ORDINANCE

FOR

BACHELOR OF COMPUTER APPLICATIONS (BCA)

GNA UNIVERSITY

Inspiring Innovation.....

(THIS ORDINANCE HAS BEEN APPROVED IN THE MEETING OF BOARD OF STUDIES HELD ON DATED 15 June, 2022)

APPLICABLE W.E.F. ACADEMIC SESSION 2022-2023

SRI HARGOBINDGARH, PHAGWARA – HOSHIARPUR ROAD,
PHAGWARA 144401, PUNJAB

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ORDINANCE FOR BACHELOR OF COMPUTER APPLICATIONS (BCA)

SHORT TITLE AND COMMENCEMENT

I. This ordinance shall be called the ordinance for the Certificate/Diploma/Bachelor/Honors of Computer Applications of GNA University, Phagwara.

II. This ordinance shall come into force with effect from academic session 2022-23.

1. Name of Program: Bachelor of Computer Applications (BCA).

2. Name of Faculty: Faculty of Computational Science.

3. Vision of the department: To develop the skilled computer and IT professionals meeting global requirements of IT industry.

4. Mission of the department

M1: To provide state of art infrastructure and conducive environment for budding IT professionals.

M2: To establish strong industry academia relationship to enhance the technical skills of the students and make them readily employable.

M3: To provide exposure to the emerging and establish tools and technology in the field of computer applications.

M4: To develop curriculum in accordance with the industry requirements.

5. Program Educational Outcomes (PEO):

- **PEO1:** To excel in software development skills coveted in the IT industry.
- **PEO2:** To produce graduates who will be effective in multidisciplinary and diverse IT environment.
- **PEO3:** To involve student in lifelong learning to adapt the technological advancements in the emerging areas of computer applications.
- **PEO4:** To provide student with an academic environment that fosters excellence, transparency, leadership and promote awareness of life-long learning.
- **PEO5:** To become an entrepreneur who can provide solutions and develop software products for Enterprise needs.

- **PEO6:** To Work as teams to build software systems and apply the technologies in various fields of Computer Applications, including hardware problems, Website development and management, databases, and software engineering techniques.
- **PEO7:** To produce computer science graduates who will be used as feeder candidates for higher studies in the field of Information Technology and Computer Applications.

6. Program Specific Outcomes (PO):

- **PSO1: Professional Skills:** Attain the ability to design and develop computer applications, evaluate and recognize potential risks and provide innovative solutions.
- **PSO2: Successful Career and Entrepreneurship:** Explore technical knowledge in diverse areas of Computer Applications and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies..
- **PSO3: Multidisciplinary Projects:** The program prepares the young professional for a range of computer applications, computer organization, techniques of computer networking, software engineering-Commerce, Web Designing, Big Data, Python and Advance JAVA.
- **PSO4: Problem Solving:** Ability to use knowledge gained for solving complex problems using Computational sciences.
- **PSO5:** To specialization in legacy applications, system software or mobile application.
- **PSO 6:** Think of the approaches for solving problem in different domains.
- **PSO7:** Be in position to develop application for IT industry.

7. Program Outcomes (PO):

- **PO1: Basic knowledge:** An ability to apply knowledge of basic mathematics, science and domain knowledge to solve the computational problems.
- **PO2: Problem Solving:** Improve reasoning with strong mathematical ability to identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge of data structure and algorithms.
- **PO3: Discipline knowledge:** An ability to apply discipline specific knowledge to solve core and/or applied computational problems.
- **PO4: Modern Tool Usage**: To identify, select and use a modern scientific and IT tool or technique for modeling, prediction, data analysis and solving problems in the area of computer science and making them to develop applications.
- **PO5: Social Contribution:** Follow professional software engineering practice by applying contextual knowledge to assess societal and legal issues.

- **PO5: Ethics:** Recognize the social and ethical responsibilities of a professional working in the discipline.
- **PO6: Computing Skills:** Analyze a problem and identify and define the computing requirements appropriate to its solution.
- **PO7: Profession and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.
- **PO8: Environment and sustainability:** Understand the impact of the professional solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO9: Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10: Social Contribution:** Follow professional software engineering practice by applying contextual knowledge to assess societal and legal issues.
- **PO11: Communication:** Communicate effectively on complex activities and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO12: Project management and finance:** Demonstrate knowledge and understanding of the management principles and apply these to one's own work, as a member and leader in a team.
- **PO13: Lifelong Learning:** Work as teams to build software systems and apply the technologies in various fields of Computer Applications, including hardware problems, Website development and management, databases, and software engineering techniques.

Additional Program Outcomes: BCA degree (Hons.)

The Bachelor of Computer Applications (BCA Hons.) program enables students to attain following addition attributes besides the afore-mentioned attributes, by the time of graduation:

(i) Apply standard software engineering practice and strategy in real time software project development.

(ii) To develop the ability to analyze a problem and devise an algorithm to solve it.

(iii) Acquaint with the contemporary trends in research setting and thereby innovative novel solution to existing solution.

(iv) Ability to work independently on a software project as an effective team member.

(v) An ability to independently carry out research / investigation and development work to solve practical problems.

(vi) An ability to write and present a substantial technical report / document.

8. General Regulations for Faculty of Computational Science:

- The University may introduce programs under Faculty of Computational Science which are specified under the UGC Act 1956. The Governing Body may approve the introduction, suspending or phasing out a program on the recommendation of the Academic Council either on its own or on the initiative of faculty.
- The admissions to a Faculty of Computational Science programs shall be generally governed by the rules of the UGC/AICTE or any other competent authority of the MHRD or as approved by Governing Body of University and shall be as notified in the admission notification of the respective academic year
- The minimum entry qualification for admission to the students of Faculty of Computational Science shall be such as may be laid down in the regulations or specified by the Governing Body like Minimum qualification for admission to the first year program of Faculty of Computational Science shall be the Senior Secondary School Certificate (10+2) examination. While deciding the admission procedure, the University may lay down compulsory subjects in qualifying examination for admission for various programs in the admission policy.
- A student shall be required to earn a minimum number of credits through various academic components of a curriculum, as provided for in the regulations.
- A student shall be required to complete all the requirements for the award of the degree within such period as may be specified in the regulations.
- A student may be granted such scholarship as may be specified in accordance with the directions of the Governing Body from time to time or regulations laid down for the same.
- A student admitted to the programs shall be governed by the rules, regulations and procedures framed and implemented by the University from time to time.
- The students shall abide by the regulations mentioned in student handbook issued by the University. These standing regulations shall deal with the discipline of the students in the Hostels, Faculty, and University premises or outside. The standing orders may also deal with such other matters as are considered necessary for the general conduct of the students' co-curricular and extra-curricular activities.

- In exceptional circumstances the chairman of Academic Council may, on behalf of the Council, approve amendments, modifications, Insertions or deletions of an Ordinance(s) which in his/her opinion is necessary or expedient for the smooth running of the program: provided all such changes are reported approved to the Council in its next meeting.

9. General Regulations for the BCA Programs:

- **Short Title and Commencement:** These regulations shall be called regulations for the UG programs in Faculty of Computational Science of the University and shall come into force on such a date as the Academic Council may approve.
- **Duration:** The undergraduate degree should be three or four-year, with multiple entries and exit options within this period. The duration of the UG programs leading to degrees of Computer Applications shall extend over four academic years (Eight Semesters) with multiple entries and exit options. The students can exit after the completion of one academic year (Two semesters) with the Certificate in Computer Applications; Diploma in Computer Applications after the study of Two academic years (Four Semesters); and Regular Bachelor Degree after the completion of Three academic years (Six Semesters). The successful completion of Four Years undergraduate Programmes would lead to Bachelor Degrees with Honours in Computer Applications. Each year will comprise of two semesters. The duration may be extended up-to two years for certificate in Computer Applications from the registered batch. The duration may be extended up-to four years for Diploma in Computer Applications from the registered batch. The duration may be extended up-to five years for Bachelor in Computer Applications from the registered batch. The duration may be extended up-to seven years for Bachelor in Computer Applications (Hons.) from the registered batch. The maximum duration of the programs excludes the period of withdrawal, due to medical reasons. However, it shall include the period of rustication or any other reason of discipline /academics e.g. detention, willful absence by the student, not getting promotion to the next class due to poor academic performance etc. Under detention, the student shall attend the University for an additional semester or more time, as equated to period of absence/suspension.
- **Starting or Phasing out of Program:** The University may offer such Undergraduate programs in Computational Science leading to award the degree in Bachelor of Computer Applications, as per nomenclature laid by the UGC regulations on the subject. A program may be phased out on recommendations of the Academic Council and approval of the Governing

Body, on account of continuous low registration in the program or any other justifiable reason like becoming obsolete etc. Similarly, the Academic Council may approve starting of a new program or modifying the existing one on the recommendations of the Academic Council.

- **Admissions:** Admission to BCA program shall be made as per procedure approved by the Governing Body and may be reviewed periodically as required. Fee structure, refund policy, total number of seats, reservation policy, and special category seats, e.g. sponsored seats, or direct entry into II year through lateral entry scheme etc. shall be defined in the admission policy.
- **Eligibility for Admission:** All those candidates who have the 10+2 or equivalent examination in any stream with 50% (45 % for SC/ST/OBC) marks in aggregate from any recognized board/ Council. **BCA (Lateral Entry):** It is a Under Graduate (UG) Program of 2 years duration (4 semesters) Eligibility: All those candidates who have passed Matriculation examination and have also passed 3 Year Diploma in any Trade from Punjab State Board of Technical Education & Industrial Training, Chandigarh or such Examination from any other recognized State Board of Technical Education, or Sant Longowal Institute of Engineering & Technology, Longowal.

Or

10+2 with 1-year Diploma in Computer Application / IT (or equivalent) from a recognized University with Mathematics as course at 10+2 or DIT / DCA level.

- **Semester System:** The BCA academic programs in the University shall be based on Semester System; namely, Even (Jan to June) and Odd (July to Dec) Semesters, in an academic year. The courses whether offered in regular semester shall be evaluated as per the policy and procedure laid down.
- **Semester Duration:** A semester will be of approximately 18-20 weeks duration. Of these, 90 days will be available for actual instructions including Mid Semester Exam.

10. Curriculum: The 4 years curriculum has been divided into eight semesters and shall include lectures/ tutorials/ laboratory work/project work/viva/seminars/presentations/ Industry Training/ assignments/ Industry Visits. The curriculum will also include other curricular, co-curricular and extra-curricular activities as may be prescribed by the university from time to time.

11. Choice Based Credit System:

The University has adopted Choice Based Credit System (CBCS), which provides an opportunity to the students to choose courses from the offered courses comprising of Core, Elective, Ability Enhancement and Audit Courses. The choice-based credit system provides a "flexible" approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Following are the types of courses and structure for the program.

12. Courses:

Outcome Based Education (OBE): OBE is a student-centric teaching and learning methodology in which the course delivery, assessment is planned to achieve, stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

I. Discipline Core Course (DCC): A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

II. Elective Course: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope, or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

i. Discipline Specific Elective (DSE) Course: Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

DSE: Twenty-four courses are offered, in semester V and VI and four courses in each bucket.

ii Vocational Courses (VC) Course: Vocational course is a course that enables individual to acquire skills set that are required for a particular job.

VC: Two VC Courses are offered each in semesters I, III, IV and VI.

Note: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Vocational Courses.

III. Foundation Course: The Foundation Courses may be of two kinds: Compulsory Foundation and Elective foundation. "Compulsory Foundation" courses are the courses based upon the content that leads to Knowledge enhancement. They are mandatory for all disciplines.

IV Ability Enhancement Courses (AEC): The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; i. Environmental Science and ii. English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

i. Ability Enhancement Compulsory Courses (AECC): Environmental Science, English Communication/MIL Communication.

ii. Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge

V. Project Work: It is considered as a special course involving application of knowledge in solving/analysing/exploring a real-life situation/difficult problem. A candidate study such as a course on his own with an advisory support by a teacher/faculty member. The work dine will have to submitted in writing.

VI. Industrial Internship/ Training: Students must complete Industrial Internship/ Training during summer holidays after the fourth semester. They have to submit a report of internship training with the necessary documents and have to appear for a viva-voce examination during fifth semester. The internship/Training will be evaluated in the fifth semester.

VII. Research Project: It is considered as a special course involving the application of knowledge in solving/analysing/exploring a real-life situations and difficult problem for a bachelor degree with honours/research.

13. Medium of Instructions:

a. The medium of instructions and examination will be English.

b. Practical work/Project Work / Project Report / Dissertation / Field Work Report / Training Report etc., if any, should be presented in English.

14. Mode: The program is offered in 'Full Time' mode of study only.

15. Attendance Requirement to be Eligible to Appear in End Semester Examination:

15.1 Every student is required to attend at least 75% of the lectures delivered: squaring tutorials, practical and other prescribed curricular and co-curricular activities.

15.2 Dean of Faculty may give a further relaxation of attendance up to 5% to a student provided that he/she has been absent with prior permission of the Dean of the Faculty for the reasons acceptable to him/her.

15.3 Further, relaxation up to 10% may be given by the Vice Chancellor to make a student eligible under special circumstances only.

15.4 No student will be allowed to appear in the end semester examination if he/she does not satisfy the attendance requirements. Further, the attendance shall be counted from the date of admission in the University or commencement of academic session whichever is later.

15.5 Attendance of N.C.C/N.S.S. Camps or Inter collegiate or Inter University or Inter State or International matches or debates or Educational Excursion or such other Inter University activities as approved by the authorities involving journeys outside the city in which the college is situated will not to be counted as absence. However, such absence shall not exceed four weeks per semester of the total period of instructions. Such facility should not be availed twice during the course of study.

16. Grading System: University follows eight letter grading system (A+, A, B+, B, C+, C, D, and F) that have grade points with values distributed on a 10-point scale for evaluating the performance of student. The letter grades and the corresponding grade points on the 10-point scale are as given in the table below.

Academic Performance	Range of marks	Grades	Grade Points
Outstanding	≥90	A+	10
Excellent	≥80 & < 90	A	9
Very Good	≥70 & < 80	B+	8
Good	≥60 & < 70	B	7
Fair	≥50 & < 60	C+	6
Average	>40 & < 50	C	5
Minimally Acceptable	40	D	4
Fail	< 40	F	0
Incomplete		I	–
Withdrawal		W	–
Grade Awaited		GA	–
S-Satisfactory, US-Unsatisfactory Minor Project		**S/US**	

Description of Grades:

a) D Grade: The D grades stands for marginal performance, i.e. it is the minimum passing grade in any course. D grade shall not be awarded below 30% marks, though each teacher may set higher marks for same.

b) F Grade: The 'F' grade denotes a very poor performance, i.e. failing a course. A student has to repeat all courses in which she/he obtains 'F' grade, until a passing grade is obtained. In the case of 'F', no Grade points are awarded. However, the credits of such courses shall be used as denominator for calculation of GPA or CGPA.

c) W Grade: The 'W' grade is awarded to a student if he/she is allowed to withdraw for an entire Semester from the University on medical grounds for a period exceeding five weeks.

d) I" Grade: The 'I' grade is awarded when the student is allowed additional opportunity like

make up Examination etc. based on which the grade is to be decided along with other components of the evaluation during the semester 24 An incomplete grade of 'I' may be given when an unforeseen emergency prevents a student from completing the work in a course. The 'I' must be converted to a performance grade (A to F) within 90 days after the first day of classes in the subsequent regular semester.

e) X Grade: It is equivalent to Fail grade but awarded due to student falling below the laid down attendance requirement. Students having X grade shall be required to re-register for the course, when offered next.

Cumulative Grade Point Average (CGPA), it is a measure of overall cumulative performance of a student over all 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 decimals places.

NB: The CGPA can be converted to percentage by using the given formula:

CGPA x 10 = %

e.g. 7.8 x 10 = 78%

Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (Course title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

16.1 Acceptance of MOOC courses

Faculty of Faculty of Computational Science accepts the MOOC course available on SWAYAM platform for credit transfer. 40% of the courses can be taken from the available list of MOOCs on SWAYAM.

1. Instructions for MOOC courses

2. MOOC courses taken for credit transfer must be approved and recommended by Dean Academics and Dean of the Faculty before the start of the semester.

3. The copy of the list of courses taken by the students for any course has to be submitted to the Controller of the Examination.

4. MOOC course should be done from SWAYAM platform as per the guidelines of UGC.

To obtain the credit the student needs to complete the assessment of the course and provide the certificate of the course issued by the SWAYAM/NPTEL. After completing the certificate, the student must submit the certificate within a week to the department.

6. The fees (if any) for the registration and / or assessment of the MOOC course must be borne by the student only.

7. The student can opt for a particular online MOOC course if and only if the credit of that course is equivalently mapped with the program structure.

8. If the student obtains the same course credit which mapped with the course, then credit shall be considered for this course and the grade/marks provided by the accessing authority shall be transfer to the student. The result of the MOOC shall be taken on record by the university examination cell and a result declared for these papers.

9. For any particular semester, all results for the MOOC course must be submitted along with the marks of other papers of the same semester by the course coordinator.

10. MOOC course coordinators shall be appointed for each of the course taken by the student.

17. Credit: Each course, except a few special audit courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and/or laboratory contact hours in a week. A letter grade, corresponding to specified number of grade points, is awarded in each course for which a student is registered. On obtaining a pass grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average. A minimum number of credits should be acquired to qualify for the programs. The absolute grading system has been followed for awarding grades in a course.

Earned Credits (EC): The credits assigned to a course in which a student has obtained 'D' (minimum passing grade) or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained F, or W or "I" grade will not be counted towards his/her earned credits. A unit by which the course is measured. It determines the number of hours of instruction required per week.

Contact Hours per Week	Credit Assigned
1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
2 Hours Practical (Lab) per week	1 credit

PROGRAM STRUCTURE MODEL FOUND APPROPRIATE AND ADOPTED
Program Structures for the Under-Graduate Program (Bachelor of Science (DMSN))

Bachelor of Computer Applications	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC), (Credits) (L+T+P)	Vocational Courses (VC), (Credits) (L+T+P)	Skill Enhancement Courses (SEC) (L+T+P)	Projects (L+T+P) /Industrial Training	Total credits
Semester 1	DSC-1 papers (5) (3+1+2), DSC-1 papers (6) (3+1+4), DSC-1 papers (4) (3+1+0), DSC-1 papers (1) (0+0+2),		AECC-1, papers(3)(2+0+2), AECC-1 papers(2)(2+0+0)	VC-1 papers (3) (3+0+0)			24
Semester 2	DSC-1 papers(6) (3+1+2), DSC-1 papers(4) (3+0+4), DSC-1 papers(3) (3+1+0) DSC-1 papers(6) (3+0+2),		AECC-1, papers(3)(2+0+2), AECC-1 papers(2)(2+0+0)				24
Exit option with Certificate (48 credits); Certificate in Computer Applications							
Semester 3	DSC-1 papers (6) (3+1+4), DSC-2 papers (5) (3+1+2), DSC-1 papers (3) (3+0+0)			VC-1 papers(3)(3+0+0),	SEC-1 papers(3)(2+0+2),		25
Semester 4	DSC-1 papers(3) (3+0+0), DSC-2 papers(6) (3+1+4), ,		AECC-1 papers (2)(2+0+0)	VC-1 papers(3)(3+0+0),	SEC-1 papers(3)(3+0+2),		23
Exit option with Diploma (96 credits); Diploma in Computer Applications							
Semester 5		DSC-3 papers(5) (3+0+4)		VC-1 papers(3)(3+0+0),	SEC-1 papers(3)(2+0+2),	Minor Project (1) (0+0+2), Industrial Training(2)	24
Semester 6		DSC-3 papers(6) (3+1+4) DSC-3 papers(5) (3+1+2)			SEC-1 papers(3)(2+0+2),	Major Project (2) (0+0+4)	20
Exit option with Bachelors (140 credits); Bachelors in Computer Applications							
Semester 7	DSC-2 papers(6) (3+1+4), DSC-2 papers(3) (3+0+0), ,					Research Project (4) (0+0+8)	22
Semester 8	DSC-1 papers(6) (3+1+4), DSC-2 papers(4) (3+1+0), , DSC-1 papers(5) (3+1+2)					Research Project II (4) (0+0+8)	23
Award of Bachelor (Hons.) (185 credits); Bachelors in Computer Applications (Hons.)							

18. Industrial Training:

- Industrial training is a core course, to be done typically during the summer vacations. A student should undergo industrial training for 4-6 weeks, starting after year 2, preferably in an industry, R & D institutions or in an academic institution is of repute permitted. Training of 4th semester shall be graded and is essential part of the degree requirement in 5th semester.
- It is the responsibility of the Corporate Relations Department (CRD) to arrange training for all the students. In the beginning of each academic session, Corporate Relations Department will prepare a program wise list of potential training organizations. These organizations will be approached by the Corporate Relations Department with a request to provide training seats. Consolidated lists of training offers will be made available to the eligible students in the beginning of even semester of the session. If a student is interested in making his/her own arrangement for the training seat, he/she will need to have the training organization approved by routing the application to the Dean of Faculty of Computational Science for approval.
- The students will be required to get their training activity and results reviewed by organization in which they have attended the training. Each Faculty shall nominate training coordinator from amongst the faculty members. The faculty will scrutinize the training report and the certificate issued by the corporate and will award a satisfactory/unsatisfactory grade, which must be sent to the controller of examination office within one month of commencement of next semester. In case the training is considered to be unsatisfactory, an Unsatisfactory' grade will be awarded, and the student shall have to undergo fresh industrial training in part or full duration as decided by the Dean of Faculty of Computational Science. The industrial training, submission of training report and obtaining satisfactory grade is mandatory requirement for award of BCA degree

19.Minor Project: A project shall be a multifaceted assignment that serves as a culminating academic and intellectual experience for students, typically during the 5th semester at the University. The project may take a wide variety of forms, but they shall be semester-long investigative projects that culminate in a final product, presentation, or performance.

20.Major Project: A major project shall be a multifaceted assignment that serves as a culminating academic and intellectual experience for students, typically during their final year at the University. Major projects may take a wide variety of forms, but they shall be Semester long investigative projects that culminate in a final product, presentation, or performance. In projects under the guidance of a faculty member, a final year student is required to do some innovative work with application of knowledge earned while undergoing various courses and labs in the earlier years. The student is expected to do literature survey and carry out development and/or experimentation. Through the project work the student must exhibit both the analytical and practical skills. The student will have to do his/her project under the guidance of the faculty member from the same department unless specifically permitted by the Head of the Department for alternate arrangements.

21.Research Project: A design to acquire special/advanced knowledge such as supplement study/support study to a project work and a student course independently with an advisory support by a teacher/faculty member is called research project. It is considered as a special course involving the application of knowledge in solving/analyzing/exploring a real-life situations and difficult problem for a bachelor degree with honors/research. Research projects may take a wide variety of forms, but they shall be Semester long investigative projects that culminate in a final product, presentation, or performance. In projects under the guidance of a faculty member, a final year student (honors) is required to do some innovative research work. The student is expected to do literature survey and carry out development and/or experimentation. The student will have to do his/her project under the guidance of the faculty member from the same department unless specifically permitted by the Head of the Department for alternate arrangements.

22. Examination/Evaluation System: The evaluation system of the University shall be oriented to encourage the academic qualities. The University follows two components to evaluate student's performance:

22.1 Internal Assessment: It includes components such as Attendance, Mid-Semester Examination, Assignments, and Continuous Assessment Test carrying a weightage of 40%. This is applicable to all theory courses.

