be permitted, under any circumstances, to refuse the change of branch offered.
- Students in clause a and b may be permitted subject to the availability of seats in the desired branch.

Credit transfer between KLEF and other institutions

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.

Credit transfer from another institution to KLEF:

A student studying in another 90 institutions 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.
- To determine the equivalent credits for a course from a previous institution on a 10-point scale at KLEF, the number of credits of the course is multiplied by the equivalent grade point of the previous institution and then divided by the number of credits of the corresponding course at KLEF.

- If a course from the previous institution has zero credits and no grade assigned, the student must sit for the final examination for the same course at KLEF.
- A transfer student seeking improvement in any course can take the final examination at KLEF, where the grade received at KLEF becomes the final grade recorded on their grade sheets.
- The student, when transferred from other institutions, must 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.

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 enrolment 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.

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.

Promotion Policy

To be eligible for provisional promotion for course registration in the next semester, a student must meet the following criterion: the student must promote in the course that serves as a prerequisite for the courses in the following semester.

Note: In case a student is unable to secure minimum P grade for a particular course even after three consecutive attempts, s/he must repeat the course by re-registration.

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 through ERP. 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.

Academic Counselling Board (ACB)

Academic Counselling 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 Counselling Board in the following circumstances:

Has CGPA of less than 6.00.

Has 'F' grade or ‘Detained’ in multiple courses.

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

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

Backlog Courses

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

Rustication

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

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:

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

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

Academic Bank of Credits:

ABC helps the students to digitally store their academic credits from any higher education institute registered under ABC in order to award Certificate/Diploma/Degree/Honors based on the credits earned by the student. All the credits acquired by the students are stored digitally by registering into Academic Bank of Credits (ABC) portal. It also supports retaining the credits for a shelf period and continue their program study with multiple breakovers. Students may exit from their current program

of study due to any unforeseen reasons or to focus on their chosen career path. In such cases, the student may break for a period of time (preferably not in the middle of an academic year) and may continue with the program of study at a later stage. Moreover, students must be able to complete their program by not exceeding the maximum duration of the program. If not, they may be issued with a Certificate, diploma, degree or honors based on the credits acquired over the period of time for all the programs approved by UGC.

CHAPTER 10

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 counsellors provide counselling and serve an educational role in K L University. We have Mentors, Academic, Career, Physiological, Co-Curricular & Extra Curricular activities counsellors to support students who are experiencing personal or academic challenges, help students choose careers and plan for university and intervene when students face behavioural, physical, or mental health challenges.

3. The duties of counsellors:

A. Mentoring:

Plan and design a system for student behaviour, 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 Counselling:

Develop a systematic and process-oriented mechanism to improve academic counselling 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 Counselling:

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 Counselling:

Organize and strengthen the student counselling 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:

Counsellors 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:

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

4. Counselling 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 counsellor/mentor.

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

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

The following are the various aspects of counselling that the counsellors will address during their interaction.

A. Mentoring

1. Counsellor 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 counselling.

5. The counselling 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 Counselling

1. Counsellor shall acquire backlog data 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 data sheet.
3. Counsellors shall counsel the students regularly to track the performance of the students.
4. The counselling 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 Counselling

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 must 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												
Y23 REGULATION, Admitted Batch Category wise Course Structure												
#no	**Course Codes**	**Course Title**	**Name**	**Type**	**Mode**	**L**	**T**	**P**	**S**	**Cr**	**CH**	**PRE-REQUISITES**
1	23UC5201	PROFESSIONAL COMMUNICATION SKILLS	PCS	AUD	R	0	0	4	0	0	4	NIL
2	23TBCA01	TOOL BASED LEARNING	TBL	SDC	R	0	0	0	8	2	8	NIL
3	23CA5101	COMPUTER NETWORKS AND COMMUNICATIONS	CNC	PC	R	3	0	2	0	4	5	NIL
4	23CA5102	DATA STRUCTURES AND ALGORITHMS	DSA	PC	R	3	0	2	4	5	9	NIL
5	23CA5103	OPERATING SYSTEMS	OS	PC	R	3	1	0	0	4	4	NIL
6	23CA5104	DATABASE SYSTEMS	DBS	PC	R	3	0	2	4	5	9	NIL
7	23CA5205	OBJECT ORIENTED PROGRAMMING	OOP	PC	R	3	0	2	4	5	9	NIL
8	23CA5206	DATA ANALYTICS	DA	PC	R	3	0	2	0	4	5	NIL
9	23CA5207	COMPREHENSIVE SOFTWARE ENGINEERING	CSE	PC	R	2	1	0	0	3	3	NIL
10	23CA6108	WEB TECHNOLOGIES	WT	PC	R	3	0	2	4	5	9	NIL
11	23IE5201	ESSENTIALS OF RESEARCH DESIGN	ERD	PC	R	1	1	0	0	2	2	NIL
12	PE1	Professional Elective 1		PE	R	3	0	2	4	5	9	NIL
13	PE2	Professional Elective 2		PE	R	3	0	0	0	3	3	NIL
14	PE3	Professional Elective 3		PE	R	3	0	2	4	5	9	NIL
15	PE4	Professional Elective 4		PE	R	3	0	0	0	3	3	NIL
16	PE5	Professional Elective 5		PE	R	3	0	2	0	4	5	NIL
17	OE1	Open Elective 1		OE	R	3	0	0	0	3	3	NIL

18	OE2	Open Elective 2		OE	R	3	0	0	0	3	3	NIL
19	23CA61E1	INTERNSHIP1	MIP	PR	R	0	0	6	0	3	6	NIL
20	23CA62E2	MAJOR PROJECT/INTERNSHIP2	MAP	PR	R	0	0	24	0	12	24	NIL
Total Credits						45	3	52	32	80	132	

List of Professional Electives for 2023-24 admitted batch of MCA										
Sl No	**Course Code**	**Course Title**	**Specialization**	**L**	**T**	**P**	**S**	**Cr**	**CH**	**Pre-requisite**
1	23CA52A1	APPLIED MACHINE LEARNING	**ARTIFICIAL INTELLIGENCE**	**3**	**0**	**2**	**4**	**5**	**9**	MCS
2	23CA52A2	PATTERN RECOGNITION		**3**	**0**	**0**	**0**	**3**	**3**	PE1
3	23CA61A3	COMPUTER VISION		**3**	**0**	**2**	**4**	**5**	**9**	PE1
4	23CA61A4	APPLIED DEEP LEARNING		**3**	**0**	**0**	**0**	**3**	**3**	PE1
5	23CA61A5	NATURAL LANGUAGE PROCESSING		**3**	**0**	**2**	**0**	**4**	**5**	PE1
6	23CA52A1	APPLIED MACHINE LEARNING	**DATA SCIENCE**	**3**	**0**	**2**	**4**	**5**	**9**	MCS
7	23CA52D2	HADOOP AND BIGDATA		**3**	**0**	**0**	**0**	**3**	**3**	PE1
8	23CA61D3	DATA VISUALISATION TECHNIQUES		**3**	**0**	**2**	**4**	**5**	**9**	PE1
9	23CA61D4	STATISTICS FOR DATA SCIENCE		**3**	**0**	**0**	**0**	**3**	**3**	PE1
10	23CA61D5	GRAPH & WEB ANALYTICS		**3**	**0**	**2**	**0**	**4**	**5**	PE1
11	23CA52C1	CLOUD COMPUTING	**CLOUD TECHNOLOGY**	**3**	**0**	**2**	**4**	**5**	**9**	NIL
12	23CA52C2	CLOUD INFORMATION SECURITY		**3**	**0**	**0**	**0**	**3**	**3**	PE1
13	23CA61C3	CLOUD ARCHITECTURES		**3**	**0**	**2**	**4**	**5**	**9**	PE1

14	23CA61C4	CLOUD SERVERLESS COMPUTING		**3**	**0**	**0**	**0**	**3**	**3**	PE1
15	23CA61C5	CLOUD WEB SERVICES		**3**	**0**	**2**	**0**	**4**	**5**	PE1
16	23CA52S1	CYBER SECURITY AND ETHICAL HACKING	**CYBERSECURITY**	**3**	**0**	**2**	**4**	**5**	**9**	NIL
17	23CA52S2	CYBER FORENSICS		**3**	**0**	**0**	**0**	**3**	**3**	PE1
18	23CA61S3	MALWARE ANALYSIS		**3**	**0**	**2**	**4**	**5**	**9**	PE1
19	23CA61S4	SECURITY GOVERNANCE AND MANAGEMENT		**3**	**0**	**0**	**0**	**3**	**3**	PE1
20	23CA61S5	CLOUD SECURITY		**3**	**0**	**2**	**0**	**4**	**5**	PE1

CHAPTER 12

ARTICULATION MATRIX

Program Articulation Matrix:

SL NO	COURSE CODE	COURSE TITLE	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	23CA5101	COMPUTER NETWORKS AND COMMUNICATIONS		2	2	3			
2	23CA5102	DATA STRUCTURES AND ALGORITHMS	2	2		3	3	3	
3	23IE5201	ESSESTIALS OF RESEARCH DESIGN		2	3	3	3		
4	23CA5104	OPERATING SYSTEMS	2	2	3	3			
5	23CA5105	DATABASE SYSTEMS	2	2	3		3		
6	23CA5206	OBJECT ORIENTED PROGRAMMING	2		3		3		
7	23CA5207	DATA ANALYTICS	2	2	3	3			
8	23CA5208	COMPREHENSIVE SOFTWARE ENGINEERING	2	3	3				3
					3	3			
			2	2	2	3	3		
9	22CA6109	WEB TECHNOLOGIES	3	3			3		
10	23UC5201	PROFESSIONAL COMMUNICATION SKILLS					2		
							2		
11	23CA52A1	APPLIED MACHINE LEARNING	2	3	3	3	3		
12	23CA52A2	PATTERN RECOGNITION		2	3				
13	23CA61A3	COMPUTER VISION	2	3	2		3	3	
14	23CA61A4	APPLIED DEEP LEARNING	2	3	3				
15	23CA61A5	APPLICATIONS OF NATURAL LANGUAGE PROCESSING	2	2	3		3		
16	23CA52D2	HADOOP AND BIGDATA	2	2	3		3		