22.2 Laboratory Courses: The examination/evaluation criteria of the practical courses shall be decided by the respective faculty member and wherever required on the availability of the external experts/visiting faculty. Faculty may set/design the practical exercises out of any marks, but the overall weightage shall be in pre-defined percentage, which the concerned faculty/course coordinator shall announce in the first class of the semester and upload on the

GU-MS. Methodology for evaluation of Lab component may include day to day work, lab records, quantity/quality of work and Viva-voce/Seminar/Practical as may be decided.

22.3 Laboratory Internal Assessment: It includes components Lab Evaluation, Internal viva, Attendance and Practical File/Report Submission carrying a weightage of 60%. The internal marks of special courses like Project, summer industry training, and six-month industry training has been predefined.

22.4 External Assessment:

a) **End Semester Examination:** These examinations shall be conducted by Controller of Examination. The examination dates and schedule shall be released by the University.

b) End Semester Examination, carrying a weightage of 60%.

c) The external marks of special courses like Project, summer industry training, and six-month industry training has been predefined.

d) External Lab Assessment which includes components (Demonstration/Written Practical Examination, External Lab Viva-Voce) carrying a weightage of 40 %.

e) Every student has to score at least 25% marks each in Continuous Assessment and End Semester Examination. The minimum pass percentage is 40% in aggregate. In case a student scores more than 25% each in Continuous Assessment and End Semester Examination, but the overall percentage in the concerned subject remains less than 40%, then a student has to repeat End Semester Examination in that subject.

22.5 Failing to meet Attendance Requirement:

a) A student is required to attend all the classes.

b) If the attendance profile of a student is unsatisfactory, he/she will be debarred. Any student, who has been debarred due to attendance shortage, shall not be allowed to take the supplementary Examination. The student shall have to register for the course in the regular semester when offered.

22.6 Make Up Examinations for Mid Semester Examination: A student may apply for a makeupexamination where he/she is not able to attend the examination schedule due to reasons of personal medical condition or compassionate reason like death of a very close relative. No other contingencies are acceptable. Except in case of medical emergency, a student needs to seek advance approval from appropriate authority before missing the Examination.

Theory Courses:

- A student missing Mid Term Examination only shall be required to take a make-up Examination.
- The students must put-up the request for make-up Examination along with the medical documents to prove the genuineness of the case (for having missed the Examination) within 5 days of last date of Examination.
- The genuineness shall be reviewed and approved by the Vice Chancellor, whose decision shall be final.
- In case a student misses the make-up Examination also, then no further chance will be provided.
- The duration of Examination shall be as decided by the Faculty member.
- Genuine approved cases shall be notified by the Controller of Examination based on the requests received and only such students shall be allowed to take make-up Examination in the subjects where approval has been granted.
- The date sheet need not be taken out as the makeup examination shall be conducted under arrangement concerned faculty, who after evaluation and sharing the evaluated answer sheet with student shall submit marks to the Controller of Examination.

22.7 Makeup of End Semester Examination: It is mandatory to appear the end semester major examination to obtain any grade for a course. A student who misses the end semester major examination shall follow a similar procedure as outlined above, to obtain approval of the Vice Chancellor to prove genuineness of the case. The student whose case is approved as genuine shall be awarded "I" Grade in the semester results in the given subject. The student shall be allowed to appear in the supplementary examination of the said subject. However, the grades shall be worked out by computing the marks obtained by students in Mid Term Exams, TA, Lab and supplementary examination (equated to the weightage of end semester examination). The total marks shall be compared with the marks of the class as in the regular semester for award of grade.

22.8 Makeup of End Semester Viva of Projects: It is mandatory to appear in the final Viva examination to obtain any grade for a project course. In case of student missing the same for genuine reasons; similar method as given for written examination of theory courses shall be followed.

22.9 Procedure to be adopted by students in case of missing any of the specified

Examination(s): Following procedure shall be adopted for establishing genuineness of the case.

a. Action by the student (Medical Cases)

I. They should report absence from the Examination(s) by fastest possible means to the Controller of Examination. It could be email or written communication by speed post or sent by hand through any means. In case of Hosteller's, if a student falls sick while residing in the hostel, he/she should seek advice of the available qualified doctor.

II. The said report should preferably be sent prior to the Examination, but not later than 5 days after the last date of the said Examination.

III. The student should on rejoining:

a. Report to the Controller of Examination with complete medical documents to include referral/Prescription slip of the doctor specifically indicating the disease and medicine prescribed, investigation/Lab reports and discharge slip in case of admission should be provided.

b. Submit the Documents to the Controller of Examination, not later than 5 days after the last date of Examination.

IV. In case delay beyond 5 days is anticipated the student should arrange for the medical documents to be sent to the University Medical Officer by hand through a friend / relative etc. and get the said genuineness deposit with the Controller of Examination.

V. No request later than 5 days after the last date of Examination shall be accepted for reasons of ignorance or any other reasons.

b. Action by students (any other reason)

In case the student must miss Examination due to genuine reason other than medical, prior written sanction of Vice Chancellor and in his absence, Dean is mandatory. No post facto requests shall be accepted in any case. The approval should be deposited with the Controller of Examination before the examination.

23. Supplementary Examination:

23.1 The supplementary examinations shall be held for each commiserating semester in December for Odd semester and May/June for Even semester, respectively. For the final semester students, there is privilege to appear in the supplementary exams of all pervious semester.

23.2 Eligibility: Student with 'F' grade is eligible to appear in the Supplementary Examination.

23.3 Supplementary for Projects: There shall be no supplementary examinations for the projects, except make up examination for missing the final viva as per rules outlined above.

24. General Rules: Examinations:

a) Showing the Answer Scripts: The answer scripts of all written Examinations i.e. Mid Term or end semester examination or any other written work conducted by a teacher shall be shown to the students. Students desirous of seeing the marked answer scripts of end Semester Examination, has to ensure their presence before results are declared, as per dates notified by the Controller of Examination.

b) Marks/Answer Sheets of all other tests shall also be shared with the students and thus, there shall be no scrutiny of grades. However, before the grades are forwarded to Registrar/Controller of Examination, they should be displayed on GU-MS and time given to students, to discuss the same with respective faculty.

c) No appeal shall be accepted for scrutiny of grades.

d) Examination Fee for Supplementary. A fee of Rs.1000/- per course or as decided by the Management from time to time will be charged from the students.

25. Improvement of overall Score: A candidate having CGPA < 5.5 and wishes to improve his/her overall score may do so within two academic years immediately after passing the degree program by reappearing into maximum four course(s)/subject(s). The improvement would be considered if and only if the CGPA becomes > 5.5.

26. Program qualifying criteria: For qualifying the Program every student is required to earn prescribed Credits as follows:

a) Certificate in Digital Marketing and social Networks **(48 credits)**

b) Diploma in Digital Marketing and social Networks **(96 credits)**

c) Bachelors in Digital Marketing and social Networks **(140 credits)**

d) Bachelor in Digital Marketing and social Networks **(Hons.) (185 credits)**

If any student fails to earn prescribed credits for the program, then he/she will get a chance to complete his/her Program in two more years than the actual duration of degree.

If any student fails to earn prescribed credits for the program, then he/she will get a chance to complete his/her Program in two more years than the actual duration of degree.

27. Revision of Regulations, Curriculum and Syllabi: The University may revise, amend, change or update the Regulations, Curriculum, Syllabus and Scheme of examinations through

vii. Should complete the requirements of the certificate/ Diploma/ Degree/ Honours Degree in maximum duration specified for the program. Semester withdrawals due to medical reasons are not counted in two years in certificate, four years for Diploma, six years in Bachelor, eight years in Honour degree. However, forced withdrawal of students e.g. rustication or expulsion or nonattendance by student due to any other reasons, shall count in the maximum period of two years for Certificate, four years for Diploma, six years for Bachelor degree and eight years for Honour degree and minimum period of two years for Certificate, three years for Diploma, four years for Bachelor degree and five years for Honour degree.

viii. Successfully completing the Internship/Training.

ix) Should have cleared all the foundational and core courses of the programs. In case of lateral entry students (direct entry into second year) the student should have completed the foundational/core courses/equivalent courses, as approved at the time of admission in the programs.

28. Conditions for Award of a Certificate/Diploma/Degree/Honours:

On successful scoring of minimum 4 grade points in all courses of the program, the Certificate/Diploma/Degree/Honours Degree shall be awarded for the candidate.

Classification of Successful Candidates: Grades

The results of successful candidates at the end of II, IV, VI and VIII semesters shall be classified on the basis of Cumulative Grade Point Average (CGPA) obtained in all the II, IV, VI and VIII semesters and Cumulative Grade Point Average (CGPA) for award of:

a) Award the Certificate course in Faculty of Computational Science for completion of first two semesters if the candidate wishes to exit.

b) Award the Diploma course in Faculty of Computational Science for completion of first four semesters in the program if the candidate wishes to exit.

c) Award the Bachelor's Degree in Faculty of Computational Science on completion of first six semesters in the program if the candidate wishes to exit.

d) Award the Bachelor degree with Honours in Faculty of Computational Science for completion of all the eight semesters of the program.

e) Nomenclature of the certificate, diploma, and degrees is mentioned in BCA Program Structure Model.

f) Earning a minimum credit as specified in the curriculum of respective program. In case of lateral entry students (direct entry into second year) the minimum credits shall be equivalent to total credits for the program less the credits of first year. This excludes the credits required to be obtained by the student of lateral entry, who is advised to take some equivalence courses.

g) Should complete the requirements of the certificate/ Diploma/ Degree/ Honours Degree in maximum duration specified for the program. Semester withdrawals due to medical reasons are not counted in two years in certificate, four years for Diploma, six years in Bachelor, eight years in Honour degree. However, forced withdrawal of students e.g. suspension or expulsion or nonattendance by student due to any other reasons, shall count in the maximum period of two years for Certificate, four years for Diploma, six years for Bachelor degree and eight years for Honour degree and minimum period of two years for Certificate, three years for Diploma, four years for Bachelor degree and five years for Honour degree.

h) Successfully completing the Internship/Training.

I) Should have cleared all the foundational and core courses of the programs. In case of lateral entry students (direct entry into second year) the student should have completed the foundational/core courses/equivalent courses, as approved at the time of admission in the programs.

Bachelor of Computer Application Semester I (First year) (CERTIFICATE)

Sr. No	Category	Course Code	Course Title	Teaching Scheme			credits	Hours	Examination Scheme		Total
				L	T	P			Internal	External	
1	Discipline Specific Core Courses-1	BCA101	Computer fundamentals & IT	3	1	0	4	4	40	60	100
2	Discipline Specific Core Courses-1	BCA121	Computer fundamentals & IT Lab	0	0	2	1	2	30	20	50
3	Discipline Specific Core Courses-2	BCA102	Problem Solving using C	3	1	0	4	4	40	60	100
4	Discipline Specific Core Courses-2	BCA122	Problem Solving using C Lab	0	0	4	2	4	30	20	50
5	Discipline Specific Core Courses-2	BCA103	Fundamentals of Mathematics	3	1	0	4	4	40	60	100
6	Discipline Specific Core Courses-2	BCA124	Workshop on HTML/CSS	0	0	2	1	2	30	20	50
7	Ability Enhanced compulsory Courses-1	COM101	English Communication	2	0	0	2	2	40	60	100
8	Ability Enhanced compulsory Courses-1	COM121	English Communication Lab	0	0	2	1	2	20	30	50

9	Ability Enhanced compulsory Courses-2	ENS001	Environmental Studies	2	0	0	2	2	40	60	100
10	Vocational Courses-1	***	VC***	3	0	0	3	3	20	30	50
		Total Credits		**16**	**3**	**10**	**24**	**29**	**330**	**420**	**750**

Bachelor of Computer Application Semester II (First year)(CERTIFICATE)

Sr. No	Category	Course Code	Course Title	Teaching Scheme			credits	Hours	Examination Scheme		Total
				L	T	P			Internal	External	
1	Discipline Specific Core Course-5	BCA206	Principles of Operating Systems	3	1	0	4	4	40	60	100
2	Discipline Specific Core Course-5	BCA226	Principles of Operating Systems Lab	0	0	2	1	2	30	20	50
3	Discipline Specific Core Course-6	BCA202	Object Oriented Programming with C++	3	1	0	4	4	40	60	100
4	Discipline Specific Core Course-6	BCA222	Object Oriented Programming with C++ Lab	0	0	4	2	4	30	20	50
5	Discipline Specific Core Course-7	BCA203	Mathematics for Computer Science	3	1	0	4	4	40	60	100
6	Discipline Specific Core Course-8	BCA207	Digital Circuit and Logic Design	3	0	0	3	3	40	60	100
7	Discipline Specific Core Course-8	BCA227	Digital Circuit and Logic Design Lab	0	0	2	1	2	30	20	50
8	Ability Enhanced compulsory Courses-2	COM201	Business Communication	2	0	0	2	2	40	60	100
9	Ability Enhanced compulsory Courses-2	COM221	Business Communication Lab	0	0	2	1	2	20	30	50
10	Ability Enhanced compulsory Courses-3	HVPE101	Human Values & Professional Ethics	2	0	0	2	2	40	60	100
	Total Credits			**16**	**3**	**10**	**24**	**29**	**350**	**450**	**800**

Bachelor of Computer Application Semester III (Second year)(DIPLOMA)

Sr. No	Category	Course Code	Course Title	Teaching Scheme			credits	Hours	Examination Scheme		Total
				L	T	P			Internal	External	
1	Discipline Specific Core Course-9	BCA307	Data structures and Algorithms	3	1	0	4	4	40	60	100
2	Discipline Specific Core Course-9	BCA327	Data structures and Algorithms Lab	0	0	4	2	4	30	20	50
3	Discipline Specific Core Course-10	BCA313	Database Management Systems	3	1	0	4	4	40	60	100
4	Discipline Specific Core Course-10	BCA333	Database Management Systems Lab	0	0	2	1	2	30	20	50
5	Discipline Specific Core Course-11	BCA308	Programming in Python	3	1	0	4	4	40	60	100
6	Discipline Specific Core Course-11	BCA328	Programming in Python Lab	0	0	2	1	2	30	20	50
7	Discipline Specific Core Course-12	BCA309	Computer Architecture	3	0	0	3	3	40	60	100
8	Vocational Courses -2	***	VC2	3	0	0	3	3	40	60	100
9	Skill Enhancement Course-1	***	SEC-1	2	0	0	2	2	40	60	100
10	Skill Enhancement Course-1	***	SEC-1 Lab	0	0	2	1	2	30	20	50
	Total			**17**	**3**	**10**	**25**	**30**	**360**	**440**	**800**

Bachelor of Computer Application Semester IV (Second year) (DIPLOMA)

Sr. No	Category	Course Code	Course Title	Teaching Scheme			credits	Hours	Examination Scheme		Total
				L	T	P			Internal	External	
1	Discipline Specific Core Course-13	BCA401	Software Engineering	3	0	0	3	3	40	60	100
2	Discipline Specific Core Course-14	BCA413	Computer Networks	3	1	0	4	4	40	60	100
3	Discipline Specific Core Course-14	BCA433	Computer Networks Lab	0	0	4	2	4	30	20	50
4	Discipline Specific Core Course-15	BCA402	Java Programming	3	1	0	4	4	40	60	100
5	Discipline Specific Core Course-15	BCA422	Java Programming Lab	0	0	4	2	4	30	20	50
6	Skill Enhancement Course -2	***	SEC-2	2	0	0	2	2	40	60	100
7	Skill Enhancement Course -2	***	SEC-2 Lab	0	0	2	1	2	30	20	50
8	Vocational Courses -3	***	VC***	3	0	0	3	3	40	60	100
9	Ability Enhanced compulsory Courses-5	GWE101	Gender Equality and Women Empowerment	2	0	0	2	2	40	60	100
		Total Credits		**16**	**2**	**10**	**23**	**28**	**330**	**420**	**750**

Note: -The students will take 4-6 weeks summer training in Industry after semester 4th and evaluate in 5th semester.

Bachelor of Computer Application Semester Semester V (Third year) (BACHELOR DEGREE)

Sr. No	Category	Course Code	Course Title	Teaching Scheme			credits	Hours	Examination Scheme		Total
				L	T	P			Internal	External	
1	Skill Enhancement Course -3	***	SEC-3	2	0	0	2	2	40	60	100
2	Skill Enhancement Course -3	***	SEC-3 Lab	0	0	2	1	2	30	20	50
3	Discipline Specific Elective Course-1	***	DSE-1	3	0	0	3	3	40	60	100
4	Discipline Specific Elective Course-1	***	DSE-1 Lab	0	0	4	2	4	30	20	50
5	Discipline Specific Elective Course-2	***	DSE-2	3	0	0	3	3	40	60	100
6	Discipline Specific Elective Course-2	***	DSE-2 Lab	0	0	4	2	4	30	20	50
7	Discipline Specific Elective Course-3	***	DSE-3	3	0	0	3	3	40	60	100
8	Discipline Specific Elective Course-3	***	DSE-3 Lab	0	0	4	2	4	30	20	50
9	Vocational Coures-4	***	VC***	3	0	0	3	3	40	60	100
10	Project	BCA529	Minor Project	0	0	2	1	2	40	60	100
11	Industry Training	BCA530	Industrial Training	-	-	-	2	-	-	-	100
Total Credits				**14**	**0**	**16**	**24**	**30**	**360**	**440**	**900**

Bachelor of Computer Application Semester VI (Third year) (BACHELOR DEGREE)

Sr. No	Category	Course Code	Course Title	Teaching Scheme			credits	Hours	Examination Scheme		Total
				L	T	P			Internal	External	
1	Discipline Specific Elective Course-4	BCA***	DSE-4	3	0	0	3	3	40	60	100
2	Discipline Specific Elective Course-4	BCA***	DSE-4 Lab	0	0	4	2	4	30	20	50
3	Discipline Specific Elective Course-5	BCA***	DSE-5	3	0	0	3	3	40	60	100
4	Discipline Specific Elective Course-5	BCA***	DSE-5 Lab	0	0	4	2	4	30	20	50
5	Discipline Specific Elective-6	BCA***	DSE-6	3	0	0	3	3	40	60	100
6	Discipline Specific Elective Course -6	BCA***	DSE-6 Lab	0	0	4	2	4	30	20	50
7	Skill Enhancement Course-4	BCA***	SEC-4	2	0	0	2	2	40	60	100
8	Skill Enhancement Course-4	BCA***	SEC-4 Lab	0	0	2	1	2	30	20	50
9	Project	BCA625	Major Project	0	0	4	2	4	40	60	100
		Total		**11**	**0**	**18**	**20**	**29**	**320**	**380**	**700**

Bachelor of Computer Application Semester VII (Fourth year) (HONOURS DEGREE)

Sr. No	Category	Course Code	Course Title	Teaching Scheme			credits	Hours	Examination Scheme		Total
				L	T	P			Internal	External	
1	Discipline Specific Core Course-16	BCA701	Design and Analysis of Algorithm	3	1	0	4	4	40	60	100
2	Discipline Specific Core Course-16	BCA721	Design and Analysis of Algorithm Lab	0	0	4	2	4	30	20	50
3	Discipline Specific Core Course-17	BCA702	Research Methodology	3	0	0	3	3	40	60	100
4	Discipline Specific Core Course-18	BCA703	Advanced Software Engineering	3	0	0	3	3	40	60	100
5	Discipline Specific Core Course-19	BCA704	Natural Language Processing	3	1	0	4	4	40	60	100
6	Discipline Specific Core Course-19	BCA724	Natural Language Processing Lab	0	0	4	2	4	30	20	50
7	Project	BCA750	Research Project-I	0	0	8	4	8	80	120	200
		Total Credits		**12**	**2**	**16**	**22**	**30**	**300**	**400**	**700**

Bachelor of Computer Application Semester VIII (Fourth year) (HONOURS DEGREE)

Sr. No	Category	Course Code	Course Title	Teaching Scheme			credits	Hours	Examination Scheme		Total
				L	T	P			Internal	External	
1	Discipline Specific Core Course-20	BCA801	Advanced Data Base Management System	3	1	0	4	4	40	60	100
2	Discipline Specific Core Course-20	BCA821	Advanced Data Base Management System Lab	0	0	4	2	4	30	20	50
3	Discipline Specific Core Course-21	BCA802	Advance Computer Architecture	3	1	0	4	4	40	60	100

4	Discipline Specific Core Course-22	BCA803	Blockchain Technologies	3	1	0	4	4	40	60	100
5	Discipline Specific Core Course-23	BCA804	Digital Image Processing	3	1	0	4	4	40	60	100
6	Discipline Specific Core Course-23	BCA824	Digital photoshop Processing Lab	0	0	2	1	2	30	20	50
7	Project	BCA850	Research Project-II	0	0	8	4	8	80	120	200
		Total		**12**	**4**	**14**	**23**	**30**	**300**	**400**	**700**

Course Structure
Bachelor of Computer Applications BCA

Sr. No	Category Type	Course code	Course Name
1	Core-1	BCA101	Computer fundamentals & IT
2	Core-2	BCA102	Problem Solving using C
3	Core-3	BCA103	Fundamentals of Mathematics
4	Core-4	BCA206	Principals of Operating Systems
5	Core-5	BCA202	Object Oriented Programming with C++
6	Core-6	BCA203	Mathematics for Computer Science
7	Core-7	BCA207	Digital Circuit and Logic Designs
8	Core-8	BCA307	Data Structures and Algorithms
9	Core-9	BCA302	Computer Networks
10	Core-10	BCA308	Programming in Python
11	Core-11	BCA309	Computer Architecture
12	Core-12	BCA401	Software Engineering
13	Core-13	BCA408	Database Management Systems
14	Core-14	BCA402	Java Programming
15	Core-15	BCA701	Design and Analysis of Algorithms
16	Core-16	BCA702	Research Methodology
17	Core-17	BCA703	Advanced Software Engineering
18	Core-18	BCA704	Natural Language Processing
19	Core-19	BCA801	Advanced Data Base Management System
20	Core-20	BCA802	Advance Computer Architecture
21	Core-21	BCA803	Blockchain Technologies
22	Core-23	BCA804	Digital Image Processing

Core Courses (Laboratory)

Sr. No	Category Type	Course code	Course Name
1	Core-1	BCA121	Computer fundamentals & IT Lab
2	Core-2	BCA122	Problem Solving using C Lab
3	Core-4	BCA124	Workshop on HTML/CSS
4	Core-5	BCA226	Principals of Operating Systems Lab
5	Core-6	BCA222	Object Oriented Programming with C++ Lab
6	Core-8	BCA227	Digital Circuit and Logic Design Lab
7	Core-9	BCA327	Data Structures and Algorithms Lab
8	Core-10	BCA322	Computer Networks Lab
9	Core-11	BCA328	Programming in Python Lab
10	Core-14	BCA428	Database Management Systems Lab
11	Core-15	BCA422	Java Programming Lab
12	Core-16	BCA721	Design and Analysis of Algorithms Lab
13	Core-19	BCA724	Natural Language Processing Lab
14	Core-20	BCA821	Advanced Data Base Management System
15	Core-23	BCA824	Digital Image Processing Lab

A) Ability Enhanced Compulsory Courses (AECC)

Sr. No	Category Type	Course code	Course Name
1	AECC1	COM101	English Communication
2	AECC2	ENS1001	Environmental Studies
3	AECC3	COM201	Business Communication
4	AECC4	HVPE101	Human Values and Professional Ethics
5	AECC5	GWE101	Gender Equality and Women Empowerment