17	23CA61D3	DATA VISUALISATION TECHNIQUES	2	3		3	3	3	
18	23CA61D4	STATISTICS FOR DATA SCIENCE	2	3	3				
19	23CA61D5	GRAPH & WEB ANALYTICS	2	3		3	3		
20	23CA52C1	CLOUD COMPUTING	2	3	3	3	3	3	
21	23CA52C2	CLOUD INFORMATION SECURITY	2	2	3				
22	23CA61C3	CLOUD ARCHITECTURES	2	3	3		3	3	
23	23CA61C4	CLOUD SERVERLESS COMPUTING	2	3		3			
24	23CA61C5	CLOUD WEB SERVICES	2	3	3				
25	23CA52S1	CYBER SECURITY AND ETHICAL HACKING	2		2	3	3		
26	23CA52S2	CYBER FORENSICS	2	3	3	3			
27	23CA61S3	MALWARE ANALYSIS	2	2	3	3	3	3	
28	23CA61S4	SECURITY GOVERNANCE AND MANAGEMENT		2	3	3			
29	23CA61S5	CLOUD SECURITY	2	2	3		3		

Course Articulation Matrix:

SL NO	COURSE CODE	COURSE TITLE	CO. No.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	23CA5101	COMPUTER NETWORKS AND COMMUNICATIONS	1	Demonstrate how to establish a connection among various devices. Explain the different networking concepts and devices that are used today for establishing connectivity.		2					
			2	Outline the functionalities of different network protocols			2				
			3	Explain different WAN technologies, topologies and other basic networking concepts.			3				

			4	Show how to troubleshoot a network.				3				
			5	Evaluate the programs and should be implemented, implementing protocols and routing algorithms.				3				
2	23CA5102	DATA STRUCTURES AND ALGORITHMS	1	Outline basic data structures such as arrays, pointers	1							
			2	Demonstrate the basic structure such as stacks and queues.		2						
			3	Solve problem involving trees and Linked List		2		3				
			4	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	2			3				
			5	Evaluate applications using control structures for linear and non-linear data structures						3		
			6	Asses the data structure for its functions based on performance metrics.					3			
3	23IE5201	ESSESTIALS OF RESEARCH DESIGN	1	Illustrate Research objects, steps involved in research and articulate appropriate Research Questions		2						
			2	Perform Literature Review in a Scholarly style and apply appropriate methods for Data collection		2	3					
			3	Represent the data in tabular/Graphical form and prepare data for analysis				3				
			4	Perform statistical modelling and analysis to optimize the data, prepare the data for publishing.			2		3			
4	23CA5104	OPERATING SYSTEMS	1	Explain overview of Operating System and basic Operating systems	2							
			2	Discover Process state and scheduling with different algorithms	2	2	3	3				
			3	Apply Process Synchronization and Dead lock prevention and avoidance.	2	3	3					
			4	Organize various paging concepts and it's algorithms	2	3	3					
5	23CA5105	DATABASE SYSTEMS	1	Illustrate the functional components of DBMS and Design an ER Model for a database.	2	2	3					
			2	Design a relational model for a database & Implement SQL concepts and relational algebra.	2	2	3					
			3	Implement PL/SQL programs, normalization techniques, indexing to construct and access database	2		3					
			4	Analyse the importance of transaction Processing, concurrency control and recovery techniques.	2		3					
			5	Choose the MangoDB to perform CURD, Indexing, Aggregation, Replication, Sharding, Performance analysis for distributed Databases	2		3		3			
			6	Choose a MongoDB and implement SQL queries and PL/SQL programs to do various operations on data.	2		3		3			
6		OBJECT ORIENT	1	Understand Principles of OOP and Inheritance	2		3					

	23CA5206	ED PROGRAMMING	2	Design and Implement interfaces, Packages and Enumeration, Exceptions & Assertions		2			3		
			3	Analyse Multi-Threading and Applets			2		3		
			4	Apply Event Handling and Abstract Window Toolkit		2			3		
			5	solve varies problem using oops techniques	2	2			3		
			6	Create awt and swing packages			3				
7	23CA5207	DATA ANALYTICS	1	Summarize the importance and environment of R Programming	2	2					
			2	Experiment with basic control and functions in R		2	3				
			3	Examine the function of data structures in R		2	3				
			4	Inference data analysis pattern suing Statistics and Data visualization		3		3			
			5	Experiment with pattern detection and data analytics function with data set		3			3		
			6	Examine statistical, data structures and data frame manipulation		3			3		
8	23CA5208	COMPREHENSIVE SOFTWARE ENGINEERING	1	Demonstrate the requirement of software development for various applications.	2	3					
			2	Explain how to reduce the complexity to transition from one phase in software development to another.		2	3				3
			3	Summarize different testing concepts			3	3			
			4	Develop and manage a software development project	2	2	2	3	3		
9	22CA6109	WEB TECHNOLOGIES	1	illustrate the basic concepts of HTML and CSS & apply those concepts to design static web pages	3						
			2	Identify and understand various concepts related to dynamic web pages and validate them using JavaScript	3						
			3	Apply the concepts of Extensible markup language		3					
			4	Examine web Applications using Scripting Languages & Frameworks	3						
			5	Create and deploy secure, usable database driven web applications using PHP					3		
			6	Design Dynamic Web Pages by using HTML, CSS, JS, PHP					3		
10	23UC5201	PROFESSIONAL COMMUNICATION SKILLS	1	To develop and demonstrate principles of listening, speaking, reading and writing in various functional contexts					2		
			2	To demonstrate different types of personal and professional skills and apply them for growth in professional zone.					2		

			3	Apply the concepts of Mathematical Principles to solve problems on Arithmetic , Algebra & Geometry to improve problem solving ability.					2		
			4	Apply the concepts and using Logical thinking to solve problems on verbal & Non-Verbal Reasoning to develop Logical thinking skills.					2		
11	23CA52A1	APPLIED MACHINE LEARNING	1	Demonstrate the types of machine learning model representation and Supervised Learning-Simple Linear Regression Analysis	2	3	3				
			2	Implementing Multiple Regression model for supervised learning	2	3	3				
			3	Experimenting Multiple Linear Regression model			2	3	3		
			4	Estimating various Regression coefficient			2	3			3
			5	Evaluate applications using linear regression techniques				3	3		3
			6	Developing Solutions for the real-wrold problems using Python programming.				3	3		3
12	23CA52A2	PATTERN RECOGNITION	1	Understand basic concepts in pattern recognition.		2					
			2	Understanding Generative Learning Models.		2	3				
			3	Understand Structured pattern recognition and Neural pattern recognition.		3					
			4	Apply pattern recognition techniques in practical problems.		3					
13	23CA61A3	COMPUTER VISION	1	Illustrate the need for image transformations and modeling, different types of image transformation, and their properties.	2	3					
			2	Apply the techniques and transformation methods for image enhancement and image restoration.			2		3		
			3	Demonstrate image processing algorithms to perform feature detection, matching, segmentation and recognition.				3	3		
			4	Apply and analyse NN, ML, and DL algorithms for image transformation, pose consistency, and segmentation.		2	3		3		
			5	Analysis and study of image processing and machine learning algorithm for computer vision					3		
			6	Evaluate and apply the algorithms used in computer vision						3	
14	23CA61A4	APPLIED DEEP LEARNING	1	Explain the concepts of Perception, Back Propagation, PCA, Singular Value Decomposition	2						
			2	Compare Autoencoders, Regularization, Denoising, Convolutional Neural Networks,		3					

			3	Construct Long Short Term Memory (LSTM) Restricted Boltzmann Machines, Deep Dream, GRU, Neural style transfer,			3				
			4	Build Markov models, Markov networks, Markov chains, Variational autoencoders, Autoregressive Models, and Generative Adversarial Networks (GANs).		3					
15	23CA61A5	APPLICATIONS OF NATURAL LANGUAGE PROCESSING	1	Summarizing the significance, Challenges and Applications of NLP	2						
			2	Experimenting tokenization and preprocessing raw text		2	3				
			3	Discriminating word Embedding Techniques		2					
			4	Categorizing various classification methods in NLP			3		3		
			5	Assessing Different Preprocessing and Prediction Techniques in NLP					3		
16	23CA52D2	HADOOP AND BIGDATA	1	understand the basic concept of Big Data, different types of Data	2						
			2	understand architecture of Hadoop and YARz			3				
			3	Outline Processing and Storage Layer of Hadoop, internal concept of MapReduce		2	3		3		
			4	Demonstrate the concept of Master and Slave Architecture				3	3		
17	23CA61D3	DATA VISUALISATION TECHNIQUES	1	Understand the need of visualization techniques	2						
			2	Explain Static Graphical Techniques		3					
			3	Apply Multivariate Graphical Techniques				3	3		
			4	Model the concept of Graphical Validation and customization		2		3	3		
			5	Evaluate programs on data visualization using Tableau or JupyteR tool				3	3		
			6	Evaluate the visualization techniques using tools					3	3	
18	23CA61D4	STATISTICS FOR DATA SCIENCE	1	Explain the basic concepts of statistics and explains the various methods of descriptive data collection and analysis	2						
			2	Show the probability distribution of a random variable, based on real-world situation, and use it to compute expectation and variance			3				
			3	Construct the linear and non-linear regression lines for the given data.	3						
			4	Apply basic concepts of statistics and explains the various methods of descriptive data collection and analysis		3					
19		GRAPH & WEB	1	Understand the impact of big data on graphs ,Network Basics and Social Networks	2			3			

	23CA61D5	ANALYTICS	2	Make use of Web Analytics:- Data sources, tools, Web traffic data	2	3					
			3	Analysing Web Analytics Strategy- website traffic analysis, audience identification and segmentation analysis, Emerging Analytics	2	3					
			4	Compare Email Testing Analysis, competitive Intelligence Analysis and Social ,Mobile, Video Analysis	2	2			3		
			5	Python for graph and web analytics					3		
20	23CA52C1	CLOUD COMPUTING	1	Employing and relate the features of Scalable Computing and System models for Distributed and Cloud Environment	2	3					
			2	Operating and Applying Implementation levels of Virtualization mechanisms in Distributed and Cloud Environment			3		3		
			3	Choosing and Sketch out Estimate Service models and Architectural Design for Resource management in Distributed and Cloud Environment		3		3			
			4	Interpreting and demonstrating Ubiquitous feature in Cloud environment and Cloud Software Programming Environments		3	3				
			5	Evaluate the Formulations and Design the Workload balancing in between resources and Virtualization of resource usage in Distributed Cloud Environment		3			3		
			6	Evaluate virtualization, estimate service models and demonstrate cloud environments.						3	
21	23CA52C2	CLOUD INFORMATION SECURITY	1	Explain the basic concepts of cloud computing, virtualization, and the importance of Information Security in the Cloud Context	2	2					
			2	Discuss various vulnerabilities, controls, and protocols in the cloud	2		2				
			3	Classify the cloud vulnerabilities and threats	2		3				
			4	Outline how cloud and Security works in a seamless model	2		3				
22	23CA61C3	CLOUD ARCHITECTURES	1	Classify cloud computing importance and services	2						
			2	Relate cloud services & models.	2	3					
			3	Explain Virtualization and its applications.			3				
			4	Apply cloud services using web services Cloud to utilize cloud resources.			3				
			5	Measure various cloud services using web services Cloud for building and deploying applications.					3		

			6	Evaluate the cloud services and its applications						3	
23	23CA61C4	CLOUD SERVERLESS COMPUTING	1	Understand the concepts of Cloud Serverless Computing	2	3		3			
			2	Organize the Serverless cloud Architecture	2	3		3			
			3	Experiment with the appropriate methodologies of testing and debugging serverless functions	2	3		3			
			4	Implement knowledge representation using Event-driven Programming in Serverless Architectures	2	3		3			
24	23CA61C5	CLOUD WEB SERVICES	1	Summarize the model of Cloud Computing As A Service	2	3	3				
			2	Illustrate the Networking Basics required for cloud services	2	3	3				
			3	Demonstrate the Control of workflow in cloud services	2		3				
			4	Explain the method of fault tolerance in cloud	2		3				
25	23CA52S1	CYBER SECURITY AND ETHICAL HACKING	1	Understand the need for cyber security	2						
			2	Analyse various types of security threats and electronic payment systems			2	3			
			3	Analyse the security issues involved in developing secure information systems			2	3			
			4	Compare different ethical hacking methods			2	3			
			5	Analyse various cyber security threats				3	3		
			6	Compare different ethical hacking methods and tools				3	3		
26	23CA52S2	CYBER FORENSICS	1	Understand Forensic Science and Recovery methods	2	3					
			2	Analyse Digital Evidence, Network Forensics and Mobile Device Forensics		2	3				
			3	Analyse Web Forensics and Email Forensics		2	3	3			
			4	Analyse the security policies, standards and cyber laws			3	3			
27	23CA61S3	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		3	3			
			4	Analyse the Exception handling in malware analysis				3	3		

			5	Analyse the Exception handling in malware analysis					3		
			6	Practising with malware analysis tools						3	
28	23CA61S4	SECURITY GOVERNANCE AND MANAGEMENT	1	To develop knowledge of e-governance and e-government		2					
			2	To know different e-governance models and infrastructure development		2	3				
			3	To implement security in e-governance		2	3				
			4	To use data warehousing and mining in e-governance			2	3			
29	23CA61S5	CLOUD SECURITY	1	Understand the principles of cryptography and Apply various cryptographic algorithms	2						
			2	Analyse various security issues and system vulnerabilities in virtualization		2	3				
			3	Analyse the technologies for virtualization based security enhancements		2	3				
			4	Analyse legal and Compliance issues and examine modern security standards			3				
			5	Develop and implement various algorithms for encryption and decryption algorithms i.e., AES, MD5 and RSA algorithms			2		3		

CHAPTER 13
SYLLABUS

PROFESSIONAL COMMUNICATION SKILLS (PCS)

COURSE CODE	23UC5201	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	To develop and demonstrate principles of listening, speaking, reading and writing in various functional contexts	3	PO 5
CO2	To demonstrate different types of personal and professional skills and apply them for growth in professional zone.	3	PO 5
CO3	Apply the concepts of Mathematical Principles to solve problems on Arithmetic , Algebra & Geometry to improve problem solving ability.	3	PO5
CO4	Apply the concepts and using Logical thinking to solve problems on verbal & Non-Verbal Reasoning to develop Logical thinking skills.	3	PO5

Syllabus:

Module 1	A)Vocabulary: Synonyms, Antonyms and One-word substitutes, (B)Reading comprehension, Critical reading, (C) Writing skills: Email writing, report writing and paragraph writing (D) Listening/Speaking Skills: listen & speak, Functional grammar
Module 2	(A) Personal Skills: Intra & Interpersonal skills (B) Assertiveness (C) Group Discussion (D) Resume writing (E) Video resumes (F) Interview skills
Module 3	Simple Equations, Ratio & Partnership, Averages, Percentages, Profit & Loss, Simple & Compound Interest, Numbers, Quadratic Equations & Inequalities, Time & Work, Time, Speed & Distance, Permutations & Combinations, Probability, Mensuration, Data Interpretation.
Module 4	Syllogism, Logical Venn Diagrams, Cubes & Dice, Number& letter series, Number, letter & word Analogy, Odd Man Out, Coding & Decoding, Blood Relations, Directions, clocks, calendars, Number, ranking & Time sequence test, Seating Arrangements, Data Sufficiency.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The Business Student's Handbook: Skills for Study and Employment	Fisher, Julie and Bailey, Peter	Cengage Learning	2017
2	The Complete Guide to mastering soft skills for workplace success	Adams, John	Adams media	2019
3	Writing Tools: 55 Essential Strategies for Every Writer	Roy Peter Clark	Little, Brown and Company	2006
4	Quantitative Aptitude	R. S. Agarwal	SCHAND	
5	A Modern Approach to Verbal Reasoning	R. S. Agarwal	SCHAND	

COMPUTER NETWORKS AND COMMUNICATIONS(CNC)

COURSE CODE	23CA5101	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Understand the fundamentals of computer networks and data communication	2	PO1
CO2	Choose the issues in Data Link Layer, IEEE Standards in networks	3	PO2
CO3	Analyse Internet Transport Protocols and different types of protocols	4	PO2
CO4	Examine various types of Network Devices and different types of Networks	4	PO3
CO5	Develop networking solutions using Routing Algorithms	5	PO5

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	Computer Networks	Andrews S Tanenbaum	5th Edition	2010
2	Data Communications and Networking	Behrouz A Forouzan	2nd Edition	2017
3	Computer Networks	Mayank Dave		2012
4	Computer Networks, A System Approach	Larry L Peterson and Bruce S Davie	5th Edition	2011
5	An Engineering Approach to Computer Networks	S.Keshav	2nd Edition	2002
6	Understanding Communications and Networks	W.A. Shay, Thomson	3rd Edition	2004

DATA STRUCTURES AND ALGORITHMS (DSA)

COURSE CODE	22CA5102	MODE	Regular	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Outline basic data structures such as arrays, pointers	2	PO1
CO2	Demonstrate the basic structure such as stacks and queues.	2	PO2
CO3	Solve problem involving trees and Linked List	3	PO2,PO4
CO4	Apply Algorithm for solving problems like sorting,searching, insertion and deletion of data	3	PO1,PO4
CO5	Evaluate applications using control structures for linearand non-linear data structures	5	PO6
C06	Asses the data structure for its functions based on perfromance metrics.	5	PO2,PO3

Syllabus:

Module 1	Introduction to Data Structures: Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion. Arrays, Pointers and Strings: Introduction to Arrays, Definition, One Dimensional Array and Multidimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings."
Module 2	Stacks and Queue :Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack Queues, Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and Priority Queue"
Module 3	Linked Lists and Trees: Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List. Trees: Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree, B Tree, B+ Tree"
Module 4	Graphs: Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms. Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique(CRT), Perfect Hashing"

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data structures	Tata McGraw-Hill	McGraw Hill Education	2014
2	Data Structures	E. Balagurusamy	McGraw Hill Education	2017
3	Algorithms II	Robert Sedgewick and Kevin Wayne	Pearson Education	2014
4	Design and Analysis of Algorithms	S.Sridhar	Oxford Unioversity Press	2014
5	Introduction to Algorithms	Thomas H.Cormen,Charles E.Leiserson	Prentice-Hall	1989

OPERATING SYSTEMS (OS)

COURSE CODE	23CA5103	MODE	R	LTPS	3-1-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO.No	Course Outcome	BTL	PO
CO1	Explain the concepts of Operating System and Process Management	2	PO1
CO2	Describe Process Synchronization and Deadlocks mechanisms	2	PO1
CO3	Illustrate the concept of Memory Management, File System Implementation, Mass-storage structure	3	PO2
CO4	Apply Protection and Case Study of LINUX and Windows	3	PO2