B) Ability Enhanced Compulsory Courses (AECC) Laboratory

Sr. No	Category Type	Course code	Course Name
1	AECC3	COM221	Business Communication Lab
2	AECC1	ENS121	English Communication Lab

C) Vocational Courses (VC)

Sr. No	Category Type	Course code	Course Name
1	VC1	BCA105	HRM for IT Manager
2	VC1	BCM101	Financial Accounting
3	VC2	CAM101	Digital Design
4	VC2	BAM102	Digital Illustration and Image Processing
5	VC3	BCA410	Fundamentals of Digital Marketing
6	VC3	BCA411	Search Engine Optimization
7	VC4	BAM203	Print Media & Advertisement Design
8	VC4	BCA516	E-Content Development

D) Skill Enhanced Course (SEC)

Sr. No	Category Type	Course code	Course Name
1	SEC1-1	BCA310	Web Development
2	SEC1-1	BCA311	PHP and MySQL
3	SEC2-2	BCA409	Linux Operating System
4	SEC2-2	BCA406	Linux & Shell Programming
5	SEC3-3	BCA515	Open-Source Programming
6	SEC3-3	BCA517	Full Stack Development
7	SEC4-4	BCA615	ASP.NET
8	SEC4-4	BCA616	Mobile App Development

E) Skill Enhanced Course (SEC) Laboratory

Sr. No	Category Type	Course code	Course Name
1	SEC1-1	BCA330	Web Development Lab
2	SEC1-1	BCA331	PHP and MySQL Lab
3	SEC2-2	BCA429	Linux Operating System Lab
4	SEC2-2	BCA426	Linux & Shell Programming Lab
5	SEC3-3	BCA535	Open-Source Programming Lab
6	SEC3-3	BCA537	Full Stack Development Lab
7	SEC4-4	BCA635	ASP.NET Lab
8	SEC4-4	BCA636	Mobile App Development Lab

F))Discipline Specific Elective (DSE)

Sr. No	Category Type	Course code	Course Name
1	DSE-1	BCA503	System Programming
2	DSE-1	BCA511	Relational Database Management System
3	DSE-1	BCA512	Artificial Intelligence
4	DSE-1	BCA513	Cryptography & Information Security
5	DSE-2	BCA509	Software Testing
6	DSE-2	BCA506	Advanced Java Programming
7	DSE-2	BCA510	R Programming
8	DSE-2	BCA511	Cyber Security
9	DSE-3	BCA512	Data Analytics
10	DSE-3	BCA508	Computer Graphics
11	DSE-3	BCA513	Machine Learning with Python
12	DSE-3	BCA514	Information Security
13	DSE-4	BCA607	Programming with C#
14	DSE-4	BCA602	Cloud Computing
15	DSE-4	BCA608	Data Science
16	DSE-4	BCA609	Network Security
17	DSE-5	BCA610	Programming with C#.NET
18	DSE-5	BCA604	Data Warehouse and Mining
19	DSE-5	BCA601	Big Data Analytics
20	DSE-5	BCA611	Cyber Forensics
21	DSE-6	BCA612	DEVOPS
22	DSE-6	BCA613	Internet of Things
23	DSE-6	BCA614	Data Visualization
24	DSE-6	BCA605	Ethical Hacking

G) Discipline Specific Elective (DSE) Laboratory

Sr. No	Category Type	Course code	Course Name
1	DSE-1	BCA523	System Programming Lab
2	DSE-1	BCA539	Relational Database Management System Lab
3	DSE-1	BCA532	Artificial Intelligence Lab
4	DSE-1	BCA533	Cryptography & Information Security Lab
5	DSE-2	BCA529	Advanced Java Programming Lab
6	DSE-2	BCA526	Cloud Computing Lab
7	DSE-2	BCA530	R Programming Lab
8	DSE-2	BCA531	Cyber Security Lab
9	DSE-3	BCA532	Data Analytics Lab
10	DSE-3	BCA528	Computer Graphics Lab
11	DSE-3	BCA533	Machine Learning with Python Lab
12	DSE-3	BCA534	Information Security Lab
13	DSE-4	BCA627	Programming with C# Lab
14	DSE-4	BCA622	Cloud Computing Lab
15	DSE-4	BCA628	Data Science Lab
16	DSE-4	BCA629	Network Security Lab
17	DSE-5	BCA630	Programming with C#.NET Lab
18	DSE-5	BCA624	Data Warehouse and Mining Lab
19	DSE-5	BCA621	Big Data Analytics Lab
20	DSE-5	BCA621	Cyber Forensics Lab
21	DSE-6	BCA632	DEVOPS Lab
22	DSE-6	BCA633	Internet of Things Lab
23	DSE-6	BCA634	Data Visualization Lab
24	DSE-6	BCA625	Ethical Hacking Lab

H) Artificial Intelligence and Machine Learning Specialization

Sr. No	Category Type	Course code	Course Name
1	DSE-1	BCA512	Artificial Intelligence
2	DSE-2	BCA510	R Programming
3	DSE-3	BCA513	Machine Learning with Python
4	DSE-4	BCA608	Data Science
5	DSE-5	BCA617	Big Data Analytics
6	DSE-6	BCA614	Data Visualization

Sr. No	Category Type	Course code	Course Name
1	DSE-1	BCA532	Artificial Intelligence Lab
2	DSE-2	BCA530	R Programming Lab
3	DSE-3	BCA533	Machine Learning with Python Lab
4	DSE-4	BCA628	Data Science Lab
5	DSE-5	BCA621	Big Data Analytics Lab
6	DSE-6	BCA634	Data Visualization Lab

I) Cyber security Specialization

Sr. No	Category Type	Course code	Course Name
1	DSE-1	BCA513	Cryptography & Information Security
2	DSE-2	BCA511	Cyber Security
3	DSE-3	BCA514	Information Security
4	DSE-4	BCA609	Network Security
5	DSE-5	BCA611	Cyber Forensics
6	DSE-6	BCA619	Ethical Hacking

Sr. No	Category Type	Course code	Course Name
1	DSE-1	BCA533	Cryptography & Information Security Lab
2	DSE-2	BCA531	Cyber Security Lab
3	DSE-3	BCA534	Information Security Lab
4	DSE-4	BCA629	Network Security Lab
5	DSE-5	BCA631	Cyber Forensics Lab
6	DSE-6	BCA625	Ethical Hacking Lab

BACHELOR OF COMPUTER APPLICATIONS (BCA)

FACULTY OF COMPUTATIONAL SCIENCES

(Applicable for 2022-2023 onwards)

BCA101: Computer Fundamentals & IT

Credits: 4

LTP 310

Course Description: The course aims to equip the students with various Office Automation Tools like Word processor, Spreadsheet program & Presentation program. The course includes Crafting professional word documents; excel spread sheets, power point presentations using the Microsoft suite of office tools.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe computer with its characteristics, types of computer memories..

CO2: Discuss the fundamental of processing unit and DOS.

CO3: Demonstrate skills in application software used for word processing and presentation.

CO4: Attain skills in documentation, accounting operations, presentation skills.

Course Content

Unit I

Introduction to Computers: Introduction, Characteristics of Computers, Block diagram of computer. Types of computers and features, Minicomputers, Micro Computers, Mainframe Computers, Super Computers. Types of Programming Languages (Machine Languages, Assembly Languages, High Level Languages). Data Organization, Drives, Files, Directories. Types of Memory (Primary and Secondary) RAM, ROM, PROM, EPROM, Secondary Storage Devices (FD, CD, HD, Pen drive) I/O Devices (Scanners, Plotters, LCD, Plasma Display) Number Systems: Introduction to Binary, Octal, Hexadecimal system Conversion, Simple Addition, Subtraction, Multiplication.

Unit II

Algorithm: Definition, Characteristics, Advantages and disadvantages, Examples. Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, Examples. Operating System and Services in O.S., Types of OS: DOS: History, Files and Directories, Internal and External Commands, Batch Files.

Unit III

Word Processing: Typing, Editing, Proofing & Reviewing, Formatting Text & Paragraphs, Automatic Formatting and Styles, Working with Tables, Graphics and Frames, Mail Merge, Automating Your Work & printing Documents.

Excel Spreadsheet: Working & Editing in Workbooks, Creating Formats & Links, formatting a Worksheet& creating graphic objects, Creating Charts (Graphs), formatting and analyzing data, Organizing Data in a List (Data Management), Sharing & Importing Data, Printing.

Unit IV

PowerPoint Presentations: Getting started in PowerPoint, creating a presentation, Creating & editing slides, previewing a slide show, Adding picture & graph, adding sound & video, adding auto shape, Animating objects.

Spreadsheets and Database packages: Purpose, usage, command, MS-Excel, Creation of files in MS-Access, Switching between applications.

Electronic Payment System: Secure Electronic Transaction, Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer (EFT), Unified Payment Interface (UPI), Immediate Payment System (IMPS), Digital Signature and Certification Authority.

Recommended Books / Suggested Readings:

1. "Computers Today", D. H. Sanders, Fourth Edition, McGraw Hill, 1988.
2. Fundamental of Computers – By V. Rajaraman B.P.B. Publications.
3. "Fundamental of Computers – By P.K. Sinha.
4. MS-Office 2000(For Windows) – By Steve Sagman.
5. "Information Technology Inside and Outside", David Cyganski, John A. Orr, Paperback Edition, Pearson Education 2002.
6. IT Tools, R.K. Jain, Khanna Publishing House

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA121: Computer Fundamentals & IT Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the students with the knowledge of computer fundamentals. The course includes DOS commands, Microsoft Office and computer hardware.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss the basic computer architecture.

CO2: Describe the fundamental Computer components that make up a computer's hardware and the role of each of these components.

CO3: Create worksheets, prepare presentations.

CO4: Acquire knowledge about DOS commands, Computer hardware and Window booting procedure.

List of Practical:

1. Identify computer hardware and software (in the lab).
2. Draw and explain the block diagram of computer system.
3. Demonstrate various peripherals and their applications.
4. Demonstrate the usage of various storage devices.
5. Illustrate the booting procedure (using windows).
6. Demonstrate installation of application software (in windows).
7. Introduction to DOS Commands.
8. Introduction to Windows.
9. Introduction to Microsoft Office.
10. Introduction to MS-Word.
11. Define page size and margins for a document.
12. Insert graphics (a picture for example) in a document.
13. Prepare a document with at least three fonts and four different font sizes. Include superscript and subscript.
14. Prepare your Biodata in one A-4 size page.
15. Prepare a document with at least three fonts and four different font sizes. Include superscript and subscript.
16. Explain the use of spell check.
17. Introduction to MS-Excel.
18. Open a work sheet, name it and save it.
19. Change the width of a column/ range of columns.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA102: Problem Solving using C

Credits : 4

LTP 310

Course Description: The course aims to equip the students with wide variety of examples and applications build on C Language. The course includes popular programming languages and how to choose Programming language for solving a problem.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Analyze the logic of a given problem.

CO2: Design and develop programs using control structures, array and pointers.

CO3: Analyze the problem statement and decide the logic to solve the problem using C Programming.

CO4: Apply the basic programming constructs for problem-solving.

Course Content

Unit I

Programming language as tools: Programming Language, Types of Programming Language, Translators-Assembler, Compiler, Interpreter. Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts. **Overview of C Language:** History of C, Character set, C tokens, Identifiers, Keywords, Datatypes, Variables, Constants, Symbolic Constants, Operators in C, Hierarchy of Operators, Expressions, Type Conversions and Library Functions.

Unit II

Managing Input and Output Operation: Formatted and Unformatted I/O Functions, Decision making, branching and looping: Decision Making Statements -if Statement, if–else statement, nesting of if-else statements, else–if ladder, switch statement, operator, Looping - while, do-while, for loop, Nested loop, break, continue, and goto statements.

Arrays: Declaring and Initializing, One Dimensional Arrays, Two Dimensional Arrays, Multi-Dimensional Arrays, Passing arrays to functions.

Unit III

Functions: Function Definition, prototyping, types of functions, passing arguments to functions, Nested Functions, Recursive functions.

Strings: Declaring and Initializing strings, Operations on strings, Arrays of strings, passing strings to functions. Storage Classes: Automatic, External, Static and Register Variables.

Unit IV

Structures-Declaring and Initializing, Nested structure, Array of Structure, Passing Structures to functions, Unions, typedef, enum, Bit fields.

Pointers: Declarations, Pointer arithmetic, Pointers and functions, call by value, Call by reference, Pointers and Arrays, Arrays of Pointers, Pointers and Structures. Meaning of static and dynamic memory allocation, Memory allocation functions.

Files: File modes, File functions, and File operations, Text and Binary files, Command Line arguments Preprocessor directives. Macros: Definition, types of Macros, Creating and implementing user defined header files

Recommended Books / Suggested Readings:

1. E. Balagurusamy, "Programming in C", Tata McGraw Hill.
2. Ashok N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education, 2006. "Fundamental of Computers – By P.K. Sinha.
3. Yashwant Kanetkar, "Let Us C", 13thEdition, PHP, 2013.
4. Kernighan and Ritchie, "The C Programming Language", PHI.
5. Byron Gotfried, "Programming in C".
6. Kamathane, "Programming in C", Oxford University Press.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance	

BCA122: Problem Solving using C Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students with wide variety of examples and applications build on C Language. The course includes about some popular programming languages and how to choose Programming language for solving a problem.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the basic concept of C Programming, and its different modules that include conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.

CO2: Use branching control statements and iterative control statements.

CO3: Describe Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.

CO4: Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.

CO5: Develop programming skills by learning the fundamentals of structured language using c

Lab Exercises:

1. Write a C program to display "Hello Computer" on the screen.
2. Write a C program to display Your Name, Address and City in different lines.
3. Write a C program to find the area of a circle using the formula: Area = PI * r2.
4. Write a C program to find the area and volume of sphere. Formulas area: Area = 4*PI*R*R Volume = 4/3*PI*R*R*R.5.Write a C program to print the multiply value of two accepted numbers.
5. Write a C program to convert centigrade into Fahrenheit. Formula: C= (F-32)/1.8.
6. Write C program to read in a three-digit number produce following output (assuming that the input is 347) 3 hundred,4 tens,7 units.
7. Write a C program to read in two integers and display one as a percentage of the other. Typically, your output should look like20 is 50.00% of 40 assuming that the input numbers where 20 and 40. Display the percentage correct to 2 decimal places.
8. Write a C program to find out whether the character presses through the keyboard is a digit or not (using conditional operator).
9. Write a C program to swap variable values of i and j.
10. Write a C program that prints the given three integers in ascending order using if else.
11. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use switch statement).
12. Write a C program to calculate the following sum: sum = 1 –x2 /2! + x4 /4! –x6 /6! +x8 /8! –x10/10!
13. Write a C program to find the roots of a quadratic equation.
14. Write a C program to check whether a given 3-digit number is Armstrong number or not.
15. Write a C program to print the different types of patterns and Pyramid.
16. Write a C program to find factorial of a given integer using non-recursive function.
17. Write a C program to find factorial of a given integer using recursive function.
18. Write a C program to find both the largest and smallest number in a list of integers.
19. Write a C program to find the second largest integer in a list of integers.
20. Write a C program to perform addition of two matrices.
21. Write a C program to use function to insert a sub-string in to given main string from a given position.
22. Write a C program using user defined functions to determine whether the given string is palindrome or not.
23. Write C program to count the number of lines, words and characters in a given text.
24. Write a C program to concatenate two strings using pointers.
25. Write a C program to find the length of string using pointers.
26. Write a C program to compare two strings using pointers.
27. Write a C program to find the sum of integer array elements using pointers.
28. Write a C program to create a union containing 6 strings: name, home address, hostel address, city, state and zip. Write a C program to display your present address.
29. Write a C program to display the contents of a file.
30. Write a C program to copy the contents of one file to another.

31. Develop a basic game using your programming skills you have learned in this lab..

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA103: Fundamentals of Mathematics

Credits : 4

LTP 310

Course Description: The course aims to equip the students to develop understanding and fluency in mathematics through inquiry, exploring and connecting mathematical concepts. The course includes about apply problem-solving skills and mathematical techniques, communication, and reasoning.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss for Representing data using various mathematical notions.

CO2: Describe different terms used in basic mathematics.

CO3: Describe various operations and formulas used to solve mathematical problems.

CO4: Describe the types of matrices and operations on matrices.

Course Content

Unit I

Complex Numbers: Complex Numbers in the form of a+ib, Real and Imaginary parts of a complex number, Complex conjugate, algebra of complex numbers.

Quadratic Equations: Solutions of Quadratic equations (with real and complex coefficients), Relations between roots and coefficients, Nature of roots.

Unit II

Statistics: Introduction, Measure of dispersion, Range, Mean deviation, Variance & Standard deviation.

Probability: Elementary events, Sample space, Compound events, Type of events, Mutually Exclusive, Independent events, Addition Law of probability (for 2 and 3 events), Conditional probability,

Unit III

Matrices: Definition, Types of matrices, Laws of operations on matrices, Transpose, adjoint and inverse of matrices, solution of linear system of equations, and Cramer's rule, Rank of Matrices, square Matrices.

Unit IV

Determinants: Basics, calculation of determinants, Properties of determinants, Area of Triangle, Minors & Cofactors, Applications of Determinants.

Recommended Books / Suggested Readings:

1. Bansi Lal & S. Arora "Two-Dimensional Co-ordinate Geometry" S. Chands'.

2. "Higher Engineering Mathematics", B. S. Grewal, 35th Edition, Khanna Publishers.

3. College Mathematics, Schaum Series, TMH.

4. Systematic Modern Mathematics Parts I & II by L.R Dhanda, G.K Saini & Suranjansaha published by Kalyani Publishers.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA124: Workshop on HTML/CSS

Credits: 1

LTP 002

Course Description: The course aims to equip the students to learn how to design and develop a Web page using HTML and CSS. The course includes practical experience to design and develop a Web site using text, images, links, lists, and tables for navigation and layout.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

After completing the course, the students will be able to:

CO1: Design and develop basic web pages using HTML and CSS.

CO2: Analyze a web page and identify its elements and attributes.

CO3: Design and develop web pages using CSS styles, internal and/or external style sheets.

CO4: Design and develop web pages using CSS for layout.

Lab Exercises:

1. Introduction to Web Design.
2. WAP in html to illustrate body and pre-tags.
3. WAP in html to illustrate text Font tag.
4. WAP in html to illustrate comment, h1....h6, and div tag.
5. WAP in html to illustrate text formatting tags.
6. WAP in html to illustrate Order List tag.
7. WAP in html to illustrate Unorder List tag.
8. WAP in html to illustrate Nested and Definition tag.
9. WAP in html to illustrate image tag.
10. WAP in html to illustrate Hyper Link tag (Anchor tag).
11. WAP in html to illustrate Table tag.
12. WAP in html to illustrate Frame tag.
13. WAP in html to illustrate Form tag.
14. WAP in html to illustrate span tag.
15. WAP in html to create a webpage to show different hobbies.
16. WAP in html to show India map.

17. WAP in html to create a web page to show registration naukri.com.

18. Create a Web Page in HTML to show Admission form.

19. A Web Page in HTML to show your resume using Appropriate Formatting Elements.

20. A Web Page in HTML to show all the Text, Color, Background and Font Elements.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

COM101: English Communication

Credits : 2

LTP 200

Course Description: The course aims to equip the students with the use of English in everyday situations both in formal and informal contexts. The course includes reading skills, writing skills, Grammar and vocabulary.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Develop a minute practical knowledge about English grammar and its usage.

CO2: Develop an understanding of the importance of free expression.

Course Content

Unit I

Reading Skills: Comprehension of Unseen Passage [Reading articles] (Intermediate) Summary Paraphrasing, Translation and Precis Writing.

Unit II

English Grammar and Usage: Parts of speech, common errors in writing (based on Parts of Speech) Tenses, Change of Voice, Transformation of Sentences.

Unit III

Basic Writing Skills and Writing Practices: Paragraph/essay writing, short life story writing, Notice (General like trip, change of name, function) making notes and Letter writing.

Unit IV

Vocabulary Enhancement: Synonym, Antonym, Idioms and Phrasal verb

Reference Book:

1. Practical English Usage. Michael Swan OUP. 1995

Suggested Readings:

1. *On Writing Well. William Zinsser.* Harper Resource Book. 2001

2. *Communication Skills.* Sanjay Kumar and Pushp Lata.Oxford University Press. 2006

3. *Exercises in Spoken English.* CIEFL, Hyderabad. Oxford University Press

Reference Book:

1. Practical English Usage. Michael Swan OUP. 1995

Suggested Readings:

1. On Writing Well. William Zinsser. Harper Resource Book. 2001

2. Communication Skills. Sanjay Kumar and Pushp Lata.Oxford University Press. 2006

3. Exercises in Spoken English. CIEFL, Hyderabad. Oxford University Press

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

COM121: English Communication Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the students with focus on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts. The course includes description of sights seen in everyday life, pronunciation of different words and its correct usage.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Develop better understanding of nuances of English language through audio- visual experience and group activities

CO2: Hone speaking skills with clarity and confidence

Course Content

Unit I

Daily Discourse: Common Everyday Situations: Conversations and Dialogues (Unit 1-6), Monologue (2D/4D/5D/6D), and Communication at workplace

Unit II

Listening Skills: Listening skills on Social Interactions (Unit 1), work and study (Unit 2), daily life (Unit 3), food (Unit 4), Places (Unit 5) and Family (Unit 6)

Unit III

Phonetic Skills: Pronunciation, Intonation, Stress (Unit 1-6) and Rhythm

Unit IV

Speaking Skills: Group Discussion / Debate, Role Plays

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)		
	Internal viva	15 Marks
	Attendance	5 Marks
End Term Exam (Summative)	External viva	30 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

ENS001: Environmental Studies

Credits : 2

LTP 200

Course Description: This course deals with the environment components, ecosystems and how to maintain equilibrium in nature, its conservation, and different methods to reduce pollution and maintain our nature.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand about environment, its role and importance for living beings.

CO2: Understand the structure of ecosystem, food chain/ web.

CO3: Understand about the natural resources and their uses.

CO4: Understand about different types of pollution created by human beings and their side effects as well as the methods to reduce these pollutions and their alternatives.

Course Content

Unit I

Introduction to environmental studies: Multidisciplinary nature of environmental studies; components of environment –atmosphere, hydrosphere, lithosphere and biosphere, Scope and importance; Concept of sustainability and sustainable development.

Unit II

Ecosystems: What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III

Natural Resources:

Renewable and Non-renewable Resources: Land Resources and land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Heating of earth and circulation of air; air mass formation and precipitation.

Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit IV

Biodiversity and Conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity nation; Endangered and endemic species of India, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit V

Environmental Pollution: Environmental pollution: types, causes, effects and controls; Air, water, soil, chemical and noise pollution, Nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste, Pollution case studies.

Unit VI

Environmental Policies & Practices: Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC). Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context.

Unit VII

Human Communities and the Environment: Human population and growth: Impact on environment, human health and welfares., Carbon footprint., Resettlement and rehabilitation of project affected persons, case studies. Disaster management: floods, earthquakes, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Suggested Readings:

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
7. McCully, P.1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, h.T. & Andrews, J.1971. Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. Wastewater Treatement. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003.Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.

16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C.E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson, E.O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on environment and Development. 1987. Our Common Future. Oxford University Press.
21. 21.www.nacwc.nic.in
22. 22.www.opcw.org

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA206: Principals of Operating System

Credits: 4

LTP 310

Course Description: The course aims to equip the students with basic knowledge of computer operating system structures and functioning. The course includes various types of operating system, CPU scheduling, memory management, secondary storage management.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

After completing the course, the students will be able to:

CO1: Describe the concepts of Operating system.