Syllabus:

Module 1	Operating System Functionalities, Types of Operating Systems, Computer Architecture support to Operating Systems, Process Virtualization: Processes, Process API code, Direct Execution
Module 2	CPU Scheduling, Multi-level Feedback, Lottery Scheduling code, Multiprocessor Scheduling Concurrency: Concurrency and Threads code, Thread API, Common concurrency problems, Dead Locks, Locked Data Structures, Condition Variables, Semaphores, Event-based Concurrency
Module 3	Memory Virtualization: Address Spaces, Memory API, Address Translation, Segmentation, Free Space Management, Introduction to Paging, Translation Look aside Buffers, Advanced Page Tables, Swapping: Mechanisms, Swapping: Policies.
Module 4	Persistence: I/O Devices, Hard Disk Drives, Redundant Disk Arrays (RAID), Files and Directories, File System Implementation, Distributed systems, Data Integrity and Protection.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Modern Operating Systems	Andrew S. Tanenbaum, Herbert Bos	Pearson Education	2014
2	Operating Systems: Internals and Design Principles	William Stallings	Pearson Education	2017
3	Linux Kernel Development	Robert Love	Addison-Wesley Professiona	2010
4	Windows Internals	Mark Russinovich, David A. Solomon, Alex Ionescu	Microsoft Press	2012

DATABASE SYSTEMS(DBS)

COURSE CODE	23CA5104	MODE	R	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the functional components of DBMS and Design an ER Model for a database.	2	PO1,PO2,PO3
CO2	Design a relational model for a database & Implement SQL concepts and relational algebra.	3	PO1,PO2,PO3
CO3	Implement PL/SQL programs, normalization techniques, indexing to construct and access database	4	PO1,PO3
CO4	Analyse the importance of transaction Processing, concurrency control and recovery techniques.	4	PO1,PO3
CO5	Choose the MangoDB to perform CURD, Indexing, Aggregation, Replication, Sharding, Performance analysis for distributed Databases	5	PO1,PO3, PO5
CO6	Choose a MongoDB and implement SQL queries and PL/SQL programs to do various operations on data.	5	PO1,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 Modelling : 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	2009
2	Fundamentals of Database Systems	RamezElmasri, University of Texas at Arlington, Shamkant B. Navathe, University of Texas at Arlington.	Pearson	2010
3	An Introduction to Database Systems	Bipin C. Desai	Galgotia Publications Pvt Ltd	2010
4	Principles of Database Systems	Jeffrey D. Ullman	Galgotia Publications	1980
5	Database Management Systems	Raghu RamaKrishnan, Johannes Gehrke	Tata McGraw Hill, 2014.	1996

OBJECT ORIENTED PROGRAMMING(OOP)

COURSE CODE	23CA5205	MODE	R	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Understand Principles of OOP and Inheritance	2	PO1,PO3,PSO1
CO2	Design and Implement interfaces, Packages and Enumeration, Exceptions & Assertions	3	PO2,PO5,PSO2,
CO3	Analyse Multi-Threading and Applets	4	PO3,PO5,PSO2
CO4	Apply Event Handling and Abstract Window Toolkit	4	PO2,PO5,PSO2
CO5	solve varies problem using oops techniques	5	PO1,PO2,PO5,PSO2
CO6	Create awt and swing packages	5	PO3,PO9,PSO1

Syllabus:

Module 1	Introduction, Principles of Object Oriented Languages, Applications of OOP, Programming Constructs: Variables, Primitive Data types, Identifiers -Naming Conventions, Keywords, Literals, Operators -Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control -Branching, Conditional, loops. Classes and Objects - classes, Objects, Creating Objects, Methods, constructors - Constructor overloading, cleaning up unused objects -Garbage collector, Class variable and Methods -Static keyword, this keyword, Arrays, Command line arguments
Module 2	Inheritance : Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class. Interfaces, Packages and Enumeration: Interface -Extending interface, Interface Vs Abstract classes, Packages - Creating packages, using Packages, Access protection, java.lang package. Exceptions & Assertions – Introduction, Exception handling techniques -try… catch, throw, throws , finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions
Module 3	Multi Threading: java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading - Using isAlive () and join (), Synchronization , suspending and Resuming threads, Communication between Threads Input/Output: reading and writing data, java.io package, Applets –Applet class, Applet structure, An Example Applet Program, Applet : Life Cycle, paint(), update() and repaint().
Module 4	Event Handling: Introduction, Event Delegation Model, java.awt.event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes. Abstract Window Toolkit :Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Ra dio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar, Swing : Introduction, JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box Pluggable Look and Feel.

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:	Dream tech	2008 edition
5	Java in a Nutshell"	Benjamin	O'Reilly Media	7th edition

DATA ANALYTICS(DA)

COURSE CODE	21CA5206	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Summarize the importance and environment of R Programming	2	PO1,PO2
CO2	Experiment with basic control and functions in R	3	PO2,PO3
CO3	Examine the function of datastructures in R	4	PO2,PO3
CO4	Inference data analysis pattern suing Statistics and Data visualization	4	PO2, PO4
CO5	Experiment with pattern detection and data analytics function with data set	4	PO2,PO5
CO6	Examine statistical, data structures and data frame manipulation	4	PO2,PO5

Syllabus:

Module 1	Introduction to Data Analytics: What are Data Analytics? – Why Data Analytics? , Data basics: Quantitative data : Nominal data, Ordinal data. What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Important commands to get started: installed. package (), package Description (), help(), find. package (), library () - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits
Module 2	R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Variables: Variable assignment, Data types of Variable, Finding Variable, Deleting Variables. R- Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - R Decision Making: if statement, if – else statement, if– else if statement, switch statement – R Loops: repeat loop, while loop, for loop – Loop control statement: break statement, next statement. R-Function: function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, R-Strings – Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower().
Module 3	R Vectors – Sequence vector, rep function, vector access, vector names, vector math, R List -Creating a List, Add/Delete Element to or from a List, Size of List, Merging Lists, Matrix Computations: Addition, subtraction, Multiplication and Division- R Arrays: Accessing Array Elements, Calculation Across Array Elements - R Factors –creating factors, generating factor levels. Basics in Statistics: Descriptive and Inferential, Sample and Population. Data Frames –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge(),

Module 4	Descriptive Statistics: Data Causation, Spotting Problems in Data with Visualization: visually Checking distributions for a single Variable - R –Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – Bar Charts: Bar Chart Labels, Title and Colors. Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir() - R-CSV Files - Input as a CSV file, Reading a CSV File, Analysing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File –R -Excel File – Reading the Excel file. Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode – Summation, Variance, Standard Deviation, Analysing a sample, The Normal Distribution, Skewness, Central Limit Theorem, Outlier. Correlation and

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	R Programming for Beginners	Sandip Rakshit	Mcgraw hill Education	2017
2	Data Analytics using R	Seema Acharya	McGrawHill Education	2018
3	R for Dummies	Andrie de Vries, JorisMeys	John Wiley and Sons	2015

COMPREHENSIVE SOFTWARE ENGINEERING(SE)

COURSE CODE	23CA5207	MODE	R	LTPS	2-1-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Understand Fundamentals Object Oriented Software Engineering	2	PO1
CO2	Design UML diagrams for Echo Systems	3	PO4
CO3	Design and apply software architectures	3	PO3
CO4	Analyse software testing and software process models	3	PO3

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, SDLC, 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.
Module 3	Reverse Engineering, Agile Development, Agile manifesto and principles, Extreme programming, Scrum, Feature Driven Development (FDD), Lean Software Development (LSD), Requirements Engineering, Requirements classification, Requirements modeling approaches, SRS and User Stories, Analysis to Design, Coupling and Cohesion, Refactoring Design Concepts, Design Principles, Software architecture, architectural styles, Use cases, Classes, Relationships, common Mechanisms and their diagrams. Interfaces, Modeling techniques for Class & Object Diagrams.
Module 4	Behavioral Modeling : Interaction diagrams. Activity Diagrams. Software testing & reliability, A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Testing methods, The Human and The Computer, Golden Rules, user interface analysis and design, interface analysis, interface design steps. Software Process Improvement, Software Quality Assurance: Six Sigma & the CMMI.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Object Oriented Software Engineering: Practical Software Development using UML and Java.	Timothy C Lethbridge & Robert, Langaneire,	Mc Graw Hill	
2	The Unified Modeling Language User Guide	Grady Booch, James Rumbaugh and Ivar Jacobson	Addison-Wesley	
3	Software Engineering; A Practitioner's Approach	Roger SPressman		
4	Object-Oriented Software Engineering: Using UML, Patterns and Java	Bernd Bruegge and Allen H. Dutoit	2nd Edition, Pearson Education	

WEB TECHNOLOGIES (WT)

COURSE CODE	23CA6108	MODE	R	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	illustrate the basic concepts of HTML and CSS & apply those concepts to design static web pages	2	PO1
CO2	Identify and understand various concepts related to dynamic web pages and validate them using JavaScript	2	PO1
CO3	Apply the concepts of Extensible markup language	3	PO2
CO4	Examine web Applications using Scripting Languages & Frameworks	4	PO1
CO5	Create and deploy secure, usable database driven web applications using PHP	5	PO5
CO6	Design Dynamic Web Pages by using HTML, CSS, JS, PHP	5	PO5

Syllabus:

Module 1	Introduction to Web Technology: HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, I frames Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5 Dynamic HTML. CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution, CSS3.
Module 2	Introduction to JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions, Fundamentals of Angular JS and NODE JS Introduction to XML: Syntax of XML, Document Structure, Document type definition, Namespaces, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.
Module 3	Introduction to PHP: Overview of PHP, general server characteristics, Creating PHP Pages, Form handling, Data Base access with PHP & MySQL. Web Servers- IIS (XAMPP, LAMP) and Tomcat Servers.
Module 4	Java Web Technologies-Introduction to Servlet, Life cycle of Servlet, Servlet methods, Java Server Pages. Database connectivity – Servlets, JSP, PHP, Practice of SQL Queries. Web development frameworks – Introduction to Ruby, Ruby Scripting, Ruby on rails –Design, Implementation and Maintenance aspects.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Programming the World Wide Web 7th Edition	Robet W Sebesta	Pearson	2013
2	Web Technologies, 1st Edition 7th impression	Uttam K Roy	Oxford	2012
3	Java Script & jQuery the missing manual, 3rd Edition	David sawyer McFarland	O'Reilly	2014
4	Web Hosting for Dummies, 1st Edition	Peter Pollock	John Wiley & Sons	2013
5	RESTful web services, 1st Edition	Leonard Richardson, Ruby	O'Reilly	2007

ESSENTIALS OF RESEARCH DESIGN (ERD)

COURSE CODE	23IE5201	MODE		LTPS	1-1-0-0	PRE-REQUISITE	Nil

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate Research objects, steps involved in research and articulate appropriate Research Questions	3	PO1
CO2	Perform Literature Review in a Scholarly style and apply appropriate methods for Data collection	3	PO2
CO3	Represent the data in tabular/Graphical form and prepare data for analysis	3	PO2
CO4	Perform statistical modelling and analysis to optimize the data, prepare the data for publishing.	4	PO2

Syllabus:

Module 1	Definition and objectives of Research-Types of research, Various Steps in Research process, Applied Mathematical tools for analysis, developing a research question- Choice of a problem, Literature review, Surveying, Synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.
Module 2	Literature Review (LR)-Meaning and its Types-Narrative and Systematic, LR using Web of Science, Google and Google Scholar, Citations-Types, referencing in academic writing, Citation vs Referencing Vs Bibliography, Citation tools- Zotero, Qualitative Research and its methods, Quantitative Research, and its Methods. Data Collection-Primary data collection using Questionnaire, Google forms, survey monkey, Testing the validity and Reliability of Questionnaire using Factor Analysis and Cronbach's Alpha respectively, Secondary data-sources.
Module 3	Diagrammatic and graphical presentation of data: Diagrams and Graphs of frequency data of one variable- histogram, barcharts-simple, sub-divided and multiple; line charts, Diagrams and Graphs of frequency data of two variables -scatter plot, preparing data for analysis. Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Error Analysis.
Module 4	Analyzing data using one-dimensional statistics, two-dimensional statistics and multidimensional statistics. Technical Writing and Publishing, Conference presentations, Poster Presentations, Plagiarism-check and tools, Self-Plagiarism. Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, Design Thinking for Contextualized Problem-Solving and Empathetic Research

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Research Methods for Engineers	C.R. Kothari		
2	Engineering Research Methodology	y Krishnan Nallaperumal		
3	Engineering Research Methodology -A Practical Insight for Researchers	Dipankar Deb and Balas		

APPLIED MACHINE LEARNING(ML)

COURSE CODE	23CA52A1	MODE	R	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Demonstrate the types of machine learning model representation and Supervised Learning- Simple Linear Regression Analysis	2	PO1,PO2,PO3
CO2	Implementing Multiple Regression model for supervised learning	3	PO1,PO2,PO3
CO3	Experimenting Multiple Linear Regression model	3	PO3,PO4,PO5
CO4	Estimating various Regression coefficient	4	PO3,PO4,PO7
CO5	Evaluate applications using linear regression techniques	5	PO4,PO5,PO7
CO6	Developing Solutions for the real-wrold problems using Python programming.	5	PO4,PO5,PO7

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. 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
Module 2	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, Geometrical Interpretation of Least Squares, Properties of the Least -Squares Estimators, Estimation of σ2, Inadequacy of Scatter Diagrams in Multiple Regression
Module 3	Supervised Learning –Multiple Linear Regression Analysis II : testing the general linear hypothesis, Test for Significance of Regression, Tests on Individual Regression Coefficients and Subsets of Coefficients, Special Case of Orthogonal Columns in X, Confidence Intervals on the Regression Coefficients, CI Estimation of the Mean Response, Simultaneous Confidence Intervals on Regression Coefficients, predicting new observations, residual analysis, model adequacy and validation.
Module 4	Supervised Learning –Non Linear Regression Analysis Introduction to non-linear regression models, non-linear least square method to estimating the regression parameters, transformation of non-linear model to linear model, linearization, other parameter estimation methods, starting values, statistical inference in non-linear regression

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	Sixth Edition, 2021
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

CLOUD COMPUTING (CC)

COURSE CODE	23CA52C1	MODE	L-T-P-S :	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	PO Mapping	BTL
CO 1	Ability to explain various concepts, architectures and deployment models relating to the cloud computing technologies	PO1	2
CO 2	Know the fundamentals of cloud, cloud Architectures and types of services in cloud	PO1	2
CO 3	Understand the concept of virtualization and how this has enabled the development of Cloud Computing	PO2	3
CO 4	Design different sample applications using IaaS, PaaS and SaaS deployment Model	PO2	3
CO 6	Develop application programs using different platforms and languages	PO4	5
CO7	Interpret and Learn the Concept of Advanced Cloud Technologies and Cloud Databases	PO4	5

Syllabus:

Module 1	Introduction to Cloud Computing: meaning of Cloud Computing, variations of cloud computing from other models, Essential Characteristics, Cloud computing Architectures, Technological Influences. Cloud Computing Architecture, the three-deployment model's IaaS, PaaS, SaaS, and Types of clouds (Public, Private and Hybrid) CLOUD INFRASTRUCTURE: Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.
Module 2	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. Establishing and using a private cloud: Network topology, HW-SE specification, installing open stack, configuring open stack availing services through open stacks, establishing virtual networks.
Module 3	Infrastructure as a Service (IaaS): Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, and Virtual Machine (VM). Resource Virtualization: Server, Storage, Network, Virtual Machine (resource) provisioning and manageability, Storage as a service, Examples Applications: Amazon EC2, Google Drive, one drive, drop box. Developing applications Using IaaS.
Module 4	Platform as a Service (PaaS): Introduction to PaaS: What is PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Computation, Storage, Examples, Google App Engine, Microsoft Azure, SalesForce.com's Force.com platforms. Developing applications using PaaS.

	Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, and Case Study on SaaS. Provisioning, scheduling and requesting VM that is identified with desired software packages. Development of Application software using the system software installed on the Virtual Machine. Developing Applications that use SaaS.

Reference Books:

S No	Title	Author(s)	Publisher	Year
1	Cloud Computing	Kris Jamsa	Wiley India Pvt Ltd	2012
2	Cloud Security: A comprehensive Guide to Secure Cloud Computing.	Krutz, Ronald L.; Vines, Russell Dean	Wiley India Pvt Ltd	2010
3	Cloud Computing Bible,	Barrie Sosinsky	Wiley India	2011

CYBER SECURITY AND ETHICAL HACKING (CSEH)

COURSE CODE	23CA52S1	MODE	Regular	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes :

CO#	CO Description	BTL	PO Mapping
CO1	Understand the need for cyber security	2	PO1
CO2	Understand various types of security threats and electronic payment systems	2	PO2, PO3
CO3	Solve the security issues involved in developing secure information systems	3	PO3, PO4
CO4	Apply different ethical hacking methods	3	PO3, PO4
CO5	Evaluate various cyber security threats	5	PO4,PO5
CO6	Evaluate different ethical hacking methods and tools	5	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, Network and Denial of Services Attack, Security Threats to E-Commerce Electronic Payment System, e- Cash, Credit/Debit Cards.
Module 3	Digital Signature, public Key Cryptography. Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.
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

PATTERN RECOGNITION (PR)

COURSE CODE	23CA52A2	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Understand basic concepts in pattern recognition.	2	PO2
CO2	Understanding Generative Learning Models.	2	PO3,PO2
CO3	Understand Structured pattern recognition and Neural pattern recognition.	2	P02
CO4	Apply pattern recognition techniques in practical problems.	3	PO2

Syllabus:

Module 1	Introduction and general pattern recognition: Pattern Recognition (PR), Pattern Recognition Approaches, Examples of PR Applications, Pattern Recognition Extensions. Statistical pattern recognition: Introduction, Supervised, Parametric Approaches, Unsupervised Approaches
Module 2	Bayes Classifier: Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities Comparison with the NNC, Naive Bayes Classifier. Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, HMM Parameters, Learning HMMs, Classification Using HMMs,
Module 3	lassification of Test Patterns. Syntactic (structural) pattern recognition & NN Classifiers: Introduction, Structural Analysis Using Constraint Satisfaction and Structural Matching, The Formal Language-based Approach, Learning/Training in the Language- based Approach. Nearest Neighbour Based Classifiers: Nearest Neighbour Algorithm, Variants of the NN Algorithm, Use of the Nearest Neighbour Algorithm for Transaction Databases, Minimal Distance Classifier (MDC).
Module 4	Applications of Pattern Recognition: Fingerprinting, cursive characteristic recognition, Biometrics, Rice inspection, Food quality analysis,

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Introduction to Statistical Pattern Recognition	Fukunaga	Academic Press	
2	Pattern Recognition and Machine learning"	M.Narasimha Murty, V. Susheela Dev	Universities Press (India) Pvt. Ltd	2011
3	"Pattern Classification",	R. O. Duda, P. E. Hart, and D. G. Stork,	2nd edition, Wiley-Interscience.	2000
4	Pattern Recognition and Machine learning	. M. Bishop,	Springe	2006