CO2: Describe the concepts of Process Management, CPU scheduling algorithms and Process Synchronization.

CO3: Discuss the concepts of Memory Management techniques, Virtual Memory and page replacement algorithms

CO4: Discuss the concepts of Storage Management, Disk Management and disk scheduling.

CO5: Apply various concepts related with deadlock to solve problems related with resources allocation.

Course Content

Unit I

Operating System: Definition, Need, Services, Types of operating systems: simple batch system, multi programmed batch system, time sharing system, parallel system, distributed system, real time system, personal computer system. Operating system components, operating system services, system calls. **Process & Thread Management:** Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, synchronization issues.

Unit II

Process Scheduling: Need of CPU scheduling, non-preemptive and preemptive scheduling, scheduling algorithms (FCSC, SJF, Round-Robin, Multilevel Queue), semaphores, types of semaphores, critical section, methods for inter-process communication. Deadlock: Deadlock Characterizations, Method for Handling Deadlocks, Deadlock Prevention, Deadlock

Avoidance, Banker's algorithm, Deadlock Detection, Recovery from Deadlock.

Unit III

I/O Device Management: I/O devices and controllers, device drivers; disk storage, scheduling and management. File Management: Basic concepts file operations, access methods, directory structures and management, remote file systems; file protection.

Unit IV

Memory Management: Memory Hierarchy, Memory Allocation Scheme, Contiguous allocation, Paging, Page Table Structures, Segmentation, Segmentation with Paging. Virtual Memory: Demand Paging, Page Replacement and its Algorithms, Thrashing. Disk Management: Disk Structure, Disk Scheduling Algorithm.

Recommended Books / Suggested Readings:

1. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.

2. Operating Systems by Sibsankar Haldar and Alex A. Aravind, Published by Pearson Education "Fundamental of Computers – By P.K. Sinha.

3. An Introduction to Operating Systems by Dietel H.M., Second Edition, Published by Addison Wesley.

4. Operating system by Stalling, W., Sixth Edition, Published by Prentice Hall (India).

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA226: Principals of Operating System Lab

Credits: 1

LTP 002

Course Description: The course aims to equip the students with basic knowledge of computer operating system structures and functioning. The course includes practical with designing and implementing concepts of operating systems such as system calls, CPU scheduling, process management and deadlock handling and process synchronization.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Implement basic services and functionalities of the operating system.

CO2: Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.

CO3: Implement memory management schemes and page replacement schemes.

CO4: Describe the concepts of deadlock in operating.

CO5: Describe the concepts of process synchronization concept.

Lab Exercises:

1. OS Installation: windows OS, Linux OS.

2. CPU Scheduling: Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority.

3. Multi-Level Queue Scheduling: Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories: system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.

4. Memory Allocation Techniques: Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit.

5. Deadlock: Write a C program to simulate Bankers Algorithm for Dead Lock Avoidance.

6. Introduction to Linux: Basic Linux Commands: ls, cat, man, cd, touch, cp, mv, rmdir, mkdir, rm, chmod, pwd.

7. Process creation and threading: Creating processes, Creating Threads,

8. Process Duplication: use of fork command.

9. Synchronization: Synchronization with Mutexes/Semaphores. Race Condition

10. Pipes: Introduction to pipes in Linux OS.

11. Semaphores: Write C program to simulate producer-consumer problem using semaphores.

Recommended Books / Suggested Readings:

1. Operating system concepts by Abraham Silberschatz, Galvin, Wiley

2. Beginning Linux Programming by Neil Mathew & Richard Stones, Wiley

3. Advanced programming in the Unix environment by W.Richard stevens and Stephen a. Rago, Pearson

4. Operating Systems a design-oriented approach by Charles Crowley, M.G.Hills

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA202: Object Oriented Programming with C++

Credits: 4

LTP 310

Course Description: The course aims to equip the students understand object-oriented programming through C++. The course includes about various concepts of Object-Oriented Programming.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Develop applications using Object Oriented Programming Concepts

CO2: Define basic concepts on object-oriented programming.

CO3: Discuss class structures as fundamental, modular building blocks.

CO4: Explain the types of inheritances and Applying various levels of Inheritance for real time problems.

CO5: Apply and implement file operations.

Course Content

Unit I

Introduction: Introducing Object Oriented Approach, Relating to other paradigms {Functional, Data decomposition}, Difference between Procedure Oriented Language(C) and Object-Oriented Language.

Characteristics of Object-Oriented Programming: Abstraction, Encapsulation, Data hiding, Inheritance, Polymorphism, code Extensibility and Reusability.

Unit II

Classes, Objects and Members: Class Declaration and Class Definition, defining member functions, Defining Object, Members access control. Class Function Definition: Member Function definition inside the class and outside the class, Friend Function, Inline Function, Static Members & Functions, Scope Resolution Operator, Private and Public Member Functions, Nesting of Member Functions. Creating Objects, accessing class data members, accessing member functions, Arrays of Objects, Objects as function arguments: Pass by value, Pass by reference, Pointers to Objects.

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Unit III

Constructors and Destructors: Declaration and Definition, Default Constructors, Parameterized Constructors, Constructor Overloading, Copy Constructors. Destructors: Definition and use, Memory Management: New, Delete, garbage collection.

Inheritance: Defining a derived class, single inheritance, protected members, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes, abstract classes, constructors in derived classes. Operator overloading: Overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function. Function overloading.

Unit IV

Polymorphism: Definition, early Binding, Polymorphism with pointers, Virtual Functions, late binding, pure virtual functions.

File Handling: Open/ Close Files commands, Read/write operations on files.

Exception Handling: Errors, Exceptions, Types of Exceptions, Use of Try, Catch and Finally blocks.

Recommended Books / Suggested Readings:

1. Object Oriented Programming with C++, E. Balagurusamy, Fourth Edition, Tata Mc-Graw Hill Seymour Lipshutz, Schaum's Outline: Data Structures with C, Tata McGraw Hill.

2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.

3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.

4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA222: Object Oriented Programming with C++ Lab

Credits: 2

LTP 004

Course Description: The course aims to equip the students to identify and practice the object-oriented programming concepts and techniques

The course includes about various concepts of Object-Oriented Programming.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Apply object-oriented programming features to program design and implementation.

CO2: Describe object-oriented concepts and how they are supported by C++.

CO3: Describe implementation issues related to object-oriented techniques.

CO4: Demonstrate the ability to analyze, use, and create functions, classes, to overload operators

CO5: Demonstrate the ability to understand and use inheritance and Pointers when creating or using classes and create templates.

CO6: Implement real time problems using Arrays and class.

Lab Exercises:

1. Simple Program on printing "Hello World" and "Hello Name" where name is the input from the user.
2. Program to check whether the given number is even or odd.
3. Program to check whether the given number is Armstrong or not.
4. Program that computes the simple interest and compound interest payable on principal amount (in Rs.) of loan borrowed by the customer from a bank for a given period of time (in years) at specific rate of interest. Further determine whether the bank will benefit by charging simple interest or compound interest.
5. Program using functions by passing values call by values method.
6. Program using functions by passing call by reference method.
7. Program to calculate the factorial of a number using recursion function.
8. Program which stores the marks of 5 students in an array and then print all the marks. **The** marks of students are 75, 85, 80, 95 and 90.
9. Program which initializes a two-dimensional array and then print all the elements in a matrix form.
10. Program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
11. Program to find both the largest and smallest number in a list of integers.
12. Program Illustrating Class Declarations, Definition, and Accessing Class Members.
13. Program to illustrate default constructor, parameterized constructor and copy constructors.
14. Develop an Object-Oriented program in C++ to read emp name, emp code, designation, experience and age. Construct the database with suitable member functions for initializing and destroying the data using constructor and destructor and dynamic memory allocation operators new and delete Program that reads a no. between 1 to 7 and then print the day corresponding to that number.
15. Program to create student class, read and print N student's details.
16. Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
17. Program to Demonstrate Friend Function and Friend Class.
18. Program to Generate Fibonacci Series use Constructor to Initialize the Data Members.
19. Program to implement the concept of single inheritance.
20. Program to illustrate the concept of multilevel inheritance.
21. Program to implement the concept of multiple inheritances.
22. Program to implement the concept of hierarchical inheritance.
23. Program to implement the concept of hybrid inheritance.

Program in C++ to prepare mark sheet of a university exam by reading stuname, rollno, subname, subcode, internal marks, external marks. Design a base class consisting of data members such as student name, roll no, sub name. Derived class consists of data members such as sub code, internal marks, external marks, construct oops data to search for a record i.e., be printed.

25. Program to show static polymorphism.
26. Program to show run time polymorphism.
27. Write a program to create memory space for a class object using new operator and to destroy it using delete operator.

28. Program to open, write and to close file.

29. Program for Exception Handling Divide by zero.

30. Any other program related to theory program to enhance the understanding of students in the subject.

30. Develop any mini project using the skills you have learned in this lab.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA203: Mathematics for Computer Science

Credits: 4

LTP 310

Course Description: The course aims to equip the students to relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.

The course includes about various concepts of sets, relations, and functions, generating functions and recurrence relations, Graph Theory for solving problems.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Apply mathematical logic to solve problems.

CO2: Describe sets, relations, functions, and discrete structures.

CO3: Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions.

CO4: Apply the principle permutation and combination principle to solve the problem.

Course Content

Unit I

Set Theory: Definition of Sets, Venn Diagrams, complements, cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), De-Morgan's laws.

Unit II

Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation.

Function: Definition and types of function, composition of functions, recursively defined functions.

Unit III

Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms (conjunctive and disjunctive), Algebra of propositions, Conditional and Bi conditional Statements, Arguments. Predicates and Quantifiers, Negation of Quantified Statements

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Unit IV

Combinatorics: Permutation, Combination, application of permutation & combination, Circular permutation & combination.

Recommended Books / Suggested Readings:

1. Discrete Mathematical Structures with Applications to Computer Science, J.P. Tremblay, R. Manohar, McGraw Hill education (India) Private Limited.
2. Discrete Mathematics for Computer Scientists & Mathematicians, Joe L. Mott, Abraham Kandel, Theodore P. Baker, Pearson, 2nd ed.
3. Discrete Mathematics and its Applications, Kenneth H. Rosen, 7th Edition, McGraw Hill education (India) Private Limited.
4. Discrete Mathematics, D.S. Malik & M.K. Sen, Revised edition Cengage Learning.
5. Elements of Discrete Mathematics, C. L. Liu and D.P. Mohapatra,4th edition, McGraw Hill education (India) Private Limited.
6. Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
7. Discrete and Combinatorial Mathematics, R. P. Grimaldi, Pearson.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA207: Digital Circuit and Logic Design

Credits: 3

LTP 300

Course Description: The course aims to equip the students with the concept of Number representation and Boolean Algebra, Combinational circuit analysis and design. K-map and tabulation methods.

Course Outcomes (CO)

Upon successful completion of the course, the students should be able to:

CO1: Describe the concept of number representation and Boolean algebra.

CO2: Demonstrate the functional codes of Binary Systems.

CO3: Demonstrate the Classification of Counters.

CO4: Implement the concepts of logic gates, flip flops and Circuits.

CO5: Recognizes the concepts of memory organization.

Course Content

Unit I

Number Systems: Binary, Octal, Decimal, Hexadecimal. Number base conversions, 1's, 2's complements, signed Binary numbers. Binary Arithmetic, Binary codes: Gray code, Excess 3 code, ASCII. LOGIC GATES: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR. Implementations of Logic Functions using gates, NAND-NOR implementations.

Unit II

Boolean Algebra: Boolean postulates and laws-De-Morgan's Theorem, Principle of Duality, Boolean expression – Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization, don't care conditions, Quine-McCluskey method.

Unit III

Combinational Circuits: Design procedure-Adders, Subtractors, BCD adder, Magnitude Comparator, Multiplexer/Demultiplexer, encoder/decoder, parity checker, code converters.

Sequential Circuits: Flip flops SR, JK, T, D and Master slave, Excitation table, Edge triggering, Level Triggering, Asynchronous/Ripple counters, Synchronous counters, Modulo-n counter,

Ring Counters. Design of Synchronous counters: state diagram, Circuit implementation. Shift registers.

Unit IV

Memory: Classification of memories, RAM organization, write operation, Read operation, Memory cycle. ROM organization, PROM, EPROM, EEPROM, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Recommended Books / Suggested Readings:

1. Zvi. Kohavi (2004), Switching and Finite Automata Theory, Tata McGraw Hill, India.
2. C. V. S. Rao (2009), Switching and Logic Design, 3rd Edition, Pearson Education, India.
3. Donald D. Givone (2002), Digital Principles and Design, Tata McGraw Hill, India
4. Roth (2004), Fundamentals of Logic Design, 5th Edition, Thomson, India.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA227: Digital Circuit and Logic Design Lab

Credits: 1

LTP 002

Course Description: The course aims to equip the students with the representation of numbers in a computer system, and how digital circuits can be designed using logic gates and flip-flops.

Course Outcomes (CO)

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate Truth-tables and logic gates.

CO2: Describe the process of designing combinational logic circuits.

CO3: Describe the process of designing sequential logic circuit modules.

CO4: Demonstrate Multiplexer circuits.

Lab Exercises: To representation of number system.

1. To verify the Truth-tables of all logic gates.
2. To realize and verify the Half & full adder circuits using logic gates.
3. To realize Half & full subtractor circuits using logic gates.
4. To realize Encoder and Decoder circuits
5. To realize Multiplexer circuits
6. To realize 4-bit binary-gray & gray-binary converters.
7. To realize Full adder & full subtractor circuits using encoder.
8. To design Full adder & full subtractor circuits using multiplexer.
9. To design and verify the Truth tables of all flip-flops.
10. To design Mod-6/Mod-9 synchronous up-down counter.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

COM201: Business Communication

Credits:2

LTP 200

Course Description: The course aims to equip the students with business communication principles. The course includes designing and mastering the most important communication skills, from professional writing presentations.

Course Outcomes (CO)

Upon successful completion of the course, the students should be able to:

CO1: Develop effective reading and writing skills.

CO2: Understand the vocabulary and technical jargons as used in business communication.

Course Content

Unit I

Theory of Communication: Process of Communication, Verbal and Non-verbal communication, Modes of Communication, and Barriers to Communication.

Unit II

Nature and Style of sensible Writing: Memorandum, Notices, Quotations/Tenders, Report Making, Minutes of Meeting, E-Mail, Press Note, Resume, Complaint Letter, Inquiry Letter, Cover Letter, Confirmation Letter, Resignation Letter, Permission Letter and Job Application.

Unit III

Vocabulary Building: Words Often Confused and Words Often Misspelt, standard abbreviations, word formation, prefix, suffix, root words from foreign languages, punctuation, phrases, and clauses.

Unit IV

Grammar: Conditional Sentences, and Degrees of Comparison

Reference Book: Cambridge English Empower Elementary Student's Book by Cambridge University Press

Recommended Books / Suggested Readings:

1. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

2. Study Writing. Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.2006.

3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Practical English Usage. Michael Swan. OUP. 1995.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

COM221: Business Communication Lab

Credits: 1

LTP 002

Course Description: The course aims to equip the students with business communication principles through creation of effective business and oral presentations. Includes study and application of team communication and use of technology to facilitate the communication. The course includes designing and mastering the most important communication skills, from professional writing presentations.

Course Outcomes (CO)

Upon successful completion of the course, the students should be able to:

CO1: Acquire in-depth knowledge of principles of business communication.

CO2: Discuss the use of video in business messages.

CO3: Deliver high-quality oral presentations.

CO4: Develop Nonverbal communication, interview preparation and resume writing.

Course Content

Unit I

Listening Skills: Listening Exercises on Journeys (Unit 7), Fit and healthy (Unit 8), Clothes and shopping (Unit 9), Communication (Unit 10), Entertainment (Unit 11) and Travel (Unit 12)

Unit II

Presentation Skills: Making PPT and Presenting Power Point Presentation

Unit III

Phonological Skills: Pronunciation, syllables and word stress

Unit IV

Speaking Skills: Interview skills

Recommended Books / Suggested Readings:

1. Cambridge English Empower Elementary Student's Book by Cambridge University Press
2. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
3. Study Writing. Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.2006.
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Practical English Usage. Michael Swan. OUP. 1995.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

HVPE101: Human Values & Professional Ethics

Credits : 2

LTP 200

Course Description: The course aims to equip the students to understand the need, basic guidelines, content and process of value education. This course includes harmony at all the levels of human living, and harmony in existence in their profession and lead an ethical life.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand the significance of value inputs in a classroom, distinguish between values and skills

CO2: Compare between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body

CO3: Compare between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work

CO4: Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.

Course Contents:

Unit I

Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Happiness and Prosperity -Current Scenario.

Unit II

Harmony in the Human Being: Understanding Human being as the Co-existence of self ('I') and the Body, discriminating between the Needs of the Self ('I') and the Body, Understanding Harmony in the self ('I'), Harmony of the self ('I') with the Body.

Unit III

Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' - the Foundational Value in Relationships, Understanding, Harmony in the Society.

Unit IV

Harmony in the Nature (Existence): Understanding Harmony in the Nature, Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature, The Holistic Perception of Harmony in Existence.

Implications of the Holistic Understanding -a Look at Professional Ethics: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Strategies for Transition towards Value-based Life and Profession.

Suggested Readings:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics

2. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Suggested Books:

1. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

2. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA307: Data Structures and Algorithms

Credits : 4

LTP 310

Course Description: The course aims to equip the students with various data structures and the algorithms for performing various operations on these data structures. The course includes about various Algorithms and basics of Data Structures.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Illustrate the classification of data types and operations of stack.

CO2: Identify and use appropriate data structure to solve problems.

CO3: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and use various data structures effectively in application programs.

CO4: Implement and Handle various searching algorithms.

CO5: Use of Data Structure to create nodes which can store different data types data.

Course Contents:

Unit I

Introduction and overview: Introduction, basic terminology, data structure, data structure operation, abstract data types.

String Processing: Introduction, basic terminology, storing strings, character data types, strings as ADT Arrays: Introduction, linear arrays, arrays as ADT, Representation of linear arrays in memory, traversing linear arrays, inserting and deleting, multi-dimensional arrays, representation of polynomials using arrays, matrices, sparse matrices.

Unit II

Stacks, queues and recursion: Introduction, stacks, array representation of stacks, linked representation of stacks, stack as ADT, arithmetic expressions: Polish notations, application of stacks, recursion, implementation of recursive procedure by stack, Queues, linked representation of queues, queue as ADT, circular queues, D-queue, Priority queue, application of queues.

Unit III

Linked list: Introduction, linked list, representation of linked list in memory, traversing a linked list, searching in linked list, memory allocation; garbage collection, insertion into a linked list, deletion from a header linked list, circularly linked list, doubly linked list

Trees: Introduction, binary trees, representing binary trees in memory, traversing binary trees, traversal algorithm using stacks, header nodes: Threads, threaded binary search trees, searching and inserting in binary search trees, deleting in binary search tree, balanced binary trees.

Unit IV

Graphs and their applications: Introduction, graph theory terminology, sequential representation of graphs, adjacency matrix: Path matrix, linked representation of a graph, operations on graphs, traversing a graph.

Sorting Techniques: Insertion sort, selection sort, merge sort, heap sort, Bubble Sorting, radix sort, shell sort. Searching Techniques: linear search, binary search and hashing.

Recommended Books / Suggested Readings:

1. E. Horowiz and S. Sahani, "Fundamentals of Data structures", Galgotia Book source Pvt. Ltd.,2003.

2. Seymour Lipshutz, Schaum's Outline: Data Structures with C, Tata McGraw Hill.

3. R.S. Salaria, "Data Structures & Algorithms" Khanna Book Publishing Co. (P) Ltd., 2002.

4. Y. Langsam et. Al., "Data Structures using C and C++", PHI, 1999.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA327: Data Structures and Algorithms Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to develop skills to design and analyze simple linear and nonlinear data structures.

The course includes about various Algorithms and basics of Data Structures.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Design and analyze the time and space efficiency of the data structure

CO2: Build an application to demonstrate the functions of linked list.

CO3: Identify problems based upon different data structure and also write programs.

CO4: Implement linked list data structure to solve various problems.

CO5: Apply graph and tree traverse technique to various applications.

CO6: Describe and apply various data structure such as stacks, queues, trees.

Lab Exercises

Program may be implemented in using C /C++

1. Design, Develop and Implement a menu driven program for the following Array operations a. Creating Array of N Integer elements. b. Display of Array elements with suitable headings. c. Inserting an element (ELEM) at a given valid position (POS). d. Deleting an element at a given valid position (POS). e. Exit.

2. To search an element in the array using Linear Search.

3. To search an element in the 2-dimensional array using Linear Search.

4. To merge two sorted arrays into one sorted array.

5. Design, Develop and Implement a menu driven program for the following operations on STACK of integers (Array implementation of stack with maximum size MAX) a. Push an element on to stack b. Pop an element from stack. c. Demonstrate how stack can be used to check palindrome. d. Demonstrate Overflow and Underflow situations on stack. e. Display the status of stack. f. Exit. Support the program with appropriate functions for each of the above operations.

6. Design Develop and Implement a Program for converting an Infix Expression to Postfix Expression. Programs should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power)and alphanumeric operands.

7. Design Develop and Implement a Program in C for the following Stack Applications. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks.

8. Design, Develop and Implement a menu driven program for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX a. Insert an element on to Circular QUEUE b. Delete an element from Circular QUEUE. Demonstrate Overflow and Under flow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit. Support the program with appropriate functions for each of the above operations.

9. Write a program for implementing Singly Linked list.

10. Write a program for implementing Doubly Linked list.

11. Write a program to implement of Binary tree and traversals (BFS & DFS).

12. Write a program to implement i) Bubble sort ii) Selection sort iii) quick sort iv) insertion sort v) Merge sort.

13. Write a program to implement recursive and non-recursive i) Linear search ii) Binary search

14. Write a program to find the location of the first node containing ITEM and also find the location of an edge in the graph G.

15. Write a program to insert new nodes to a graph G and delete a node from a graph G.

Lab Course Evaluation Pattern:

<table>
<tr><th>Criteria</th><th>Description</th><th>Maximum Marks</th></tr>
<tr><td>Internal Assessment (Summative)</td><td>Lab Evaluation (Five times a semester):
Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)</td><td>15 Marks</td></tr>
<tr><td rowspan="4"></td><td>Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design</td><td></td></tr>
<tr><td>Internal viva</td><td>5 Marks</td></tr>
<tr><td>Attendance</td><td>5 Marks</td></tr>
<tr><td>Practical File</td><td>5 Marks</td></tr>
<tr><td>External Assessment (Summative)</td><td>External Viva</td><td>20 Marks</td></tr>
<tr><td colspan="2">Total</td><td>50 Marks</td></tr>
<tr><td>Attendance (Formative)</td><td colspan="2">A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.</td></tr>
</table>

BCA313: Database Management Systems

Credits : 4

LTP 310

Course Description: The course aims to equip the students to Develop a good database design and normalization techniques to normalize a database

The course includes fundamental concepts of Data Base Management System, Data Models, and Different Data Base Languages.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Analyze Data Base design methodology.

CO2: Design and create tables in database and execute queries.

CO3: Design a database based on a data models using normalization.

CO4: Describe the concept of Transaction and database security in DBMS.

Course Contents:

Unit I

Introduction: Characteristics of database approach, Data base users-DBA, Data base designers and end users, traditional file system vs DBMS, components of DBMS, Advantages and disadvantages of using DBMS, DBMS architecture and data independence. DBMS language-DDL, DML, DCL, Data Modes-Schemas and instances.

ER Modeling- Introduction- Entity types, Entity sets, Attributes and Keys, Relationship Types, Relationship Sets relationship instances, Constraints on relationship types, Weak entity types, and ER diagrams.

Unit II

Relational Data Model: Relational model concepts domains, attributes, tuples and relations, characteristics of relations. Relational Model constraints Relational Databases and relational data base schemas, entity integrity, referential integrity and foreign keys with examples. **Relational algebra and Relational calculus:** Relations Operations- SELECT, PROJECT, UNION, INTERSECTION, The CARTESIAN PRODUCT, JOIN, EQUIJOIN, Aggregate functions. Examples of queries in Relations Algebra Tuple relations calculus, Domain relational calculus.

Unit III

Data Normalization: Informal Design Guidelines for relation schemas, functional dependencies, Normal forms- first, second and third normal form, Boyce-Codd normal form, Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF). **Transaction processing:** Introduction to transaction processing, Transaction and system concepts, Desirable properties of transactions.

Unit IV

Concurrency Control: Locking techniques for concurrency control. **Database Security and Authorization:** Types of security, control measures, database security and the DBA, Access protection, User accounts and database audits, Access Control based on granting and revoking privileges.

Recommended Books / Suggested Readings:

1. Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 6th Edition, (2013).

2. Desai, B.C., 1993: An Introduction to Database Systems, Galgotia Publ. Private Ltd.

3. Date, C.J.: Data Base Systems, Vols. II, Narosa Publ. & I.

4. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems Pearson Education, 5th edition.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA333: Database Management Systems Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students with fundamental concepts of Data Base Design, Data Models. The course includes professional Data Base Languages (SQL/Oracle).

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe and implementation of the database language (DDL & DML).

CO2: Demonstrate the queries with clause like order by and arithmetic operators.

CO3: Describe the concept of joins in database.

CO4: Describe the concepts of aggregate functions, substring comparison.

CO5: Design ER-models to represent simple database application scenarios.

Lab Exercises:

1. To write a query with a function of DDL commands such as create, alter, drop.

2. Create a table stud marks with following attributes Name data type:

Name	Datatype
Rollno	number (6)
Regnumber	number (14)
Semester	number (1)
CGPA	number (2,4)

Alter the Table

a) Add the constraint UNIQUE for regnumber attribute from studmarks table.

b) Remove the constraint for the regnumber attribute.

c) Modify the data type of regnumber to varchar (16).

3. Create a student table and describe the Schema of the student Table:

Name	Datatype
ROLLNO	NUMBER (6)
NAME	VARCHAR2(15)
DEPT	VARCHAR2(10)
CITY	VARCHAR2(15)
DOB	DATE
GENDER	CHAR (1)

a) Add foreign key constraint for the column rollno from studmarks that refers rollno from student table.

b) Add one more column age in student table with NOT NULL constraint in student table.

c) Remove the column city from the student table.

d) RENAME THE TABLE: a) Change the name of the table student to stud. b) Change the name of the attribute dob to dateofbirth.

e) DROP THE TABLE: a) Drop the table stud

4. To write a query with a function of DML commands such as create, alter, drop:

a) Create a table book with attributes bookno, title, publication, author, price, quantity, edition.

b) Insert few records into the table books.

c) Describe the table books.

d) Show the list of titles with their authors.

e) List various authors for the same book title.

f) Show the authors details for the table books.

g) Select the list of book details whose price is greater than 800.

5. To write and execute SQL queries for the nested and join queries.

6. Use of aggregate functions.

7. Use of substring comparison.

8. Use of order by statement.

9. Design and Develop Conceptual Data Model (E-R Diagram) for ERP management System with all the necessary entities, attributes, constraints and relationships. Design and build Relational Data Model for application specifying all possible constraints.

BCA308: Programming in Python

Credits : 4

LTP 310

Course Description: The course aims to equip the students with programming paradigms brought in by Python with a focus on File Handling. The course includes basic programming constructs in python.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the Numbers, Math functions, List, Tuples and Dictionaries in Python

CO2: Interpret Object oriented programming in Python.

CO3: Design user defined functions, modules, and packages.

CO4: Identify and manage the exceptions in programs through appropriate exceptions handling methods.

CO5: Discuss store and forward switching network, Explain Routing algorithm.

Course Contents:

Unit I

Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Multiple Assignment, Keywords, Identifiers, Python Statement, Input-Output functions, Indentation, Documentation, Data Types.

Unit II

Operators and Expressions: Arithmetic Operators, Assignment Operators, relational and Logical Operators, Bitwise Operators, Ternary operator, Increment or Decrement operator, Membership Operators, Identity Operators, Expressions and order of evaluations.

Unit III

Control Structures: Decision making statements, Python loops, Python control statements.

Array: Array, array representation, basic operations performed on array.

Structures & Functions: Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Defining Functions, Exit function, default arguments.

Modules: Module, creating modules, import statement, Path Searching of a Module, Module Reloading, Standard Modules.

Unit IV

Python packages: Introduction to PIP, Installing Packages via PIP, Using Python Packages.

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.

Object Oriented Programming: Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data Hiding.

Recommended Books / Suggested Readings:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly.
3. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
4. Core Python Programming, R. Nageswara Rao, 2nd Ediiton, Dreamtech.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA328: Programming in Python Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the students to familiarize with basics of Python programming. The course includes fundamentals of shell scripting/programming.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.

CO2: Develop logic of programming problems using various data types and control structures of Python.

CO3: Interpret Object oriented programming in Python.

CO4: Implement modules and functions using Python.

Lab Exercises:

1. Write a program to compute GCD of two numbers.
2. Write a program to find factorial of number.
3. Write a program to find the given year is leap or not.
4. Write a program to display current date and time.
5. Write a program which accepts the radius of circle from the user and calculate the area.
6. Write a program to swap two variables.
7. Write a program to check prime number.
8. Write a program to check whether string is palindrome.
9. Write a program to generate Fibonacci series.
10. Write a program to find the quadratics equation.
11. Programs based on decision making statements.
12. Programs based on looping statements.
13. Programs based on array.
14. Write a program to find the duplicate elements in List.
15. Write a program to sorting the List.
16. Write a program to find the differences between two lists.
17. Write a program to find the most frequent words in a text read from a file.
18. Write a program to find the longest words.
19. Write a program to illustrate of use of arg and kwargs.
20. Programs based on functions.
21. Write a program to create a module of factorial in Python.
22. Write a Python class named Rectangle constructed by a length and width and a method which will compute the area of a rectangle.
23. Write a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle
24. Any other programs related to it.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks

BCA309: Computer Architecture

Credits : 3

LTP 300

Course Description: The course aims to equip the students to learn the basic principles of computer organization, operation and performance. The course includes functions of various hardware components, Boolean algebraic expressions to digital design and prepares the student to be able to design a basic computer system.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the basic functioning of various parts of computer system from hardware point of view and interfacing of various peripheral devices used with the system.

CO2: Describe general Instruction types, formats, addressing modes and organization.

CO3: Summarize various modes of Data transfer and interface.

CO4: Classifies memory organization and management.

Course Contents:

Unit I

Basic Computer Organization and Design: Instruction codes, Computer registers, Computer Instructions, Timing and control, Instruction Cycle, Memory reference instructions, Input/ Output and Interrupt, Design of basic Computer, Design of Accumulator Logic. Register Transfer and Micro-operations: **Register transfer language & operations**, arithmetic microoperations, logic microoperations, shift microoperations, arithmetic logic shift unit. Design of a complete basic computer and its working.

Unit II

Design of Control Unit: Control memory, design of control unit – microprogrammed, hardwired, and their comparative study. **Central Processing Unit:** General Register organization, Stack organization, Instruction formats, Addressing Modes, Data transfer and manipulations, Program control, RISC and CISC architecture

Unit III

Input-Output organization: Peripheral devices, I/O Interface, asynchronous data transfer, modes of transfer, priority interrupt, DMA, I/O processor, serial communication. **Memory organization:** Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.

Unit IV

Advanced concepts of Computer Architecture: Concept of pipeline, Arithmetic pipeline, Instruction, vector processors and array processors. Introduction to parallel processing, Inter-Processor communication & synchronization.

Recommended Books / Suggested Readings:

1. M. Moris Mano, Computer System Architecture, Pearson Education.
2. William Stallings, Computer Organisation and Architecture, Pearson Education.
3. David A Patterson, Computer Architecture, Pearson Education.
4. P. Pal Choudhri, Computer Organisation and Design, PHI.
5. J. P. Hayes, Computer System Architecture, Pearson Education.
6. Kai Hawang, Advanced Computer Architecture, Tata McGraw Hill.
7. Riess. Assembly Language and Computer Architecture and using C++ and JAVA, Cengage Learning

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA401: Software Engineering

Credits : 3

LTP 300

Course Description: The course aims to equip the students to provide a basic theory of software engineering. The course includes theoretical principles to a group software development project.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the various types of software process models.

CO2: Extract and analyze software requirements specifications for different projects

CO3: Develop basic level of software architecture/design

CO4: Apply standard coding practices

CO5: Derive and Illustrate the test case and various testing methods.

Course Contents:

Unit I

Introduction to Software Engineering: Definition, Program Vs Software, and Software process, Software Characteristics, Brief introduction about product and process, Software process and product matrices. Software life cycle models: Definition, Waterfall model, Increment process models, Evolutionary process models, Agile process, Agile models, Selection of a life cycle model.

Unit II

Software Requirement Analysis and Specification: Requirements Engineering, type of requirements, Feasibility Studies, Requirement Elicitation, Various steps for requirement analysis, Requirement documentation, Requirement validation, an example to illustrate the various stages in Requirement analysis. Project planning-Size estimation, cost estimation, the constructive cost model (COCOMO).

Unit III

Software Requirement Analysis and Specification: Requirements Engineering, type of requirements, Feasibility Studies, Requirement Elicitation, Various steps for requirement analysis, Requirement documentation, Requirement validation, an example to illustrate the

Unit III

Data Normalization: Informal Design Guidelines for relation schemas, functional dependencies, Normal forms- first, second and third normal form, Boyce-Codd normal form, Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF). **Transaction processing:** Introduction to transaction processing, Transaction and system concepts, Desirable properties of transactions.

Unit IV

Concurrency Control: Locking techniques for concurrency control. Database Security and Authorization: Types of security, control measures, database security and the DBA, Access protection, User accounts and database audits, Access Control based on granting and revoking privileges.

Recommended Books / Suggested Readings:

1. Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 6th Edition, (2013).

2. Desai, B.C., 1993: An Introduction to Database Systems, Galgotia Publ. Private Ltd.

3. Date, C.J.: Data Base Systems, Vols. II, Narosa Publ. & I.

4. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems Pearson Education, 5th edition.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA413: Computer Networks

Credits : 4

LTP 310

Course Description: The course aims to equip the students to acquire knowledge data communication and Computer Networks.

The course includes Basics of Data Communication, Network Topologies, protocols, Networking models.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Define, use and implement Computer Networks and the basic components of a Network system.

CO2: Identify different transmission media and network models.

CO3: Analyze the topologies and network models.

CO4: Formulate framing control and flow control, Explain error correcting codes and error detecting codes.

CO5: Discuss store and forward switching network, Explain Routing algorithm.

Course Contents:

Unit I

Introduction: network: network criteria, Network Topologies, physical structures, network types. Network models- TCP/IP protocol suite, the OSI model. Physical layer- Introduction to data and signals, Transmission impairment, Multiplexing. Transmission media: guided media and unguided media, switching circuit switching.

Unit II

Data-link layer: Introduction to data-link layer: Nodes and links, services, two categories of links, two sublayers, link-layer addressing, error detection and correction: types of errors, redundancy, detection versus correction, coding, block coding, cyclic codes, checksum, forward error correction, Data link control (DLC): DLC services, data-link layer protocols, wired LANs: ethernet, wireless LANs.

Unit III

Introduction to network layer: network-layer services, packet switching datagram approach, virtual-circuit approach, network-layer performance, IPv4/IPv6 addresses, Forwarding of IP packets: forwarding based on destination address, forwarding based on label, routers as packet switches Network-layer protocols: internet protocol (IP), ICMP. Routing- introduction: unicasting, multicasting, broadcasting. Unicast routing: routing algorithms, unicast routing protocols.

Unit IV

Introduction to transport layer: Transport-layer services, connectionless and connection-oriented protocols, transport-layer protocol: simple protocol, stop-and-wait protocol, go-back-n protocol, selective-repeat protocol, Piggybacking. Transport-layer protocols: Introduction, services, port numbers, user datagram protocol, transmission control protocol, SCTP.

Recommended Books / Suggested Readings:

1. Data Communications and Networking. Behrouz A. Forouzan.

2. Data Communications and Networking (McGraw-Hill Forouzan Networking.

3. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI.

4. Peterson and Davie. Computer Networks (2nd Edition). San Francisco, CA: Morgan Kaufmann Publishers, 1999.

5. Walrand and Varaiya. High Performance Communication Networks. San Francisco, CA: Morgan Kaufmann Publishers, 1996. ISBN: 1558603417.

6. James F. Kurose and Keith W. Ross, "Computer Networking", Pearson Education.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance	

BCA433: Computer Networks Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the students to aware about various types of cables used in guided media like co-axial, fiber optical, twisted pair cables and its categories. The course includes working with packet tracer to simulate various networks.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate the installation and configuration of network simulator

CO2: Demonstrate and measure different network scenarios and their performance behavior.

CO3: Describe the Packet Tracer software.

CO4: Design and setup an organization network using packet tracer.

List of Practical:

1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in Detail.
3. Study of network IP.
4. To study of different type of LAN equipment's.
5. Connect the computers in Local Area Network.
6. Study of basic network command and Network configuration commands.
7. Introduction to Packet Tracer 5.3 & Simple 5 PC's network.
8. Creating a Network topology using CISCO packet tracer software.
9. Configure basic routing and switching using CISCO packet tracer software.
10. Router Configuration Using Packet Tracer

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks

BCA402: Java Programming

Credits : 4

LTP 310

Course Description: The course aims to equip the students to learn various object-oriented features of the Java language. The course includes encapsulation, Inheritance and polymorphism, use data types, arrays, exception handling, Multithreading.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the principles and practice of object-oriented analysis and design in the construction of robust, maintainable programs, which satisfy their requirements.

CO2: Implement, compile, test and run Java programs comprising more than one class, to address a particular software problem.

CO3: Demonstrate the principles of object-oriented programming.

CO4: Demonstrate the ability to use simple data structures like arrays in a Java program.

CO5: Describe the concept of package, interface, multithreading and File handling in java.

Course Content

Unit I

Overview of Java: Introduction, Programming Paradigm, Oops Concepts, Evolution of Java, Features of Java, C++ Vs Java, Java and Internet, Java and www, Java Support Systems, Java Environment.

Key Features of Java: Introduction, Java Program Structure, Simple Java Program, Tokens, Java Statements, Java Virtual Machine, Constants and Variables, Declaration of Variables, Scope of Variables, Data Types, Symbolic Constants, Type Casting, Command Line Arguments.

Operators - Operators, Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Increment and Decrement, Conditional Operators, Special Operators, Assignment Operators, Expression & Its Evaluation.

Unit II

Control Statements: Introduction, Control Statements, Sequence Control Statement, Decision Control Statement, Case Control Statement, Iteration Control Statement, Jump in Loops, Labeled Loops. Method: Defining, Declaring, and calling of method, Call by Value and

Call by Reference, Recursion, Method Overloading.

Arrays and Strings: Introduction, Array, Need of Array, Types of Arrays, One Dimensional Array, Two-Dimensional Array, Multidimensional Array, Strings, Concatenation of Strings, Methods for String Comparison, Methods for Searching Strings, Changing the Case of Characters, String Buffer. Classes: Introduction, Defining A Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Access Control, Constructors, Constructor Overloading, Garbage Collection, Finalize () Method, This Keyword, Static Members, Nesting of Methods.

Unit III

Inheritance: Inheritance, Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical inheritance, Using Super. **Constructor** Order of Execution in Inheritance, Overriding Methods, Final Variables and Methods, Final Classes, Abstract Methods and Classes, Containership, Visibility Control **Interface & Packages:** Introduction, Interfaces, Defining Interface, Implementing Interface, Accessing Interface Method, Accessing Interface Variable, Extending Interfaces, Packages, System Packages, Using System Packages, User Defined Packages, Adding Class to A Package, Accessing and Using Package.

Unit IV

Exception Handling: Introduction, Exceptions, Using Try & Catch, Multiple Catch Clauses, Finally, Throw, Throws.

Multithreading: Introduction, The Main Thread, Creating Threads, Life Cycle of Thread, Using Threads Methods, Thread Priorities, Stopping and Blocking a Thread, Thread Exceptions, Using Is Alive () And Join (), Synchronization

Applet Programming: Local and Remote Applets, Applets and Applications, Building Applet Code, Applet Life

Cycle: Initialization State, Running State, Idle or Stopped State, Dead State, Display State.

Managing I/O Files: Concept of Streams, Stream Classes, Byte Stream Classes, Input Stream Classes, Output Stream Classes, Character Stream Classes, Reader Stream Classes, Writer Stream Classes, Using Streams, Reading and Writing Files.

Recommended Books / Suggested Readings:

1. E. Balaguruswamy, Programming with JAVA, A primer, 3e, TATA McGraw-Hill Company.

2. Programming in Java by Sachin Malhotra, OXFORD University Press.

3. John R. Hubbard, Programming with Java, Second Edition, Schaum's outline Series, TATA McGraw-Hill Company.

4. Deitel & Deitel. Java TM: How to Program, PHI (2007).

5. Java Programming: From Problem Analysis to Program Design- D.S Malik

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA422: Java Programming Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to provide the foundation of good programming skills by discussing key issues to the design of object-oriented programming. The course includes fundamentals of programming such as variables, conditional and iterative execution, methods, etc.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Use the Java SDK environment to create, debug and run simple Java programs.

CO2: Create Java application programs using sound OOP practices (e.g., interfaces and APIs).

CO3: Apply the Java Programming concepts to develop Software.

CO4: Develop and deploy Applet in java.

Lab Exercises:

1. Program to display a message on the screen.
2. To write a Java program to add two numbers.
3. To write a program to perform arithmetic operations.
4. To write a program to calculate area of the circle.
5. To write a program to print the area of the rectangle.
6. To write a program to check whether the no is even or odd.
7. To write a program to find the greatest among 3 nos' using nested if.
8. Program to find calculate sum, average and check if pass or fail.
9. To write a program to perform arithmetic operations using switch statement.
10. To write a program to print the name of the entered natural no (1-10).
11. To write a program to find sum of n natural numbers.
12. To write a program to find the factorial of a number entered by the user.
13. To write a program to find sum of n numbers entered by the user.
14. To write a program to find sum of two numbers using class and object.
15. To write a program to print the marksheet of a student.
16. To write a program to perform arithmetic operations using static members.
17. To write a program to print the greatest value using nesting of methods.
18. To write a program to calculate area and volume using inheritance of classes
19. To write a program to implement method overriding.
20. To write a program to read and print n numbers using arrays.
21. To write a program to read and sort n numbers.
22. To write a program to find the sum of two matrices.
23. To write a program to calculate the sum of two matrices.
24. Java program to demonstrate the use of Constructor.
25. To write a program to perform arithmetic operations using package.
26. To write a program to implement multiple inheritance using interfaces.
27. To write a program to display the concept of exception handling.
28. To write a program to perform multithreading using multiple class method.
29. To write a program to use applet function to draw a shape of the house.
30. To write a program to use applet function to draw a shape of the CAR
31. Any other programs related to this.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks

GWE101: Gender Equality and Women Empowerment

Credits : 2

LTP 200

Course Description: The course aims to equip the students to provide the knowledge around the revolving issues for gender equality and women's empowerment. The course includes the issues of gender and the gender inequalities prevalent in society, Women and Law and Prevention of Sexual Harassment.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Recognize the intersections between gender and other social and cultural identities

CO2: Engage in promoting social justice and human rights

CO3: Explain how theories of gender and sexuality have been influenced by and influence their social contexts

CO4: Describe the social construction of gender and sexuality and explain who these constructions are shaped by the time, location, and culture.

Course Contents:

Unit I

Introduction to Women's Studies: Sex and Gender, socialization, Definition, Nature, Scope and various dimensions.

Unit II

Approaches of Feminism: Feminism and Patriarchy, Feminist ideology, Feminist Movements in brief.

Unit III

Basic concepts of Gender and Society: Sexual division of Labour, Masculinity & feminity, Man and Woman relationship, Self-awareness, consciousness raising.

Unit IV

Women and Law: Constitutional Laws and Fundamental rights, Human Rights, Women related Law, Women in Politics

Recommended Books / Suggested Readings:

1. Gill, Rajesh, Contemporary Indian Urban Society- Ethnicity, Gender and Governance, Bookwell Publishers, New Delhi, 2009.

2. Jain, Devaki and Rajput, Pam, (eds), Narratives from the Women's Studies Family, Sage, New Delhi, 2003.

3. Mies, Maria, Indian Women and Patriarchy, Concept Publishing Company, New Delhi, 2004.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA701: Design and Analysis of Algorithms

Credits : 4

LTP 310

Course Description: The course aims to equip the students to use of different paradigms of problem solving will be used to illustrate clever and efficient ways to solve a given problem. The course includes techniques for effective problem solving in computing.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Decide the appropriate data type and data structure for a given problem.

CO2: Select the best algorithm to solve a problem by considering various problem characteristics, such as the data size, the type of operations, etc.

CO3: Compare algorithms with respect to time and space complexity.

CO4: Apply various algorithm design techniques to solve algorithmic problems.

Course Contents:

Unit I

Introduction: Algorithm, why study algorithm, need of algorithm, algorithm vs program, Complexity of Algorithm, Fundamentals of Algorithmic Problem Solving. Fundamentals of the Analysis of Algorithm Efficiency: Asymptotic Analysis of algorithms, Asymptotic Notations.

Unit II

Divide and Conquer: General method, Binary search, finding the maximum and minimum, merge sort, quick sort. Greedy method: General method, Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, Prim algorithm, Kruskal algorithm.

Unit III

Dynamic programming: The general method, multistage graphs, all-pairs shortest path, Single source shortest path, 0/1 Knapsack problem, Traveling Salesperson problem.

Unit IV

Basic traversal and search techniques: BFS and traversal, DFS and traversal, Bi-connected components and DFS. **Backtracking:** General method, 8-queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

Recommended Books / Suggested Readings:

1.Fundamental of Computer algorithms – Horowitz and Sahni.

2. The art of Computer Programming – Donald Knuth.

3. Design Methods and Analysis of Algorithms – S.K. Basu.

4. The Design and Analysis of Computer Algorithms – Aho, Hopcraft and Ullaman.

5. Sarabasse & A.V. Gelder Computer Algorithm – Introduction to Design and Analysis, Publisher – Pearson 3rd Edition 1999

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA721: Design and Analysis of Algorithms Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to learn how to analyze a problem & design the solution for the problem. The course includes time complexity & memory usage of the solution must be very low.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Identify the problem given and design the algorithm using various algorithm design techniques.

CO2: Implement various algorithms in a high-level language.

CO3: Analyze the performance of various algorithms.

CO4: Compare the performance of different algorithms for same problem.

Lab Exercises:

1. Implement Insertion Sort.
2. Implement Merge Sort (The program should report the number of comparisons).
3. Implement Heap Sort (The program should report the number of comparisons).
4. Implement Quicksort (The program should report the number of comparisons).
5. Implement Greedy method:

i) Minimum Cost Spanning Tree by Prim's Algorithm.

ii) Minimum Cost Spanning Tree by Kruskal's Algorithm.