HADOOP AND BIG DATA (HBD)

COURSE CODE	23CA52D2	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NIL

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 & Outline Processing and Storage Layer of Hadoop, internal concept of Map Reduce , YARN	2,3	PO2
CO3	understand architecture of Spark and Outline Core components in Spark	2,3	PO2
CO4	Apply Hadoop plus Spark for achieving Big Data Analytics	4	PO3,PO4,PO5

Syllabus:

Module 1	Understanding Big Data: Definition of 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, Maintenance/storage of Big data, Big Data use cases for major IT Industries
Module 2	Introduction to Hadoop: What is Hadoop, Apache Community, History of Hadoop, How is Hadoop Important, Apache Hadoop Ecosystem, Hadoop Architecture, Difference between Hadoop 1.x,2.x and 3.x Architecture, Master- Slave Architecture, Advantages of Hadoop. HDFS and its features, Map Reduce and its features, Map Reduce V1 vs Map Reduce V2, Hadoop YARN-job scheduling in YARN, storage options in HADOOP – File Formats & Compression Formats, Encryption, and User Authentication.
Module 3	Introduction to Spark: What is Spark, history of Spark, Theoretical concepts in Spark – Resilient distributed datasets, Directed acyclic graphs, Spark Context, Spark Data Frames, Actions and Transformations, Spark deployment options, Spark APIs. Core Components in Spark – Spark Core, Spark SQL, Spark Streaming, GraphX, MLib. The Architecture of Spark .
Module 4	Big Data Analytics with Hadoop plus Spark: Limitations of Hadoop, Overcoming limitations of Hadoop, Spark solutions, spark practical on big data analytics ,Hadoop Practical on Big data analytics , Hadoop vs Spark, Why Hadoop plus Spark – Hadoop features, Spark features. Installing Hadoop plus Spark Clusters.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Practical Big Data Analytics	Nataraj Dasgupta	Packt Publishing	2018
2	Big Data Analytics	Venkat Ankam	Packt Publishing	2016
3	Big Data Analytics with Hadoop 3.0	Sridhar Alla	Packt Publishing	2018

CLOUD INFORMATION SECURITY (CIS)

COURSE CODE	22CA52C2	MODE		LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Explain the basic concepts of cloud computing, virtualization, and the importance of Information Security in the Cloud Context	2	PO1, PO2
CO2	Discuss various vulnerabilities, controls, and protocols in the cloud	2	PO3, PO1
CO3	Classify the cloud vulnerabilities and threats	3	PO1, PO3
CO4	Outline how cloud and Security works in a seamless model	3	PO1, PO3
CO5	Execute and perform cloud security measures	5	PO2, PO4

Syllabus:

Module 1	Introduction to Virtualization & Cloud: Virtualization and Cloud computing concepts, Private cloud Vs Public cloud, IAAS, PAAS & SAAS concepts, Virtualization security concerns, Hypervisor Security, Host/Platform Security, Security communications, Security between Guest instances, Security between Hosts and Guests.
Module 2	Cloud Controls Matrix &Top Cloud Threats: Introduction to Cloud Controls Matrix & Top Cloud Threats, Cloud Controls Matrix, Trusted Cloud Initiative architecture and reference model, requirements of Security as a Service (Secaas) model and Top Security threats to the cloud model.
Module 3	Cloud Security: Cloud Security vulnerabilities and mitigating controls, Cloud Trust Protocol, Cloud Controls Matrix. Complete Certificate of Cloud Security Knowledge (CCSK).
Module 4	Cloud Trust Protocol &Transparency: Introduction to Cloud Trust Protocol & Transparency, Cloud Trust Protocol and Transparency, Transparency as a Service, Concepts, Security, Privacy & Compliance aspects of cloud.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Cloud Security – A comprehensive Guide to Secure Cloud Computing"	Ronald L. Krutz and Russel Dean Vines	Wiley Publishing, Inc.	2010
2	"Cloud Computing Explained"	John Rhoton	Recursive Limited	2009
3	"Cloud Computing - A Practical Approach"	Anthony T Velte, Toby J Velte and Robert Elsenpeter	McGraw Hill	2010
4	"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"	Tim Mather, Subra Kumaraswamy, and Shahed Latif	O'Reilly Media	2009

CYBER FORENSICS (CFS)

COURSE CODE	23CA52S2	MODE	REGULAR	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Understand Forensic Science and Recovery methods	2	PO1, PO2
CO2	Analyse Digital Evidence, Network Forensics and Mobile Device Forensics	4	PO2, PO3
CO3	Analyse Web Forensics and Email Forensics	4	PO2,PO3, PO4
CO4	Analyse the security policies, standards and cyber laws	4	PO3, PO4

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 evidences 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

COMPUTER VISION (CV)

COURSE CODE	23CA61A3	MODE	R	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the need for image transformations and modeling, different types of image transformation, and their properties.	2	PO1,PO4
CO2	Apply the techniques and transformation methods for image enhancement and image restoration.	3	PO1,PO2
CO3	Demonstrate image processing algorithms to perform feature detection, matching, segmentation and recognition.	4	PO1,PO2
CO4	Apply and analyse NN, ML, and DL algorithms for image transformation, pose consistency, and segmentation.	4	PO5,PO1
CO5	Analysis and study of image processing and machine learning algorithm for computer vision	5	PO5

Syllabus:

Module 1	Introduction to Computer vision: 2D and 3D transformation, Co-vectors, Stretch/Squash, Planar surface flow, Bilinear Interpolant. 3D rotations, 3D to 2D projections :Orthography and para perspective, Pin hole Camera Model, Camera Intrinsic ,Image sensing pipeline, samplin, and aliasing.
Module 2	Linear Filtering: 1D and2D convolution, Separable ltering, Examples offlinear filters (Moving average/ Box filter, Bilinear, Gaussian, Sobel,Corner Filter), Bandpass and steerable filters: applacian of gaussian filter, Nonlinear filters: Median filter, Bilateral filter, Binary Image processing, Morphology, Fourier Transforms, DCT, Applications sharpening , blur and noise removal, interpolation, Decimation, multi resolution, Image pyramids.
Module 3	Boundary Detection: Fitting Lines and Curves, Active Contours, Hough Transform, Generalized Hough Transform, SIFT Detector: Interest Points, Detecting Blobs, SIFT Detector, SIFT Descriptor, SURF Features.
Module 4	Image Stitching: Image transformations (2x2 &3x3), Computing Holography, Dealing with Outliers: RANSAC, Face Detection: Uses of Face Detection, Haar Features for Face Detection, Integral Image, Nearest Neighbor Classifier, Support Vector Machines.,Perception: Object tracking, Image Segmentation, Appearance Matching, Deep Learning Architecture for Computer Vision Applications: Convolutional neural networks, ImageNet Dataset, YOLO, VGG16/19, RESNET, Effi cientNet, U-NET.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Perform basic Image Handling and Processing operations on the image.	Russell kirsch	Kickstarted Publications	2011
2	Geometric Transformation, compute homography matrix	Razavan	Klein	2013
3	Edge detection, Line Detection and Corner Detection	Mohamed AEi-sayed	Lambert	2012
4	Image classification using SVM	Ramon amayan	Rupa publications	2010

DATA VISUALIZATION TECHNIQUES (DV)

COURSE CODE	23CA61D3	MODE	Regular	LTPS	3-0-2-4	PRE-REQUISITE	NIL

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	Analyse 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
CO5	Hands-on practice creating basic bar graphs, grouping bars, customizing color, size, and title, adding labels, and applying bar graphs in business scenarios.	3	PO1,PO2,PO5
CO6	Practicing annotation techniques such as adding text, mathematical expressions, lines, arrows, shaded shapes, and error bars. Modifying axes, including swapping x and y axes, changing scaling ratios, positioning tick marks and labels, adjusting the appearance of axis labels, creating circular graphs, using themes, and manipulating legends.	4	PO1,PO3,PO5

Syllabus:

Module 1	Introduction to Data Visualization: Brief 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, importance of Scree Plot, application of Scree Plot in determining number of clusters and factors, QQ plot, importance of QQ plot in distribution of data for the further quantitative analysis, PP plot, applications and usage of PP Plot for distribution detection. 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, changing the scaling ration in the axis, positioning of axis and arranging tick marks and labels, changing the appearance of axis labels, circular graphs, using themes, changing the appearance of theme elements, creating the own themes, legends : removing the legends, position of legends, legend title, labels in legends.