6. Implement Knapsack Problem using Greedy Approach.
7. Implement 0/1 Knapsack problem using Dynamic Programming.
8. Implement backtracking algorithm for the N-queens problem.
9. Implement Backtracking: a) Graph Coloring Problem b) Hamiltonian Problem

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks

BCA 702: Research Methodology

Credits : 3

LTP 300

Course Description: This course offers "An overview of research methodology including basic concepts employed in quantitative and qualitative research methods. Includes computer applications for research.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Identify the suitable research methods and articulate the research steps in a proper sequence for the given problem.

CO2: Conduct the literature survey, define the problem statement and suggest suitable solution for the problem.

CO3: Analyze the problem and conduct experimental design with the samplings.

CO4: Perform the data collection from various sources segregate the primary and secondary data.

Course Contents:

Unit I

Research Methodology: Introduction, meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology, research and scientific method, importance of knowing how research is done, research process, criteria of good research, and problems encountered by researchers in India.

Unit II

Literature review, Data collection and sampling design: Review concepts and theory, review previous findings, Sources of data: Primary and secondary data, Methods of data collection, Sampling fundamentals.

Unit III

Modeling and Analysis: Probability distributions, Processing and analysis of data, Data analysis skills, Distributions, Statistical and multivariate analysis, Correlation and regression, Fundamentals of Time series analysis, spectral analysis, Error analysis, Simulation techniques.

Unit IV

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Recommended Books / Suggested Readings:

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018.

2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011 Study Material.

3. Research Methods: the concise knowledge base Trochim, Atomic Dog Publishing, 2005.

4. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009.

5. Richard I Levin amp; David S. Rubin, Statistics for Management, 7/e. Pearson Education, 2005.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA 703: Advanced Software Engineering

Credits : 3

LTP 300

Course Description: This course aims to equip students to develop techniques of software-intensive systems through successful requirements engineering, design, testing, maintenance and evolution, and project and quality management.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Interpret the basic concepts of Software Engineering and demonstrate the phases of software development Life cycle using various system models.

CO2: Compare various testing techniques and relate Software advancement methods to build Quality Software products.

CO3: Describe the Design Patterns, Software Testing and its automation.

CO4: Describe the concepts of Web Engineering and Agile methodology.

Course Contents:

Unit I

Introduction: Problem Domain, Challenges, Software Engineering Approach; Software Development process: Process Characteristics. **Software Engineering models:** Predictive software engineering models, model approaches, predictive and adaptive waterfall, waterfall with feedback (Sashimi), incremental waterfall, V model, Prototyping and prototyping models. **Software Requirements Analysis and Specification:** Analysis Approaches, Characteristics and Components of SRS, Validation, Metrics.

Unit II

Software Design: Design Principles, Module level concepts, Design Notation and Specification, Structured Design Methodology, Verification, Metrics, OO Analysis and OO Design, OO Concepts, Object –oriented Design Methodology approach. Design Patterns: Basic concepts of Design patterns, how to select a design pattern, Creational patterns, Structural patterns, Behavioral patterns. Concept of Anti-patterns. **Software Testing:** Software testing principles, Program inspections, Program walkthroughs, Program reviews. **Blackbox testing:** Equivalence class testing, Boundary value testing, Decision table testing, pairwise testing, State transition testing, Use-case testing; White box testing: control flow testing, Data flow testing. **Testing automation:** Defect life cycle; Regression testing, testing automation; Testing non- functional requirements.

Unit III

Software Quality: Quality concepts, Software Quality Assurance Group, Activities, ISO 9000. Capability Maturity Model, Six-Sigma, Metrics for Software Quality, McCabe's cyclometer complexity metric. Software Reliability: Definition, Basic Concepts, Parameters for Evaluation. S**oftware Configuration Management:** Using version control, managing dependencies, managing software configuration, Managing build and deployment environments. Continuous Integration: Prerequisites for continuous integration, Essential practices. C**ontinuous Delivery:** Principles of Software delivery, Introduction and concepts.

Unit IV

Web Engineering: Attributes Of web-based applications, the WebE process, a framework for WebE. Formulating, analyzing web-based systems, design and testing for web-based applications, Management issues. Agile: Introduction to Agile, Value points of Agile, Principle of Agile, Agile comparisons with traditional model of Software Engineering, Agile Team, Agile Implementation, Introduction to Scrum, DevOps.

Recommended Books / Suggested Readings:

1. E. Fairley, "Software Engineering Concepts", McGraw-Hill, 1985.

2.Rohit Khurana, “Software Engineering: Principles and Practices”, Vikas Publishing House 2007.

3. Ian Sommerville, “Software Engineering “, Pearson Education, 2001

4. Designing User Interface, James E Powell, Galgotia Publications, 1991.

5. Roger S. Pressman, Software Engineering, A Practitioner's Approach, McGraw Hill International Edition (2009) 7th edition.

6. Philip A. Laplante, What Every Engineer Should Know about Software Engineering, CRC, Press.

7. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company, (2006) 8th ed.

8. KK Aggarwal, Yogesh Singh, Software Engineering, (2012), 3rd Edition, New Age International.
9. James F. Peter, Software Engineering - An Engineering Approach, John Wiley (2004).
10. Pankaj Jalote, An integrated Approach to Software Engineering, Narosa (2005).
11. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill Edition, 2008
12. Ali Behforroz, Frederick J. Hudson, "Software Engineering Fundamentals", Oxford Indian Reprint, 2012
13. Kassem A. Saleh, "Software Engineering", First Edition, J. Ross Publishing, 2009.
14. Jibitesh Mishra, Ashok Mohanty, "Software Engineering", Pearson Education, First Edition, 2012.
15. Erich Gamma et. al., Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley.
16. Vaskaran Sarcar, Java Design Patterns: A Hands-On Experience with Real-World Examples, Apress.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA 704: Natural Language Processing

Credits : 4

LTP 310

Course Description: This course is intended as a theoretical and methodological introduction to a the most widely used and effective current techniques, strategies and toolkits for natural language processing.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the fundamentals of Natural Language Processing.

CO2: Describe global vectors for word representations.

CO3: Perform NLP tasks like NER, POS Tagging.

CO4: Describe the application based on natural language processing and to show the points of syntactic, semantic, and pragmatic processing.

Course Contents:

Unit I

NLP Basics and Text Preprocessing: NLP Introduction, NLP Applications Computational linguistics- Introduction, syntax, semantics, morphology, co-location, and other NLP problems. Text Preprocessing - tokenization, part-of-speech tagging, chunking, syntax parsing, and named entity recognition. Public NLP toolkits – NLTK, spacy.

Unit II

Text Representations and Embedding: One-hot encoding, Bag-of-Words (BoW) Dictionary: Term Frequency – Inverse Document Frequency (TFIDF), N-gram. Word Embedding: Word2vec, Glove, and FastText. Text categorization: Basic supervised text categorization algorithms, including Naive Bayes, k Nearest Neighbor (kNN), and Logistic Regression. Sequences and sequential data.

Unit III

Language Modeling: N-gram and Neural Language Models Language Modelling with N-gram, Simple N-gram models, smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development

Unit IV

Word Level Analysis: Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Recommended Books / Suggested Readings:

1. Breck Baldwin, Language processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015
2. Richard M Reese, Natural Language Processing with Java, O'Reilly Media, 2015
3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second, Chapman and Hall/CRC Press, 2010
4. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008
5. Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3 rd Edition, 2018.
6. Jurafsky and James H. Martin. Speech and Language Processing (3rd ed).
7. Hobson Lane, Cole Howard, Hannes Hapke Natural Language Processing in Action 2019
8. Jacob Eisenstein Introduction to Natural Language Processing 2019
9. Dipanjan Sarkar, Text Analytics with Python 2016

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA 724: Natural Language Processing Lab

Credits : 2

LTP 004

Course Description: This course is to introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in the field. The course includes time complexity & memory usage of the solution must be very low.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concepts of natural language processing.

CO2: Describe global vectors for word representations

CO3: Recognize named entity using neural networks.

CO4: Perform sentimental analysis.

Lab Exercises:

1. Understand and implement word2vec
2. Understand the skip-gram method in word2vec
3. Understand and implement GloVe using gradient descent and alternating least squares
4. Understand and implement recursive neural tensor networks for sentiment analysis
5. Word Analysis, Word Generation
6. N-Grams, N-Grams Smoothing

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	

	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA 801: Advanced Database Management System

Credits : 4

LTP 310

Course Description: The course aims to equip the students with fundamentals concepts of Database Management System, Data Models and Transaction management.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Transform high-level conceptual model to relational data model, populate database and formulate queries based on principles of normalization.

CO2: Design and Implement a Database for any given problem.

CO3: Describe the various emerging Database Models, Technologies and Applications.

CO4: Describe the concepts of intelligent database and temporal database

Course Content

Unit I

Database Design: Informal Design Guidelines for Relation Schemas, Problems of Bad Database Design. **Normalization:** Functional Dependency, Full Functional Dependency, Partial Dependency, Transitive Dependency, Normal Forms– 1NF, 2NF, 3NF, BCNF, Multi-valued Dependency, Join Dependency and Higher Normal Forms- 4NF, 5NF.

Unit II

Transaction Management and Query Optimization: Properties of Transaction, Serializability, Concurrency Control, Locking Mechanisms, Two Phase Commit Protocol, Deadlock, Query Processing, Heuristics of Query Optimization, Cost Based Query Optimization.

Concurrency Control and recovery: Two phase locking techniques for concurrency control; concurrency control based on timestamp ordering; multi-version concurrency control techniques; validation(optimistic) concurrency control techniques; granularity of data items and multi granularity locking, recovery concepts and recovery techniques.

Unit III

Object Based Databases: Overview, Complex Data types, Structured types and inheritance in SQL, Table Inheritance, Array and Multiset types in SQL, Object identity and reference types in SQL.

XML: DTD and XML Schema, XML presentation, XML Applications.

Next Generation Databases: Distributed Relational Databases, Non-relational Distributed Databases, Mobile database, Multimedia database, Geography databases, Gnome databases, Knowledge databases, deductive databases and semantic databases, Spatial database.

Unit IV

Intelligent Databases: Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases TSQL2- Deductive Databases-Recursive. Introduction to Parallel database and I/O Parallelism

Recommended Books / Suggested Readings:

1. Silberschatz, H.F. Korth and S. Sudharshan, 2006, Database System Concepts, 5th Edition, Tata McGraw Hill, New Delhi.
2. J. D. Ullman, 1988, Principles of Database Systems, Galgotia Publishers, New Delhi.
3. C.J. Date, 1985, An Introduction to Database Systems, Third Edition, Narosa, New Delhi.
4. Elmasri and Navathe, 1999, Fundamentals of Database Systems, Third Edition, Pearson Education, Delhi.
5. An Introduction to Database System, Bipin C. Desai, Revised Edition, 2012, Galgotia Publications Pvt Ltd-New Delhi.
6. Database Management Systems, Raghu Ramakrishnan, Third Edition, 2014, McGraw-Hill.
7. SQL, PL/SQL the Programming Language of Oracle, Ivan Bayross, 4th Revised Edition, 2009, BPB Publications.
8. Judith Hurwitz, Alan Nugent, Fern Halper, and Marcia Kaufman, “Big Data for Dummies”, Wiley Publication, New Delhi, 2013.
9. Hector Garcia-Molina, Jeffrey Ullman and Jennifer Widom, “Database Systems: The Complete Book”, Second Edition, Prentice Hall, 2008
10. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T. Snodgrass, V.S. Subrahmanian, Roberto Zicari, -Advanced Database Systems‖, Morgan Kaufmann publishers,2006.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA 821: Advanced Data Base Management System Lab

Credits : 2

LTP 004

Course Description: This course is to introduce the students with advanced principles and techniques required in the design and implementation of database systems. The course includes SQL and PL/SQL, advanced databases.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe various types of databases and their advanced applications.

CO2: Describe the complex query processing.

CO3: Identify how and where databases are used in industry.

CO4: Examine the requirements on special databases.

Lab Exercises:

1. Basic SQL and PL/SQL
2. Study and Working of WEKA Tool
3. Distributed Database Partitioning and queries on distributed database
4. Distributed Database for Bookstore
5. Parallel Database and queries.
6. Parallel Database – University Counselling for FCS students.
7. Temporal and Spatial Database and queries
8. Geography databases
9. Graph Database Neo4jOverview, CQL overview, Write, read general clause, functions

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks

BCA 802: Advanced Computer Architecture

Credits : 4

LTP 310

Course Description: The course aims to equip the students to provide basic concepts of computer architecture, Pipeline and Vector Processing, memory organization and Multiprocessors. The course includes basic concepts and structure of computers, Parallelism concepts in Programming, different memory systems, multiprocessor and Interconnection structures.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate concepts of parallelism in hardware/software.

CO2: Interpret performance of Pipeline and Vector Processing.

CO3: Identify SIMD and MIMD architecture.

CO4: Describe memory organization and architectural features of processors.

Course Contents:

Unit I

Fundamentals of Computer Architecture: Computational model, Evolution of computer architecture, process thread, Concurrent and parallel execution, types of parallelism, levels of parallelism. Instruction set principles: Classifying instruction set architecture, memory addressing, address modes for signal processing, Operations in the instruction sets, instruction for control flow, MIPS architecture.

Unit II

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors. Computer Arithmetic: Addition & Subtraction, Multiplication algorithms, Division Algorithms, Floating point arithmetic operations, Decimal Arithmetic unit, Decimal Arithmetic operations. SIMD Architecture- Introduction, Parallel Processing, classification of Parallel Processing, Fine-Grained SIMD Architecture, coarse-Grained SIMD Architecture.

Unit III

Vector architecture and MIMD Architecture-, addressing modes, instructions formats, effect of simplification on the performance, example processors such as MIPS, PA-RISC, SPARC, Power PC, etc.

IO Organization: Peripheral devices, I/O interfaces, asynchronous data transfer, Modes of Data transfer, Priority Interrupts, DMA, I-O processors, Serial Communication. **Memory Organization:** Memory Hierarchy, Main Memory, Associative Memory, Cache Memory, Virtual Memory, Memory management hardware.

Unit IV

Multiprocessors: single cycle processors, hardwired and micro-coded FSM processors, pipelined processors, multi-core processors, analyzing processor performance. **Interconnection structures:** Time Shared, Common bus, Multi-port, Crossbar switch, Multistage, Inter-processor arbitration, Inter-processor communication & synchronization, cache coherence. Parallel Computing: Parallel Virtual Machine and message passing interface, Libraries, and calls. Advanced architectures today's Fastest Computer.

Recommended Books / Suggested Readings:

1. Morris M. Mano, Computer System & Architecture, PHI Publications.
2. Stallings & Williams, Computer Organization & Architecture, Maxwell Macmillan.
3. V. Rajaraman & Radhakrishnan, Introduction to Digital Computer Design, PHI Publications.
4. P. Pal Chowdhary, Computer Organization & Design, PHI Publications.
5. Computer Architecture: A Quantitative Approach, by J.L Hennessy and D.A Patterson.
6. Digital Design and Computer Architecture, by D.M Harris and S.L Harris.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA 803: Blockchain Technologies

Credits : 4

LTP 310

Course Description: The course aims to equip the students to provide basic concepts of blockchain technology. The course includes Blockchain, Double Spending, Bitcoin.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate the basics of Block chain concepts using modern tools/technologies.

CO2: Analyze the role of block chain applications in different domains including cybersecurity.

CO3: Evaluate the usage of Block chain implementation/features for the given problem.

CO4: Analyze the application of specific block chain architecture for a given problem

Course Content:

Unit I

Introduction to Blockchain: How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and private key basics, pros and cons of Blockchain, Myths about Bitcoin.

Unit II

Blockchain: Architecture, versions, variants, use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.

Unit III

Concept of Double Spending: Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy, payment verification, Resolving Conflicts, Creation of Blocks

Unit IV

Introduction to Bitcoin

Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency, Law and Regulations. Case Study.

Recommended Books / Suggested Readings:

1. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by Arshdeep

Bikramaditya Signal, Gautam Dhameja Priyansu Sekhar Panda., A Press.

2. Blockchain Applications: A Hands-On Approach by Bahga, Vijay Madisetti

3. Blockchain by Melanie Swan, OReilly

4. Bitcoin and Cryptocurrency Technologies by Aravind Narayan. Joseph Bonneau, princton

5. Bitcoin and Blockchain Basics: A non-technical introduction for beginners by Arthu.T Books.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA 804: Digital Image Processing

Credits : 4

LTP 310

Course Description: The course aims to equip the students to provide basic concepts of basic digital image properties and processing technology.

The course includes Digital Image Fundamentals, Binarization and Segmentation of Grey level images, Image Restoration, Segmentation Techniques.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe Image formation and transformation using sampling and quantization

CO2: Define different types of signal processing techniques used for image sharpening and smoothing

CO3: Perform and demonstrate the compression and coding techniques used for image data.

CO4: Describe the need for image compression and techniques of image compression.

Course Content:

Unit I

Digital Image Fundamentals: A simple image model, Sampling and Quantization, Imaging Geometry, Digital Geometry, Image Acquisition Systems, Different types of digital images. **Bilevel Image Processing:** Basic concepts of digital distances, distance transform, medial axis transforms, component labeling, thinning, morphological processing, extension to grey scale morphology.

Unit II

Binarization and Segmentation of Grey level images: Histogram of grey level images, Optimal thresholding using Bayesian classification, multilevel thresholding, Segmentation of grey level images, Water shade algorithm for segmenting grey level image. Detection of edges and lines in 2D images: First order and second order edge operators, multiscale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, edge linking.

Unit III

Image Restoration: Image Restoration-Constrained and unconstrained restoration Wiener filter, motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.

Unit IV

Segmentation Techniques: Segmentation Techniques-thresholding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications.

Recommended Books / Suggested Readings:

1. Ganzalez and Wood, "Digital Image Processing", Addison Wesley, 1993

2. Anil K. Jain, "Fundamental of Image Processing", Prentice Hall of India.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA 824: Digital Image Processing Lab

Credits : 1

LTP 002

Course Description: This course is to introduce the students to provide basic concepts of basic digital image properties and processing technology.

This laboratory course completely deals with basics of image processing and their experimental observations.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the image fundamentals, mathematical transforms necessary for image processing.

CO2: Evaluate the techniques for image enhancement and image restoration.

CO3: Analyze images in the frequency domain using various transforms.

CO4: Interpret Image color models.

Lab Exercises:

1. To create a program to display grayscale image using read and write operation.
2. To create a vision program to find histogram value and display histograph of a grayscale and color image.
3. To create a vision program for Non-Linear Filtering technique using edge detection
4. To create a vision program to determine the edge detection of an image using different operators.
5. To create a program to discretize an image using Fourier transformation.
6. To create a program to eliminate the high frequency components of an image.
7. To create a color image and perform read and write operation.
8. To obtain the R, B, G colour values and resolved colour values from a colour box by choosing any colour.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks

Vocational courses (VC)

BCA105: HRM for IT Manager

Credits : 3

LTP 300

Course Description: The course aims to equip the students with the techniques and principles to manage human resource of an organization and focused on Indian experiences, approaches and cases.

The course includes focuses on changing environment of HRM, Human Resource Planning, Human Resource Information System (HRIS), Job analysis, Recruitment and Selection & Training & development, Performance appraisal, it deals with issues related to people such as compensation, Industrial Disputes, Industrial Relations and trade unions.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concept of Human resources management.

CO2: Discuss the development, implementation, and evaluation of employee recruitment, selection, and job analysis.

CO3: Develop, implement, and evaluate employee training and development programs.

CO4: Describe various industrial disputes, trade unions, and social security measures.

Course Content:

Unit I

Human Resource Management: Concept, Nature, scope, managerial and operative functions of Human resource management, roles, skills & competencies of HR Manager, HRD definition, goals and functions; The changing environment of HRM – globalization, cultural environment, technological advances, workforce diversity, corporate downsizing, changing skill requirement.

Unit II

Human Resource Planning: Process, forecasting demand & supply, Skill inventories, Human Resource Information System (HRIS), introduction to succession planning, Job analysis – Uses, methods, process, Job description & Job specifications. Concept of Job Design, Recruitment and Selection: internal & external sources, e- recruitment, selection process.

Unit III

Training: Concept, Need, and importance of training, on the job and off the job Methods of training, Performance appraisal: concept, uses of performance appraisal, Traditional and Modern methods of performance appraisal, factors that distort appraisal, appraisal interview, Concept of Career planning, objectives of career planning.

Unit IV

Compensation: Steps of determining compensation, components of pay structure, factors influencing compensation levels, Brief introduction of social security, health, retirement & other benefits, Industrial Relations: Introduction to Industrial Relations, industrial dispute-concept, causes & machinery for settlement of disputes, Trade unions role, types, functions, problems.

Recommended Books / Suggested Readings:

1. De Cenzo, D.A. & Robbins: Fundamentals of Human Resource Management, New York: John Wiley & Sons.
2. Dessler, G: Human Resource Management, Pearson.
3. Monappa & Saiyaddin: Personnel Management, Tata McGraw Hill.
4. Rao, V.S.P.: Human Resource Management- Text and Cases, Excel Books.
5. R. Wayne Mondy & Rober M. Noe: Human Resource Management, Pearson.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCM101: Financial Accounting

Credits : 3

LTP 300

Course Description: The course aims to equip the students with conceptual knowledge of the financial accounting and understand the concepts and procedures of financial reporting, including income statement, balance sheet, and statement of cash flows. The course includes theoretical framework, accounting process, business income and accounting for hire purchase and installment systems.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Acquire with conceptual knowledge of the financial accounting.

CO2: Prepare financial statements in accordance with Generally Accepted Accounting Principles.

CO3: Use accounting concepts, principles and framework to analyze and effectively communicate information to a variety of audiences.

CO4: Record the accounting treatment of various kinds of business transaction.

Course Content:

Unit I

Accounting as an information system, the users of financial accounting information and their needs, Qualitative characteristics of accounting information, Functions, advantages and limitations of accounting, Branches of accounting, Bases of accounting, cash basis and accrual basis. The nature of financial accounting principles – Basic concepts and conventions, Financial accounting standards: Concept, benefits, procedure for issuing accounting standards in India, Salient features of First-Time Adoption of Indian Accounting Standard (Ind-AS)

Unit II

Preparation of ledger account, Accounting Process From recording of a business transaction to preparation of trial balance including adjustments: Capital and Revenue expenditure & receipts, Preparation trial balance, Profit and Loss Account and Balance Sheet preparation (Basic only).

Unit III

Nature of Depreciation, Accounting concept of Depreciation, Factors in the measurement of Depreciation, Methods of computing depreciation: straight line method and diminishing balance method; Disposal of depreciable assets-change of method.

Unit IV

Inventories: Meaning. Significance of inventory valuation; Inventory Record Systems: periodic and perpetual. Methods: FIFO, LIFO and Weighted Average. Salient features of Indian Accounting Standard (Ind-AS): 2.

Recommended Books / Suggested Readings:

1. Robert N Anthony, David Hawkins, Kenneth A. Merchant, Accounting: Text and Cases. McGraw-Hill Education, 13th Ed. 2013.
2. 3. Prof. Jawahar Lal, Seema et al Financial Accounting, Himalaya Publishing
3. Charles T. Horngren and Donna Philbrick, Introduction to Financial Accounting, Pearson Education
4. J.R. Monga, Financial Accounting: Concepts and Applications. Mayur Paper Backs, N. Delhi
5. M.C. Shukla, T.S. Grewal and S.C. Gupta. Advanced Accounts. Vol.-I. S. Chand & Co., New Delhi.
6. S.N. Maheshwari, and. S. K. Maheshwari. Financial Accounting. Vikas Publishing House, N Delhi
7. Deepak Sehgal. Financial Accounting. Vikas Publishing H House, New Delhi.
8. Bhushan Kumar Goyal and HN Tiwari, Financial Accounting, International Book House
9. Goldwin, Alderman and Sanyal, Financial Accounting, Cengage Learning.
10. Tulsian, P.C. Financial Accounting, Pearson Education.
11. Compendium of Statements and Standards of Accounting. The Institute of Chartered Accountants of India, New Delhi

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

CAM101: Digital Design

Credits : 3

LTP 300

Course Description: The course aims to equip the students with detailed understanding of Photoshop's role in digital media.

The course includes principles of design, Basic to advanced photo editing techniques used in industry.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Work with digital graphics and color compositions.

CO2: Create logical and aesthetical digital designs.

CO3: Describe various techniques of creating matte paints.

CO4: Create magazine covers and promotional material.

Course Content:

Unit I

Principles of design: Balance, Proportion, Rhythm, Harmony and unity, Emphasis.

Unit II

Photoshop: Introduction to digital art and platform, Pixel, Raster, Vector, Bit depth, Resolution. User Interface: Basic setting and color, Canvas. **Working with Layers and Tools:** Layer management, understanding menu bar, retouching photo and images, Text, understanding tool bar, Understanding channels, Layer mask, Quick mask tool. **Composition and Color Correction:** Understanding compositing, Color correction tools and techniques.

Unit III

Digital& Matte Painting: Understanding Digital painting, Tools and techniques of digital painting. Understanding concept of Matte painting, Tools and techniques of matte painting.

Unit IV

Filter and Effects: Working with various filters and effects used in Photoshop for different kind of project work.

Recommended Books / Suggested Readings:

1. Lidwell William, (January 1, 2010), Universal Principles of Design, Rockport Publishers.

2. Mark Galer and Philip Andrews, (26 July 2012), Adobe Photoshop CC Classroom in a Book (2018 release), Focal Press; Pap/DVD edition.

3. Kevin Musk (3 October 2021), Digital Matte Painting Kindle Edition.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BAM102: Digital Illustration and Image Processing

Credits : 3

LTP 300

Course Description: The course aims to equip the students' knowledge about the principles of design and their implementation in digital design.

The course includes understanding difference between raster and vector graphics and practical experience of creating Digital paintings using Adobe Photoshop and Illustrator.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Know about digital graphics and color compositions.

CO2: Use Illustrator tools to create logical and aesthetical vector designs.

CO3: Learn various techniques of creating matte paints.

CO4: Create magazine covers and promotional material.

Course Content:

Unit I

Principles of design: Balance, proportion, Rhythm, Harmony and unity, Emphasis.

Unit II

Vector Graphics Designing: (Character Creation) Introduction to Illustrator, Introduction to User Interface, Understanding tools, Working with Image and Shapes Manipulation, Selecting and Aligning, grouping, Exploring object arrangement, working with nested group, Creating and Editing Shapes, Understanding Drawing modes, Joining Paths, Using Image Trace to create Shapes, Transforming objects, Working with Color and Pencil Tools, drawing with the Pencil tools, Path finding & Graphics type panels, Painting with Patterns, Working with Live Paint, Understanding the Perspective Grid, Preset Grid, Active Grid, Understanding Symbols, Illustrator Symbols Library, Creating and Editing Symbols

Unit III

Raster Graphics Designing- Photo manipulation, restoration, concept art- Introduction to Photoshop, digital art and platform, pixel, Raster, vector, Bit depth, Resolution, working with layers and tools, Layer management, understanding menu bar, retouching photo and images, Text, understanding tool bar, understanding channels, Layer mask, Quick mask tool, Composition and Color Correction, Understanding compositing, Color correction tools and techniques.

Unit IV

Matte Painting & Digital Painting: Understanding Digital painting, Tools and techniques of digital painting, concept of Matte painting, Tools, and techniques of matte painting, Understanding various filters and effects. Using Layers to create depth in a matte painting. Using various tool to re-touch and restore an old image. Color grading an image. Brush patterns and creating brushes in photoshop.

Recommended Books / Suggested Readings:

1. Lidwell, William, (October 1, 2003), Universal Principles of Design, Rockport Publishers.

2. Adobe Photoshop Classroom in a Book, 3 February 2021 by Conrad Chavez (Author), Andrew Faulkner (Author)

3. Mattingly, David B, (8 April 2011), The Digital Matte Painting Handbook, Sybex; Pap/Dvdr edition.

4. 4. Adobe Creative Team, (July 5, 2013), Adobe Illustrator CC: Classroom in a book, Adobe Press; 1 Edition

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA410: Fundamentals of Digital Marketing

Credits : 3

LTP 300

Course Description: The course aims to equip the students with knowledge of Internet Marketing topics including online advertising, search, social media, and online privacy.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Develop understanding of the processes and techniques of digital marketing.

CO2: Assess the challenges and the opportunities of digital marketing.

CO3: Evaluate future trends in digital marketing.

CO4: Describe the different types of marketing in the Digital Marketing.

Course Content

Unit I

Introduction to Digital Marketing: Difference between Traditional Marketing and Digital Marketing, Benefits of using Digital Media, Inbound and Outbound Marketing, Online marketing POEM: (Paid, Owned, and Earned Media), Components of Online Marketing (Email, Forum, Social network, Banner, Blog), Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing.

Unit II

Search Marketing: Basics of Search Marketing, organic and paid search results, Overview of Google AdWords, keyword research and analysis, Search Engine Optimization techniques: on-page optimization and off-page optimization. Web Analytics: Digital measurement landscape, introduction to Google Analytics, interpreting the data in Google Analytics.

Unit III

Social Media Marketing: Different social media channels, social media for various businesses: B2C and B2B, measuring social media ROI, Content Marketing: Storytelling in social media. Email Marketing: Basics of email marketing. Concept of A/B testing and its use in email marketing.

Unit IV

Display and Mobile Marketing: Display Marketing: different kinds of display marketing, display marketing ecosystem, retargeting, and dynamic retargeting. Mobile Marketing: different kinds of mobile marketing, the mobile market ecosystem.

Writing for Digital Marketing: Identify the readers, understand the needs of your users, understand the context of use, and understand the business objectives, Purpose of content, Accessible content, Case study for any one company that benefitted due to digital marketing.

Recommended Books / Suggested Readings:

1. Damian Ryan and Calvin Jones, "Understanding Digital Marketing".

2. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.

3. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.

4. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.

5. Ian Dodson, "The art of Digital Marketing".

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA411: Search Engine Optimization

Credits : 3

LTP 300

Course Description: The course aims to equip the students with the ways in which search engines function as well as how users interact with them with an eye towards predicting customer behaviors who search for goods and services.

The course includes SEO, Website Structure, Quality Score Optimization.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the overview of search engine marketing.

CO2: Create Web pages designed to be easily crawled and optimally indexed by search engines.

CO3: Discuss Google Analytics and other metrics and tools to monitor progress in achieving search engine marketing goals and Attract inbound Links from other Web Sites.

CO4: Describe the basic principles of Pay Per Click campaigns.

Course Content

Unit I

Search-Engine Optimization: Find Your Target Audience, Set Budget, Set Goals, Keyword Generation, Using the Google AdWords Keyword Tool, Bing Keyword Tool. Creating Pages: An Introduction to Creating Pages, Choose Filenames, Optimize Title Tags, Optimize Meta Keyword Tags, create a Meta Robots Tag, Add Emphasis with Header Tags, Optimize Images, Create Links, Validate HTML

Unit II

Website Structure: Web Hosting, Optimize for Multiple Browsers, Plan and Design a Website Structure, create a Robots.txt File, specify a Canonical Page, Using the Nofollow Attribute, Creating Content, Using Latent Semantic Content, Optimize Non-HTML Documents. Creating Communities: Create a Blog with WordPress, create a Blog with Tumblr, Write Search-Engine-Optimized Posts, create a community with vbulletins, Create a community with phpBB.

Unit III

Building Links: Gather Link Intelligence with Open Site Explorer, Using Effective Anchor Text, Content Marketing with Guest Blogging, and Info graphics. Using Google Analytics, Set Up E-Commerce Tracking, Insert Tracking Code on Your Thank You page, Using Third party Shopping Carts. Social Media Optimization. Creating Pay-Per-Click Campaigns: Learn About AdWords' Accounts, create an AdWords Campaign, Using Google AdWords Editor, Optimize Your Account.

Unit IV

Quality Score Optimization: View your Quality Scores, Optimize Your Quality Score, Test Ad Copy with Advance Keyword Insertion, Using Display Network Target Campaigns, Install Remarketing, Optimize Your Landing Pages Optimizing for Other Search Engines, Increase Exposure an Ask.com, Improve Your Ranking on Bing, Using Shopping Engines to Drive Traffic, Produce Sales with eBay Auctions. Using Craigslist to Drive Traffic, Get Listed on Local.com and ReferLocal.com.

Recommended Books / Suggested Readings:

1. Search Engine Optimization for Dummie by Peter Kent.

2. Search Engine Optimization 3rd Edition by Kristopher B. Jones and Foreword by Boyk.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BAM203: Print Media and Advertisement Design

Credits : 3

LTP 300

Course Description: The course aims to equip the students about the fundamentals and basics of Printing and Advertisement designing. The course includes about various aspects of Advertisement Layout and designing different kinds of advertisements using Adobe Illustrator.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Create graphics for branding and campaigning.

CO2: Create professional ads using design principles and elements.

CO3: Recognize the essentials of newspaper- digital as well as print, understanding RGB and CMYK.

CO4: Create innovative designs for film promotional material.

Course Content

Unit I

Introduction to Print Media & Advertisement: What is Advertisement, what is Print Media, A brief history of advertisement & Print media, the role of advertisement in print media, various aspects of advertisements, understanding the difference between RGB and CMYK color modes. Difference between print media and digital media.

Unit II

Advertisement Layout & Design Elements: Understanding Size, Balance, Typography, Understanding the design elements of logo, Signage, Branding and creating office stationeries.

Unit III

Graphic Design for Media and publishing House: Understanding Book design, Magazine, Advertisement full page, Half page and for magazine/newspaper and its essentials.

Unit IV

Designing for Advertisement: Understanding Poster designing and its essentials, Poster as a strong medium of Advertising Innovative Designs for Animation Films, Slogan, Designing brochure.

Recommended Books / Suggested Readings:

1. Landa, Robin, (27 October 2010), Advertising by Design: Generating and Designing Creative ideas across Media, John Wiley & Sons; 2nd Edition edition.

2. Ken Burtenshaw and Nik Mahon, (2011), The Fundamentals of Creative Advertising, Ava Publishing; 2nd revised edition edition.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA516: E-Content Development

Credits : 3

LTP 300

Course Description: The course aims to equip the students with best use of headlines, subheads, bullets, and hyperlinks. In this course students will be able to ddiscuss the impact of the business objectives and promotional messages, determine tested techniques for effective content writing, describe the impact of mass media promotion and differentiate the content development for different media purposes.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Determine fast track methods to write and produce engaging content for website or blogs.

CO2: Build successful web content.

CO3: Develop the smartest ways to write articles blogs or web contents.

CO4: Classify the right social media channels to promote your contents.

Course Content

Unit I

Understanding writing for the web and how to engage your online audience, how audiences read online and the way we need to write for the web, understanding your audience – who are they, characteristics and personas, turning jargon into reader friendly messages, building relationships with different audience segments, Features/benefit driven content.

Unit II

What makes effective or ineffective web pages and copy, Developing ideas and web content of interest to your online readers, Stories, statistics and other effective ways to convey your message, Planning and structuring your web content ,Effective navigation – how people 'hunt' their way through/to your information, Finding and using the right keywords, The latest SEO copywriting techniques and strategies, Writing headlines, subheads, body copy, bullet points and hyperlinks – and where to use them in copy and other content, Opening sentences that hook your audience ,Other important web copy elements such as titles, metatags, and ALT tags.

Unit III

Creating web-friendly PDF's – and when/where to use them, Images – best practices, alt tags, Info graphics tip, Handy tools for web writers, Email copywriting techniques and strategies, how people read and interact with emails Appropriate tone and style, establishing credibility with your audience, Planning your newsletter content.

Unit IV

Subject lines that work, boosting your subscriber numbers, Emails on mobile. Case study of any organization which successful by content writing.

Recommended Books / Suggested Readings:

1. The Art of SEO 2nd Edition Mastering Search Engine Optimization by Eric Enge, Stephan Spencer, Jessie Sticchiola, Rand Fishkin, publisher O'Reilly Media

2. The Art of SEO 3rd Edition Mastering Search Engine Optimization by Eric Enge, Stephan Spencer, Jessie Sticchiola publisher O'Reilly Media

3. Search Engine Optimization for Dummies by Peter Kent.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA310: Web Development

Credits : 2

LTP 200

Course Description: The course aims to equip the students with ability to develop responsive web application. The course includes HTML, CSS, JavaScript, Dreamweaver.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Define the basic concepts of Internet and Web Services.

CO2: Describe, analyze and apply the role of languages like HTML, DHTML, CSS, and JavaScript in the workings of the web and web applications.

CO3: Analyze and create web pages using HTML, DHTML and Cascading Styles sheets.

CO4: Analyze and build interactive web applications.

Course Content

Unit I

Introduction: History of the Internet and World Wide Web, Website and its types, Web Portal, Browsers and their versions, its functions, URLs, digital certificates for websites, HTTP, HTTPs, establishing connectivity on the internet client IP address, How IP addressing came into existence, web server.

Unit II

Web Development: Introduction to HTML, HTML Document structure tags, HTML comments, Text formatting, inserting special characters, anchor tag, adding images and Sound list types of lists, tables, frames and floating frames, Developing Forms, Image mapping.

Unit III

Overview of DHTML: Introduction, Cascading Style Sheets (CSS), types of CSS, Page layout using CSS. Introduction to JavaScript: How & Where to put the Java Script Code, JavaScript Statements, Comments, Variables, Operators, Control Statements, Loops, Document Object Model (DOM), Popup Boxes, Functions.

Unit IV

Introduction to Dreamweaver: Understanding Workspace Layout, Managing Websites, creating a Website, Using Dreamweaver Templates, Adding New Web Pages, Text and Page Format, Inserting Tables, Lists, Images, Adding Links, etc. **Purchasing a Domain Name & Web Space:** Domain Name & Web Space, getting a Domain Name & Web Space (Purchase or Free), Uploading the Website to Remote Server.

Recommended Books / Suggested Readings:

1. Internet for EveryOne: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.
2. Greenlaw R; Heppe, "Fundamentals of Internet and WWW", 2nd Edition, Tata McGraw-Hill, 2007.
3. Raj Kamal, "Internet & Web Technologies", edition Tata McGraw-Hill Education.2009.
4. HTML & CSS: The Complete Reference, Thomas Powell, Fifth Edition
5. HTML, XHTML and CSS All-In-One for Dummies Andy Harris, Second Edition
6. JavaScript, A Beginner's Guide John Pollock, Third Edition
7. Dreamweaver CS5 For Dummies Janine C. Warner, Paperback Edition

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA330: Web Development Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the Build and publish web sites, a popular visual web site production and management program, using HTML, CSS and JavaScript.

The course includes practical experience with web application using java technologies to create fully functional website/web applications.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Analyze and apply the role of languages like HTML, CSS, JavaScript, and web applications.

CO2: Analyze a web page and identify its elements and attributes.

CO3: Create web pages using HTML, Cascading Styles sheets.

CO4: Create dynamic web pages using JavaScript (client-side programming).

CO5: Build and consume web services.

Lab Exercises:

1. Basic HTML Tags, Table Tags, List Tags, Image Tags, Forms.
2. Design the static web pages required for an online bookstore web site.
3. Design of the cart page and the registration page required for online bookstore.
4. Write Java Script to validate the following fields of the above registration page. Name (Name should contain alphabets and the length should not be less than 6 characters). Password (Password should not be less than 6 characters length), Phone number (Phone number should contain 10 digits only).
5. Design a web page using CSS (Cascading Style Sheets) which includes the following: a) Use different font, styles: In the style definition you define how each selector should work (font, color etc.). Then, in the body of your pages, you refer to these selectors to activate the styles
6. Set a background image for both the page and single elements on the page.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA311: PHP and MySQL

Credits : 2

LTP 200

Course Description: The course aims to equip the students to understand how server-side programming works on the web. The course includes PHP basic syntax for variable types, conditional structures, storing data in arrays using PHP built-in functions and creating custom functions.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concepts of PHP.

CO2: Create, back up a MySQL database.

CO3: Describe the concepts of loop, array, functions and String in PHP.

CO4: Describe the concepts of PHP connection with MySQL.

Course Content

Unit I

Introducing PHP: PHP introduction, inventions and versions, scope, Basic Syntax, PHP variables and constants, Types of data in PHP, Expressions, scopes of a variable (local, global), PHP Operators: Arithmetic, Assignment, Relational, Logical operators, Bitwise, ternary and MOD operator, PHP operator Precedence and associatively.

Unit II

PHP conditional events and Loop: PHP IF Else conditional statements (Nested IF and Else), Switch case, while, For and Do While Loops, Goto, Break, Continue and exit.

PHP Functions: Function, Need of Function, declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference, Scope of Function Global and Local.

Unit III

Working with Arrays: Storing data in arrays, processing arrays with loops and iterations, using arrays with forms working with array functions, working with dates and times.

String Manipulation: Creating and accessing String, Searching & Replacing String; Formatting, joining and splitting String, String Related Library functions.

Unit IV

Tables and Database in PHP: MySQL Connection PHP, Classes Objects, PHP Framework Code Generation scripts, Web Services, Introduction to MySQL, MYSQL for Web application Creating Database, create table, Constraints, Where Clause, Alias, Using MySQL from PHP.

Recommended Books / Suggested Readings:

1. Core PHP Programming by Leon Atkinson: Pearson Publishers.

2. PHP A Beginner's Guide, VIKRAM VASWANI, Tata McGraw-Hill, 2008.

3. The PHP Complete Reference, Steven Holzner –Tata McGraw-Hill Edition,2010

4. The complete Reference PHY by SteverHolzner: McGrow Hill

5. PHP 5.0 and MySQL Bible Tim Converse, Joyce Park, Clark Morgan, Publishers: John Wiley & Sons.

6. Beginning PHP 5.0 Database by Christopher Scollo, Harish Rawat, Deepak Thomas, and Publisher: WROX press.

7. PHP – A beginners Guides BY: Ashok Appu Publisher: Wiley.

8. MySQL Bible by Steve Suehring Publisher: John Wiley &Sons.

9. PHP Black Book by Peter Moulding.

10. PHP 5 and MySQL – Tim converse, Joyce Park and Clark Morgan - Bible Wiley.

11. Beginning PHP 5.3 by matt Doyle – By Word publication.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA331: PHP and MySQL Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the students to familiarize with connectivity between PHP and MySQL and develop programs to add records, retrieve records and delete records from a table. The course includes developing applications in PHP using various concepts of basic programming in PHP.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the fundamentals of PHP.

CO2: Apply control structures/logic to web pages.

CO3: Implement client-side and server-side scripting.

CO4: Implement Database connectivity.

Lab Exercises:

1. Create a php webpage and print "hello world".
2. Create a php program to find odd or even number from given number.
3. Write a php program to find maximum of three numbers.
4. Write a PHP program to swap two numbers.
5. Write a program to do PHP Functions -Adding parameters.
6. Write a program to do Array Operation in PHP.
7. Write a program to do Multidimensional array in PHP
8. Give the example of string function: strcmp.
9. Insertion, Updating and Deletion of rows in MYSQL tables.
10. Database connectivity in PHP with MySQL.
11. Creating simple webpage using PHP and MySQL.
12. Create a form, add the data into it and submit it to the database by connecting it to MySQL database using PHP.
13. Write a program to Develop student registration form and display all the submitted data on another page
14. Write PHP code to upload image.
15. Write a program that keeps track of how many times a visitor has loaded the page.
16. Write a program that displays a different message based on time of day. For example, page should display "Good Morning" if it is accessed in the morning.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA409: Linux Operating System

Credits : 2

LTP 200

Course Description: The course aims to equip the students to familiarize with Linux Operating System working, function and features.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the fundamentals of Linux Operating System.

CO2: Apply the commands for managing the file and directories in the Linux OS.

CO3: Describe the Linux process and Linux editor.

CO4: Describe the shell programming.

Course Content

Unit I

Overview: Operating system, OS services and Components, Types of OS, **Concept of process and threads,** Process states, Process management, Context switching, Interaction between processes and OS. **OS services and Components,** Multitasking, Multiprogramming, Timesharing, Buffering, Spooling.

Unit II

Linux System: Linux introduction and file system – Basic features, advantages, installing requirement, basic architecture of UNIX/Linux system, Kernel, Shell. **Commands for files and directories:** cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files. **Disk related commands:** checking disk free spaces, Essential linux commands.

Unit III

Processes in Linux: process fundamentals, connecting processes with pipes, redirecting input output, manual help, Background processing, managing multiple processes, changing process priority, scheduling of processes at command. batch commands: kill, ps, who, sleep. I**ntroduction to threads:** threads, user threads and kernel threads, creation and management of the threads. **Editor:** vi editor.

Unit IV

Printing commands: grep, fgrep, find, sort, cal, banner, touch, file. File related commands: ws, sat, cut, grep, dd, etc. **Shell programming:** Shell programming basic, various types of shell, shell programming in bash, conditional and looping statements, case statements, parameter passing and arguments, shell variables, shell keywords, creating shell programs for automate system tasks and report printing, use of grep in shell.

Recommended Books / Suggested Readings:

1. Linux programming- Foreword By- Alan Cox.
2. Linux System Programming. Robert Love, O'Reilly, SPD.
3. Linux Command Line and Shell Scripting Bible Publisher: Wiley Indian Edition. By Richard Blum.
4. Linux the complete reference by Richard Mathews (TMH).
5. Red Hat Linux: The Complete Reference by Peterson (TMH)
6. Red Hat Linux 718 By Bill Ball, David Pitts.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA429: Linux Operating System Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the students to familiarize with Linux Operating System working, function and features.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the command of Linux Operating System.

CO2: Apply the text editing skills with Linux editor.

CO3: Describe the shell programming.

CO4: Apply the compilation and running c program in Linux.

Lab Exercises:

1. Study the commands of Linux.
2. Study of Emac / Vi editor
3. To write C Programs using the following system calls of UNIX operating system fork, exec,
4. getpid, exit.
5. Program for Simulation of ls Unix Commands
6. To write simple shell programs by using conditional, branching and looping statements.
7. Write a menu driven shell script which will print the following menu and execute the given task
8. to display result on standard output.
9. MENU
   a) Display calendar of current month
   b) Display today's date and time
   c) Display usernames those are currently logged in the system
   d) Display your name at given x, y position
   e) Display your terminal number
   f) Exit
10. Write a shell script to validate the entered date. (Eg. Date format is: dd-mm-yyyy).
11. Write a shell script to check entered string is palindrome or not.
12. Use of g++ compiler to compile c/c++ program.
13. Write a program for process creation using C. (Use of gcc compiler)

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA406: Linux and Shell Programming

Credits : 2

LTP 200

Course Description: The course aims to equip the students to Understand and make effective use of Linux utilities and Shell scripting language (bash) to solve problems. The course includes Linux file system, commands. Shell scripting.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the key concepts of Linux.