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

CLOUD ARCHITECTURES(CA)

COURSE CODE	23CA61C3	MODE	R	LTPS	3-0-2-4	PRE-REQUISITE	Nil

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Classify cloud computing importance and services	2	PO1
CO2	Relate cloud services and 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

MALWARE ANALYSIS (MA)

COURSE CODE	23CA61S3	MODE	R	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the Goals of Malware Analysis and Creating fake networks	2	PSO2,PO1,PO4
CO2	Demonstrate the usage of virtual machines in the context of malware analysis.	2	PSO1,PO1,PO2
CO3	Apply the concept of exception handling in the context of malware analysis. How can it be used to identify and analyse malware activity	3	PSO1,PO1,PO2
CO4	Develop a plan for analyzing malware persistence mechanisms	3	PO5,PSO2,PO1
CO5	Evaluate malware analysis programs web servers and password cracking	5	PO5

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, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots, Creating fake networks
Module 2	X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic 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, The Structure of a Virtual Machine, Analysing Windows programs, Anti-static analysis techniques, obfusca
Module 3	Live malware analysis, dead malware analysis, analysing 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, Exception Handling, Patching
Module 4	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	“Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software"”	Michael Sikorski and Andrew Honig	No Starch Press	2017
2	"The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory"	Michael Hale Ligh, Andrew Case, Jamie Levy, and Aaron Walters	Willey	2012
3	"Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code"	Michael Hale Ligh, Steven Adair, Blake Hartstein, and Matthew Richard	Willey	2012
4	"Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation"	Bruce Dang, Alexandre Gazet, and Elias Bachaalany	Willey	2019
5	"Black Hat Python: Python Programming for Hackers and Pentesters"	Justin Seitz	No Starch Press	2011

APPLIED DEEP LEARNING (ADP)

COURSE CODE	23CA61A4	MODE	R	LT PS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Describe the fundamental concepts of deep learning, including neural networks, activation functions, loss functions, and optimization techniques.	3	PO1, PO2, PO5.
CO2	Apply deep learning frameworks such as TensorFlow or PyTorch to develop and implement deep learning models.	2	PO2, PO3,.
CO3	Apply deep learning techniques to image classification, object detection, and natural language processing tasks	3	PO1, PO2, PO5
CO4	Apply Generative Adversarial Networks (GANs) for image and text generation.	3	PO1, PO2, PO5

Syllabus:

Module 1	Introduction to Deep Learning: Overview of machine learning and deep learning Neural networks and their components Activation functions, loss functions, and optimization Training deep neural networks
Module 2	Convolutional Neural Networks (CNNs): Fundamentals of image data and preprocessing Building and training CNNs Applications of CNNs (e.g., image classification, object detection) Recurrent Neural Networks (RNNs): Sequence data and time series analysis Building and training RNNs Applications of RNNs (e.g., natural language processing, speech recognition)
Module 3	Transfer Learning and Pretrained Models: Transfer learning techniques, Fine-tuning pretrained models, Reinforcement learning and its applications Explainable AI and model interpretability, Ethical considerations in deep learning. Natural Language Processing (NLP) and Transformers: Introduction to NLP Transformers architecture for NLP tasks Fine-tuning pre-trained language models
Module 4	Generative Adversarial Networks (GANs): Introduction to GANs Training GANs for image generation Applications of GANs (e.g., image synthesis) Deploying Deep Learning Models: Model deployment methods (e.g., cloud, edge devices) Model optimization and inference speed Model version control and updates

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Deep Learning"	Ian Goodfellow, Yoshua Bengio, and Aaron Courville.	MIT press	2016
2	"Deep Learning for Computer Vision"	Rajalingappaa Shanmugamani.	Packt Publishing.	2018
3	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"	Aurélien Géron.	O'Reilly Media	2nd (2019)

STATISTICS FOR DATASCIENCE(SDS)

COURSE CODE	23CA61D4	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Explain the basic concepts of statistics and explains the various methods of descriptive data collection and analysis	2	PO1,PO2,PO6
CO2	Show the probability distribution of a random variable, based on real-world situation, and use it to compute expectation and variance	2	PO1,PO2,PO6
CO3	Construct the linear and non-linear regression lines for the given data.	3	PO2,PO3,PO6
CO4	Apply basic concepts of statistics and explains the various methods of descriptive data collection and analysis	3	PO2,PO3,PO4,PO6,
CO5	Analysis of data with the help Statistical functions in Excel /SPSS / Minitab tools	5	PO2,PO3,PO4,PO6,

Syllabus:

Module 1	Basic Statistics: Importance of Statistics-Primary and secondary data-Data collection methods Presentation of numerical and categorical data. Concepts of central tendency and dispersion-Mean, median and mode-Partition Values-Quartiles for grouped and ungrouped data-Range-Quartile Deviation-Standard deviation and coefficient of variation for grouped and ungrouped data.
Module 2	Probability Distribution: Random Variable- Discrete Random and Continuous Random variable, Probability Distribution of a Random Variable, Mathematical Expectation Types: Binomial, Poisson, Normal Distribution, Mean and Variance of Binomial, Poisson, and Normal Distribution
Module 3	Correlation: Introduction, Types, Properties, Methods of Correlation: Karl Pearson's Coefficient of Correlation, concept of point biserial correlation, Rank Correlation and Phi-coefficient. Regression: Introduction, Aim of Regression Analysis, Types of Regression Analysis, Lines of Regression, Properties of Regression Coefficient and Regression Lines, Comparison with Correlation
Module 4	Working on Statistical data with Ms-Excel: Working with Data using MS-Excel, Importing Data Sort, Data Filter, Advance Filter, Data Validation, Data Consolidation, What-If Analysis, Data Grouping, Subtotal, Data regression, Working with function; statistical functions. Index numbers-Laspeyere-Passche-Fisher's price and quantity index numbers Time reversal and factor reversal tests.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Probability and Statistics for Engineers and Scientists	Ronald E. Walpole, Sharon L. Myers and Keying Ye,	Pearson-8ed	2017
2	Fundamentals of Business Statistics	Sharma J.k.	Vikas Publishing House	2019
3	A textbook of probability and statistics	B. Sooryanarayana :	S. Chand 2003	2003

CLOUD AND SERVERLESS COMPUTING(CSC)

COURSE CODE	23CA61C4	MODE		LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Understand the concepts of Cloud Serverless Computing	2	PO1, PO2, PO5
CO2	Organize the Serverless cloud Architecture	3	PO1, PO2, PO5
CO3	Experiment with the appropriate methodologies of testing and debugging serverless functions	3	PO1, PO2, PO5
CO4	Implement knowledge representation using Event-driven Programming in Serverless Architectures	3	PO1, PO2, PO5

Syllabus:

Module 1	Introduction to Cloud Serverless Computing, Overview of Serverless Computing, Benefits, and drawbacks of Serverless Architecture, Comparison with traditional server-based approaches, Serverless platforms, and providers
Module 2	Serverless Architecture, Serverless design patterns, Microservices and serverless, Scalability and elasticity in serverless environments, Data storage and management in serverless applications
Module 3	Function-as-a-Service (FaaS),Introduction to FaaS platforms, Developing serverless functions, Managing dependencies and external integrations Testing and debugging serverless functions
Module 4	Event-driven Programming in Serverless Architectures, Understanding event-driven programming models, Event sources and triggers, Implementing event-driven workflows, Orchestration and choreography

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Serverless Architectures on AWS: With examples using AWS Lambda	Peter Sbarski	DT Editorial Services	1st edition (2017)
2	Building Serverless Web Applications Paperback	Diego Zanon	Packt Publishing Limited	1st edition (2017)
3	Serverless Applications with Node	Slobodan Stojanovic, Aleksandar Simovic, and Mladen Macanovic	Pearson Education	3rd edition (2017)
4	Practical AWS Lambda: Build and Deploy Event-Driven Serverless Applications	Yohan Wadia	Ingram short title	1st edition (2017)

SECURITY GOVERNANCE AND MANAGEMENT(SGM)

COURSE CODE	23CA61S4	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Understand basic security for the system.	2	PO1,PO2,PO3
CO2	Applying Security Governance Objectives to various organizations	3	PO3
CO3	Applying Security Strategy ,Strategy Constraints to various organizations	3	PO3
CO4	Applying Incident Management and Response Metrics to various organizations	3	PO4

Syllabus:

Module 1	Governance Overview—How Do We Do It? What Do We, Why Governance?,: Benefits of Good Governance, A Management Problem, Legal and Regulatory Requirements: Security Governance and Regulation, Roles and Responsibilities: The Board of Directors ,Executive Management,Security Steering Committee, The CISO,CIA Model , User identity and Access Management: Authentication, Account Authorization, Validation, Access Control
Module 2	Strategic Metrics: Governance Objectives, Information Security Outcomes : Defining Outcomes , Security Governance Objectives: Security Architecture, CobiT ,Capability Maturity Model , ISO/IEC 27001/27002 63, Other Approaches, Risk Management Objectives: Risk Management Responsibilities, Managing Risk Appropriately ,Determining Risk Management Objectives
Module 3	Current State: Current State of Security, Current State of Risk Management , Gap Analysis—Unmitigated Risk , Developing a Security Strategy: Failures of Strategy ,Attributes of a Good Security Strategy Strategy Resources , Strategy Constraints, Sample Strategy Development: The Process, Implementing Strategy: Action Plan Intermediate Goals , Action Plan Metrics , Reengineering , Inadequate Performance , Elements of Strategy
Module 4	Security Program Development Metrics: Information Security Program Development Metrics ,Program Development Operational Metrics ,Information Security Management Metrics: Management Metrics ,Security Management Decision Support Metrics ,CISO Decisions , Incident Management and Response Metrics: Incident Management Decision Support Metrics

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	INFORMATION SECURITY Governance: A Practical Development and Implementation Approach	KRAG BROTBYA	WILEY	2009
2	Information Systems Security: Security Management, Metrics, Frameworks And Best Practices	Nina Godbole	2010	ISC2 Press
3	Information Security Risk Analysis	Thomas R. Peltier	3rd edition	Auerbach, 2012
4	Principles of Information Security	Michael E. Whitman	5 edition (2015)	Cengage Learning India Private Limited

APPLICATIONS OF NATURAL LANGUAGE PROCESSING(ANLP)

COURSE CODE	23CA61A5	Mode	R	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes:

CO. No	Course Outcome	PO/PSO	BTL
CO 1	Understand approaches to syntax and semantics in NLP	PO1, PSO1	2
CO 2	Apply the statistical estimation and statistical alignment models P	PO2, PSO1	3
CO 3	Analyse grammar formalism and context free grammars	PO2, PSO1	3
CO 4	Apply Rule based Techniques, Statistical Machine translation (SMT), word alignment	PO1, PSO1	3
CO 5	Evaluating NLP algorithms using python	PO5, PSO1	5

Syllabus:

Module 1	"Overview of NLP. Statistical machine translation. Language models and their role in speech processing. The problem of ambiguity. NLP tasks in syntax, semantics, and pragmatics. Words: Structure, Semantics, Parts of Speech, Sentences: Basic ideas in compositional semantics, Classical Parsing (Bottom up, top down, Dynamic Programming: CYK parser). Sentences: Parsing using Probabilistic Context Free Grammars and EM based approaches for learning PCFG parameters. N-gram Language Models. "
Module 2	Information Theory: The role of language models. Simple N-gram models, Entropy, relative entropy, cross entropy. Statistical estimation and smoothing for language models. Part Of Speech Tagging and Sequence Labelling. Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training). n-gram models. Syntactic parsing: Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Top-down and bottom-up parsing, empty constituents, left recursion.
Module 3	Modern Statistical Parsers Search methods in parsing: Agenda-based chart, A*, and "best-first" parsing. Dependency parsing. Discriminative parsing. Semantic Analysis: Lexical semantics and word-sense disambiguation. Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Coreference, pronoun resolution algorithm, text coherence, discourse structure. Semantic Role Labelling and Semantic Parsing.
Module 4	Information Extraction (IE): Named entity recognition and relation extraction. IE using sequence labelling. Information sources, rule-based methods, evaluation (recall, precision). Statistical Machine Translation (SMT), Alignment Models. Statistical Alignment Models and Expectation Maximization (EM) EM and its use in statistical MT alignment models. The EM algorithm. Machine Translation (MT): Basic issues in MT. Rule based Techniques, Statistical Machine translation (SMT), word alignment.
Module 5	Evaluating NLP algorithms using python

Textbooks:

1. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition". Daniel Jurafsky and James H. Martin,
2. Natural language Understanding James A 2nd Edition Pearson Education.
3. Natural language processing: a Paninian perspective "Bharati A., Sangal R., Chaitanya V." 2000 Pearson Education.

Reference books:

1. Natural language processing and Information retrieval ". Siddiqui T., Tiwary U. S. " 2008
2. Foundations of Statistical Natural Language Processing Cambridge "Christopher D; Hinrich Schuetze" 1999 MIT Press

GRAPH AND WEB ANALYTICS(GWA)

COURSE CODE	23CA61D5	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Understand the importance of Bigdata on Graphs, Network basics and Social networks	2	PO1
CO2	Make use of Web Analytics – Data sources, tools, Web traffic data	3	PO1,PO5
CO3	Analyzing Web Analytics Strategy- website traffic analysis, audience identification and segmentation analysis, Emerging Analytics	4	PO1
CO4	Compare Email Testing Analysis, competitive Intelligence Analysis, and Social, Mobile, Video Analysis	4	PO1,PSO2
CO5	Implementing Python programming for graph and web analytics	4	PO4,PO5,PO6

Syllabus:

Module 1	Graph Analytics: Origin of Graph Theory, Graph Basics, types of Graphs, Finding the best path, Dijkstra's Algorithm, operation on graphs. Network Basics: Types of Networks, Properties of Networks, Network Measures, Matrices: Adjacency matrix SocialNetworks:PropertiesofsocialnetworkscaleFreeNetwork,SmallworldNetworks,NetworkNavigation.Node_LevelAnalysis:Degree_centrality,closenesscentrality,betweenesscentrality,EigenvectorCentrality,pagerank,GroupLevelAnalysis:Cohesive subgroups,cliques,clusteringcoefficient,triaSlice,K-Cores.CommunityDetection:Graph partitioning, Hierarchical clustering
Module 2	Web Analytics: Introduction- State of the analytics union, state of the industry, Rethinking web analytics, clickstream, multiple outcomes analysis, experimentation a imperative, tactical shift. Strategy for choosing the optimal analytics tool- vendor selection analysis, running an effective tool pilot, checking SLA's for web-analytics vendor contract. Clickstream analysis- Critical web metrics, visits and visitors engagement, attributes of great metrics, strategically aligned tactics for impactful web metrics.
Module 3	Web Traffic Data: Practical solutions- Sources of traffic, outcomes, foundational analytical strategies, segmentation, benefits of and creating and app measuring the search quality, search engine optimization analysis, google example, content coverage, indexing by search engines, paid search analysis, direct traffic analysis, email campaign analysis, campaign response, website behaviour, data Testing, actionable testing ideas.
Module 4	Component of Web Analytics Strategy : Competitive Intelligence Analysis- Data Sources, website traffic analysis, search and keyword analysis, audience identification and segmentation analysis. Emerging Analysis of the performance of Videos.

Text Books:

Sl No	Title	Author(s)	Publisher	Year
1	Python for graph and Network Analysis	Mohammad Zuhair Al-Taie, Seifedine Kadry	Springer Publication	2017
2	Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity	Avinash Kaushik	Sybex	2009
3	Graph Analysis and Visualization	Richard Brath David Jonker	Willey publisher	2015
4	Advanced Web Metrics with Google Analytics	Brian Clifton	Syrex	2012
5	A textbook of Graph theory	R.Balakrishnan and K.Ranganathan	Universitext	2012

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Michael Beasley, "Practical Web Analytics for User Experience: How Analytics can help you Understand your Users"	Morgan Kaufmann, 2013 2. Justin Cutroni	O'Reilly	2010

CLOUD WEB SERVICES (CWS)

COURSE CODE	23CA61C5	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Summarize the model of Cloud Computing As A Service	2	PO1,PO2,PO3
CO2	Illustrate the Networking Basics required for cloud services	2	PO1,PO2,PO3
CO3	Demonstrate the Control of workflow in cloud services	3	PO1,PO3
CO4	Explain the method of fault tolerance in cloud	3	PO1,PO3
CO5	Experiment with the AWS Cloud	3	PO1,PO3, PO5

Syllabus:

Module 1	Cloud Web concepts: Search engine, Apache Hadoop, Grid Computing, Amazon Web Services, REST APIs, SOAP API, Query API, User Authentication, Connecting to the Cloud, Open SSH Keys, Tunnelling/ Port Forwarding, Image (glance), Object Storage (swift), ACL, Logging, Signed URI, Compute (nova), Cloud value proportion, Cloud economics, cloud architecture and design principles, AWS Cloud basic services
Module 2	Networking & Storage: Overview, Key pairs, Network Types, LAN, Gateways and Router, IP Classes and Subnets, CIDR, Utilities, Instances Management, Image Management, direct connect, hybrid deployments, VPN, Security groups, Block Storage (cinder), Ubuntu in the Cloud, Installation, Utilities, File system, basic concepts of storage and databases, various storage services, storage solutions, database services.
Module 3	Global Infrastructure and Security: Methods of deploying and operating cloud, global infrastructure, availability zone, benefits of CloudFront and Edge locations. AWS Corer services, resources for technology support, methods for provisioning services, Benefits of shared responsibility model, layers of security, Multi Factor Authentication, Identity Access Management Security levels, security policies, benefits of compliance, security services.
Module 4	Monitoring & Pricing: Approaches for monitoring, benefits of Cloud watch, CloudTrial, Trust Advisor, Pricing and support model, free tire, benefits of organization and consolidated billing, Budgets, Explorer, AWS pricing calculator, various AWS support plans, AWS market place.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Cloud Computing: Principles and Paradigms	RajkumarBuyya, James Broberg, Andrzej M. Goscinski	Wiley	2011

2	OpenStack Essentials	Dan Radez	Wiley	2009
3	Cloud Computing: Concepts, Technology and Architecture	Erl	Pearson Education	2009
4	Resource Management in Utility and Cloud Computing	Han Zhao,Xiaolin Li	Springer	2013

CLOUD SECURITY (CS)

COURSE CODE	23CA61S5	MODE		LTPS	3-0-2-0	PRE-REQUISITE	Nil

Course Outcomes:

CO#	CO Description	BTL	PO Mapping
CO1	Explain Importance of Information Security in the Cloud Context	2	PO1, PO2
CO2	Identify various concepts of cloud security	2	PO1, PO2
CO3	Develop the cloud vulnerabilities and threats	3	PO3,PO4,PO7, PO8
CO4	Construct how cloud and Security works in a seamless model	3	PO3,PO4,PO5, PO7, PO8
CO5	Practical	5	PO1, PO2, PO4,PO5, PO7, PO8

Syllabus:

Module 1	Introduction to Virtualization & Cloud: Virtualization and Cloud computing concepts, Private cloud Vs Public cloud, IAAS, PAAS & SAAS concepts, Virtualization security concerns, Hypervisor Security, Host/Platform Security, Security communications, Security between Guest instances, Security between Hosts and Guests
Module 2	Cloud Controls Matrix &Top Cloud Threats: Introduction to Cloud Controls Matrix & Top Cloud Threats, Cloud Controls Matrix, Trusted Cloud Initiative architecture and reference model, requirements of Security as a Service (Secaas) model and Top Security threats to the cloud model
Module 3	Cloud Security: Cloud Security vulnerabilities and mitigating controls, Cloud Trust Protocol, Cloud Controls Matrix. Complete Certificate of Cloud Security Knowledge (CCSK).
Module 4	Cloud Trust Protocol &Transparency: Introduction to Cloud Trust Protocol & Transparency, Cloud Trust Protocol and Transparency, Transparency as a Service, Concepts, Security, Privacy & Compliance aspects of cloud.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Visible Ops Private Cloud – Andi Mann, Kurt Miline and Jeanne Morain, IT Process Institute.	John Rhoton 2009.	Visible Ops Private Cloud	2011
2	Cloud Computing Bible	Barrie Sosinsky	Wiley	2011
3	Cloud Computing Explained	John Rhoton		2011
4	Cloud Security and Privacy	Tim Mather, Subra Kumaraswamy, and Shahed Latif		2009
5	Cloud Security – A comprehensive Guide to Secure Cloud Computing	Ronald L. Krutz and Russel Dean Vines		2009