CO2: Describe the basic commands of Linux operating system.

CO3: Write shell scripts.

CO4: Describe file systems and directories and operate them.

Course Content

Unit I

Introduction to Linux: History, Distributions, Features, Linux Architecture, Kernel, Types of Shells, Difference between Windows and Linux Working environments-KDE, GNOME, Xface4 etc. Different types of editors, vi editor and its command.

Unit II

Linux File System: File System, Hierarchy of File system, Devices and Drives in Linux, Mounting devices File System Parts-Boot Block, Super Block, Inode Block, Data Block.

Unit III

Commands, Utilities and File Management: Managing file and directories: mkdir, cd and pwd, ls, cat, more, less. Nested directories, File and Directory.

Operations: find, cp, mv, rm, ln etc.

Filters: head, tail, pr, cut, paste, sort, uniq, grep, egrep, fgrep. Text Editors-vi, vim.

File and Directory permissions: chmod, chown, chgrp.

Printing the files: lpr, lpq, lprm etc. Archive and File compression, Windows integration tools.

Unit IV

Shell programming with the Bourne again shell(bash): Introduction, shell responsibilities, pipes and Redirection, here documents, running a shell script, the shell as a programming language, Shell meta characters, File name substitution, Shell variables, Command substitution, Shell commands, the environment, Quoting, Test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

Recommended Books / Suggested Readings:

1. Linux programming- Foreword By- Alan Cox.
2. Linux System Programming. Robert Love, O'Reilly, SPD.
3. Linux Command Line and Shell Scripting Bible Publisher: Wiley Indian Edition. By Richard Blum.
4. Linux the complete reference by Richard Mathews (TMH).
5. Red Hat Linux: The Complete Reference by Peterson (TMH)
6. Red Hat Linux 718 By Bill Ball, David Pitts.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA426: Linux and Shell Programming Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the students to familiarize with the Linux environment. The course includes fundamentals of shell scripting/programming.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss the Installation and configuration process of Linux OS.

CO2: Determine Unix/Linux environment.

CO3: Write shell scripts to automate various tasks.

CO4: Describe the basics of Linux administration.

Lab Exercises:

1. Installing and configuring Linux -windows.
2. Creating and managing user accounts.
3. Study of logging/logout details.
4. Customizing desktop.
5. Practice on Linux commands.
6. Practice on Visual Interface (V.I.) commands.
7. Study of Unix/Linux file system (tree structure).
8. Study of bashrc, /etc/bashrcand Environment variables.
9. Write and execute at least 10 programs in Linux using shells such as a) Factorial of numbers b) Even/odd numbers c) Fibonacci series d) Prime numbers e) Arrange the numbers f) Reverse of numbers g) Lower case to upper case h) Greatest of three numbers etc. To write a program to use applet function to draw a shape of the CAR
10. Any other programs related to this

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA515: Open-Source Programming

Credits : 2

LTP 200

Course Description: Open source is an online instructional resource that can be freely used distributed and modified to create products using open source.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Use, and develop applications using different open-source technology.

CO2: Describe the concept of open-source software.

CO3: Investigate and Manage Processes in Linux OS

CO4: Implementation of web and database concept with opensource Apache and MySQL.

Course Content

Unit I

Introduction to Open Source: Open Source vs. Commercial Software, Linux, Free Software, Application of Linux OS. Linux Kernel, Linux Distributions.

Unit II

Linux Introduction: Linux Essential Commands, File system Concept, Standard Files, The Linux Security Model, Vi Editor, Partitions creation, Shell Introduction, String Processing, Investigating and Managing Processes, Network Clients, Installing Application.

Unit III

Apache: Starting, Stopping, and Restarting Apache, Modifying the Default Configuration, Securing Apache, Set User and Group, Consider Allowing Access to Local Documentation - Don't Allow public html Web sites - Apache control with access.

Unit IV

Introduction to MY SQL: The Show Databases and Table, The USE command, Create Database and Tables, Describe Table, Select, Insert, Update, and Delete statement, Some Administrative detail, Table Joins, Loading and Dumping a Database.

Recommended Books / Suggested Readings:

1. "Open-Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", James Lee and Brent Ware, Dorling Kindersley (India) Pvt. Ltd, 2008

2. "Setting up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Eric Rosebrock, Eric Filson, Published by John Wiley and Sons, 2004.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA535: Open-Source Programming Lab

Credits : 1

LTP 002

Course Description: Open source is an online instructional resource that can be freely used distributed and modified to create products using open source.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Use, and develop applications using different open-source technology.

CO2: Implement various applications using build systems.

CO3: Investigate and Manage Processes in Linux OS.

CO4: Build basic web applications using PHP.

Lab Exercises:

1. Overview of FOSS & Basic Command interface on Linux
2. Usage of Basic Linux Commands, File Utilities Commands
3. Vi Editor & its Modes, Introduction of Basic administrative commands
4. Learning Administrative Commands
5. Learning Shell Scripting
6. Learn how to Compile, Debug & Execute C, C++ & Java
7. Programming Code without IDEs
8. Learning Basics of LAMP/WAMP/XAMP Server
9. Learning A Deep Dive in MySql
10. Basics of PHP Web Programming.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA517: Full Stack Development

Credits : 2

LTP 200

Course Description: Full Stack Development tackle projects that involve databases, APIs, build user-facing websites, or even work with clients during the planning phase of projects.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the basic concept of HTML and CSS.

CO2: Describe the concept of Java script and React JS.

CO3: Implementation of the concept of NodeJS and MongoDB.

CO4: Describe the concept of Express JS.

Course Content

Unit I

HTML: Formatting Tags, Links, List, Tables, Frames, forms. Cascading Style Sheets: Concept of CSS, Creating Style Sheet, Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties), CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color, Creating page Layout and Site Designs.

Unit II

Java Script: Introduction, Documents, Documents, forms, statements, functions, objects in Java Script, Events and Event Handling, Arrays, FORMS, Buttons, Checkboxes, Text fields and Text areas. React JS: Introduction, Templating using JSX, Components, State and Props, Lifecycle of Component, Rendering List and Portals, Error Handling, Routers, Redux and Redux Saga, Immutable.js, Service Side Rendering, Unit Testing, Webpack.

Unit III

NodeJS: Basics and Setup, Node js Console, Node js Command Utilities, Node js Modules, Node js Concepts, Node js Events, Node js with Express js, Node js Database Access. MongoDB: SQL and NoSql Concepts, Create and Manage MongoDB, Migration of Data into MongoDB, MongoDB with PHP, MongoDB with NodeJS, Services Offered by MongoDB.

Unit IV

Express JS- Advanced Topics Middleware, creating a Custom Middleware, Built-in Middleware, Environments, Configuration, Debugging, Templating Engine, Database Engines, Database Integration, Authentication, Structuring Express Applications.

Recommended Books / Suggested Readings:

1. The Full Stack Development Book Author Bhowmick Snehadeep ISBN: 9789389085938

2. Full Stack Web Development For Beginners: Learn Ecommerce Web Development Using HTML5, CSS3, Bootstrap, JavaScript, MySQL, and PHP by Riaz Ahmed

3.https://www.simplilearn.com/free-online-full-stack-development-course-skillup

4. Full-Stack React, TypeScript, and Node Build cloud-ready web applications using React 17 with Hooks and GraphQL by David Choi.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA537: Full Stack Development Lab

Credits : 1

LTP 002

Course Description: Full Stack Development tackle projects that involve databases, APIs, build user-facing websites, or even work with clients during the planning phase of projects.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Create web pages using HTML and Cascading Style Sheets.

CO2: Analyze a web page and identify its elements and attributes.

CO3: Implementation of the concept of NodeJS and MongoDB.

CO4: Describe the concept of Express JS.

Lab Exercises

1. Create basic web sites using HTML.
2. Understand how to use CSS to style HTML elements
3. Use the Bootstrap framework to increase speed of development.
4. Understand the uses of SQL.
5. Build Search filter in React
6. Display a list in React
7. Simple Login form in React
8. Write a program in node.js to parse the given URL.
9. There is a given object, write node.js program to print the given object's properties.
10. Write a node.js program to get files or directories of a directory in JSON format.
11. Installing and Interacting with the MongoDB server.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA615: ASP.NET

Credits : 2

LTP200

Course Description: This course will help the students to understand ASP.NET web development with ADO.Net.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe Database concepts in ADO.net and apply the knowledge to implement distributed data- driven applications using VB.Net, SQL-Server and ADO.Net.

CO2: Design, document, debug ASP.Net web forms with server and validation controls and implement ASP.Net web services.

CO3: Acquire fundamentals of Web application design, development, and deployment using ASP.NET.

Course Contents

Unit I

Introduction: Overview of ASP.NET framework, Understanding ASP. NET Controls, Applications, Web servers, installation of IIS, Web forms, web form controls server controls, client controls. web forms & HTML, Adding controls to a web form, Buttons, Text Box, Labels, Checkbox, Radio Buttons, List Box, etc. Running a web Applications, creating a multiform web project.

Unit II

Form Validation: client-side validation, server-Side validation, validation controls: Required Field, Comparison, Range, Calendar control, Ad rotator Control, internet Explorer Control. State management- View state, Session state, Application state.

Unit III

ADO.NET: Architecture of ADO.NET, connected and Disconnected Database, create connection using ADO.NET Object Model, Connection Class, Command Class, Data Adapter Class, Dataset Class. Display data on data bound Controls and Data Grid.

Database Accessing on web applications: Data Binding concept with web, creating data grid, Binding standard web server controls. Display data on web form using Data bound control.

Unit IV

XML: Writing datasets to XML, Reading datasets with XML.

Web services: Introduction, Remote method call using SOAP, web service description language, building & consuming web service, Web Application deployment.

Recommended Books / Suggested Readings:

1. VB.NET Black Book by Stevenholzner - Dreamtech.

2. ASP.NET Unleashed.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA635: ASP.NET Lab

Credits : 1

LTP 002

Course Description: This course will help to Set up a programming environment for ASP.net programs, configure an asp.net application and Creating ASP.Net applications using standard .net controls.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Design web applications using ASP.NET.

CO2: Use ASP.NET controls in web applications.

CO3: Debug and deploy ASP.NET web applications

CO4: Create database driven ASP.NET web applications and web services.

Lab Exercises:

1. Design a web page for user registration that has following fields. User First Name, Last Name, DOB, city, pin code, user id, add new password, confirm password, Registration and cancel button.
2. Use validation control with necessary fields with registration form.
3. Store registration form data to the database when user click submit button. Provide error message with registration form if input user id has already existed, otherwise open a new web page.
4. Create a user login web page, when user input id and password are correct with database then open a new default web page containing user id. (Use session state variable)
5. Create a web page that will display all user information in tabular form.
6. Create a web page that will enable to edit any required fields to only login user.
7. Create web page that contain aid rotater control and is capable to display more than one images.
8. Create an XML file for student records that has following fields...Roll no, name, class. Branch.
9. Assign XML data base record into data sets and display into data grid.
10. Design a home page that contain a few hyperlinks to provide navigate all above web pages.

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA616: Mobile App Development

Credits : 2

LTP200

Course Description: The course aims to equip the students to understand, how to develop and deploy an application to the app market. The course includes Activities, Fragments and Intents.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the development environment for Android Application.

CO2: Develop basic Mobile applications.

CO3: Discuss component of an Android Application.

CO4: Apply the concept of the SQLite and location-based services.

Course Contents

Unit I

Introduction to Android: Overview, History, Features of Android, Architecture of Android, Linux Kernel, Native Libraries, Android Runtime, Application Framework, Applications, Tools – (JDK, SDK, Android Studio, ADT, AVD, Android Emulator), Creating your first Android Application, Components of an Android Application, Notifications.

Unit II

Activities, Fragments and Intents: Introduction to Activities, Activity Lifecycle, Introduction to Intents, Linking Activities using Intents, calling built-in applications using Intents, Introduction to Fragments, Adding Fragments Dynamically, Lifecycle of Fragment, Interaction between Fragments. **Android User Interface:** Understanding the Components of a Screen, Views and ViewGroups, LinearLayout, AbsoluteLayout, TableLayout, RelativeLayout, FrameLayout, Scrolllayout, ScrollView, Adapting to Display Orientation, Managing Changes to Screen Orientation, Utilizing the Action Bar.

Unit III

Fragments: Understanding Specialized Fragments, using a ListFragment, using a DialogFragment, Using a PreferenceFragment. **Designing Your User Interface with Views:** Using Basic Views: TextView, Button, ImageButton, EditText, CheckBox,ToggleButton, RadioButton, and RadioGroup Views , ProgressBar View, AutoCompleteTextView. Using Picker Views: TimePicker View, DatePicker View. Using List: Views to Display Long Lists, ListView View, Using the Spinner View.

Unit IV

Displaying Pictures and Menus: Using Image Views to Display Pictures, Gallery and ImageView Views, Image Switcher, Grid View. **Databases:** Introduction to SQLite, SQLiteOpenHelper and SQLiteDatabase, Creating and Using Database, Working with Cursors, Building and executing queries. Messaging and E-mail: Introduction to SMS Messaging and Sending E-mail. **Location-Based Services and Google Map:** Display Google Maps, Getting Location Data. **Preparing and Publishing:** Preparing app for publishing, Deploying APK files, uploading in Market.

Recommended Books / Suggested Readings:

1. Beginning Android4 Application Development, By Wei-Meng Lee WILEY India Edition WROX Publication.

2. Professional Android 4 Application Development, By Reto Meier WROX Publication.

3. Wei-Meng Lee, Beginning android 4 application Development, John Wiley & sons, Inc, 2012.

4. Andrew Whitechapel, Sean McKenna, Windows Phone 8 Development Internals, Microsoft Press 2013.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA636: Mobile App Development Lab

Credits : 1

LTP 002

Course Description: The course aims to equip the students to develop skills in Android Studio.

The course includes mobile Programming basic concepts.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the platforms upon which the Android operating system will run.

CO2: Create applications that runs under the Android operating system.

CO3: Describe deploy android applications.

CO4: Develop application to send SMS and email.

Lab Exercises:

1. Creating "Hello world" Application.
2. Develop an application to implement the concept of intent.
3. Creating an application that displays message based on the screen orientation.
4. Develop an application using Picker view.
5. Develop an application using List view.
6. Applying a theme in your activity/application.
7. Create menu in Application.
8. To store local data of application using user preferences.
9. Use SQLite to Create / Read / Write data.
10. Create an application to send SMS.
11. Create an application to send an e-mail.
12. Display Map based on the Current/given location.
13. Learn to deploy android Applications

Lab Course Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA503: System Programming

Credits : 4

LTP 310

Course Description: The course aims to equip the students to Develop complex applications using asynchronous programming techniques. The course includes to writing code that prioritizes operating system support for programmers.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the basics of system programs like editors, compiler, assembler, linker, loader, interpreter and debugger.

CO2: Describe the various concepts of assemblers and microprocessors.

CO3: Describe how linker and loader create an executable program from an object module created by assembler and compiler.

CO4: Discuss the various phases of compiler and compare its working with assembler.

Course Content

Unit I

Overview of System Software: Introduction, Software, Software Hierarchy, Systems Programming, Machine Structure, System Software Development, Recent Trends in Software Development, Levels of System Software.

Overview of Language Processors: Programming Languages and Language Processors, Language Processing Activities, Program Execution, Fundamental of Language, Processing, Symbol Tables.

Unit II

Assemblers: Elements of Assembly Language Programming, Design of the Assembler, Assembler Design Criteria, Types of Assemblers, Two-Pass Assemblers, One-Pass Assemblers, Single pass Assembler for Intel x86. **Macro and Macro Processors:** Introduction, Macro Definition and Call, Macro Expansion, Nested Macro Calls, Advanced Macro Facilities, Design of a Macro Preprocessor, Functions of a Macro Processor, Basic Tasks of a Macro Processor, Design Issues of Macro Processors, Features, Macro Processor Design Options, Two-Pass Macro Processors, One-Pass Macro Processors.

Unit III

Linker and Loaders: Introduction, Relocation of Linking Concept, Design of a Linker, Self-Relocating Programs, Linking in MSDOS, Dynamic Linking, Loaders, Different Loading Schemes, Sequential and Direct Loaders, Compile-and-Go Loaders, General Loader Schemes, Absolute Loaders, Relocating Loaders, Practical Relocating Loaders, Linking Loaders, Relocating Linking Loaders, Linker's v/s Loaders. Scanning and Parsing: Programming Language Grammars, Classification of Grammar, Ambiguity in Grammatic Specification, Scanning, Parsing, Top-Down Parsing, Bottom-up Parsing, Language Processor Development Tools, LEX, YACC.

Unit IV

Compilers: Types of Compilers, Binding and Binding Times, Data Structure used in Compiling, Scope Rules, Memory Allocation, Compilation of Expression, Compilation of Control Structure, Code Optimization. **Interpreters & Debuggers:** Benefits of Interpretation, Overview of Interpretation, The Java Language Environment, Java Virtual Machine, Types of Errors, Debugging Procedures, Classification of Debuggers, Dynamic/Interactive Debugger.

Recommended Books / Suggested Readings:

1. System Programming by D M Dhamdhere McGraw Hill Publication
2. System Programming by Srimanta Pal OXFORD Publication
3. System Programming and Compiler Construction by R.K. Maurya & A. Godbole.
4. System Software – An Introduction to Systems Programming by Leland L. Beck, 3rd Edition,
5. Pearson Education Asia
6. System Software by Santanu Chattopadhyay, Prentice-Hall India,2007

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA523: System Programming Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to Develop complex applications using asynchronous programming techniques. The course includes to writing code that prioritizes system support for programmers.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the basic System Programming concepts.

CO2: Use of system programming languages to develop complex applications.

CO3: Implement the lexical analyzer.

CO4: Discuss the Recursive and Predictive Parsing.

Lab Exercises:

1. Write a program to implement the lexical analyzer.
2. Write a Lexical Analyzer (using lex utility for UNIX).
3. Write a program to left factor the given grammar.
4. Write a program to remove the Left Recursion from a given grammar.
5. Aim: Implement Recursive Descendent Parsing for the given Grammar.

E->T+E/T

T->F*T/F

F->(E)/i

6. Implement Predictive Parser for the given grammar.

E->T+E/T

T->F*T/F

F->(E)/i

7. Write a SAL program in text file and generate SYMTAB and LITTAB
8. Use macro features of C language
9. Write a program which generates Quadruple Table for the given postfix String
10. Write a C program to parse a given string using Predictive parsing for given grammar.

type → simple | ↑id | array [simple] of type simple → integer | char | num dotdot num

11. Write a program that displays a different message based on time of day. For example, page

should display "Good Morning" if it is accessed in the morning.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA511: Relational Database Management System

Credits : 4

LTP 310

Course Description: The course aims to equip the students to understand the importance of database in real world applications. The course includes relational database concepts and transaction management concepts in database system. SQL commands.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the areas of database design and SQL programming.

CO2: Describe relational database technology for building applications for the current trend.

CO3: Analyze a business situation and build suitable database applications.

CO4: Describe the Concurrency Control and Physical Storage Media.

Course Contents

Unit I

Introduction: Data, Database, DBMS, File Processing System Vs DBMS-Data Independence, Data Catalog, Three schema Architecture of a database, Functional components of DBMS. **ER Model:** Entity, Attributes and its Type, Entity and Relationship, Design Issues of ER Model Constraint. **RDBMS:** Understanding the history of RDBMS, its role and importance of creating robust database, RDBMS Terminology, CODD's rule for RDBMS, Concept of Relational Model.

Unit II

Structured Query Language (SQL): Overview of SQL, Data Definition Commands, Set operations, Aggregate function, Null values, Data Manipulation commands, Data Control commands, Views in SQL, Nested and Complex queries. **Working with SQL:** triggers, use of data base triggers, database triggers Vs. SQL*forms, types of triggers, how to apply database triggers, BEFORE vs. AFTER triggers, combinations, syntax for creating and dropping triggers, Views, and Packages.

Unit III

Relational Database Design: Relational Database Design: Design guidelines for relational schema, Function dependencies. **Integrity and Security in Database:** Domain Constraints, Referential integrity.

Transactions Management: Transaction concept, Transaction states, ACID properties,

Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of isolation.

Unit IV

Concurrency Control: Lock-based, Timestamp-based, Validation-based protocols, Deadlock handling, Recovery System: Failure Classification, Storage structure. **Overview of Physical Storage Media:** Magnetic Disks, RAID, Tertiary storage, File Organization, Organization of Records in Files, Indexing and Hashing, Ordered Indices, Static Hashing, Dynamic Hashing. **Database Security techniques and storage techniques:** DAS, NAS, SAS.

Recommended Books / Suggested Readings:

1. Abraham Silberschatz, Henry F. Korth, SudharshanS, (2006), "Database System Concepts", Fifth Edition, Tata McGraw Hill. (Unit I, IV & V).

2. Date C.J., Kannan A., Swamynathan S., (2006), "An Introduction to Database Systems", Eighth Edition, Pearson Education.

3. Ramez Elmasri, Shamkant B. Navathe (2007), "Fundamentals of Database Systems", Fourth Edition, Pearson / Addision wesley.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA531: Relational Database Management System Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to understand the importance of database in real world applications. The course includes use of Structured Query Language (SQL), learn SQL syntax and PL/SQL.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Design and implement a database schema for a given problem-domain.

CO2: Create and maintain tables in SQL.

CO3: Create and maintain tables using PL/SQL.

CO4: Develop programs using PL/SQL.

Lab Exercises:

1. TABLE CREATION: a) Create table CUST based on the following details

Name	Type	Remark
CID	VARCHAR2(6)	PRIMARY KEY
CNAME	VARCHAR2(10)	
CCITY	VARCHAR2(8)	

2. Create table PROD based on the following detail

Name	Type	Remark
PID	VARCHAR2(6)	PRIMARY KEY
PNAME	VARCHAR2(10)	
PCOST	NUMBER (4,2)	
PPROFIT	NUMBER (3)	

3. Create table SALE_DETAIL based on the following details

Name	Type	Remark
CID	VARCHAR2(6)	COMPOSITE PRIMARY KEY
PID	VARCHAR2(6)	COMPOSITE PRIMARY KEY
SALE	NUMBER (3)	
SALEDT	DATE	

INSERTION AND DATA RETRIEVAL:

a) Insert and Save Records in CUST, PROD and SALE_DETAIL table.

b) Data Retrieval using SELECT-WHERE, RELATIONAL OPERATOR, ARITHMETIC OPERATOR and use of ORDERBY, DISTINCT, BETWEEN, IN, DUAL and LIKE operator.

2.FUNCTIONS:

a) Date Functions, Numeric Functions, Character Functions, Conversion Functions.

b) Group Functions, Set Functions.

4.ALTER, UPDATE, DELETE, SUBQUERY AND JOINS:

a) Use of ALTER, UPDATE, DELETE and DROP Commands.

b) Using SUBQUERY and JOINS (Equi Join, Non-Equi Join, Outer Join, Self-Join) in data retrieval.

c) Create Views, Sequences and Constraints related Query.

PL/SQL:

1. Make use of COMMIT, ROLLBACK, and SAVEPOINT in a PL/SQL Block.

2. Create a PL/SQL Script to convert temperature in Fahrenheit into Celsius, and vice versa.

3. Calculate the sum of the even integers between 1 and 100.

4. Create a PL/SQL block to find ODD or EVEN NUMBER by using Searched CASE Statements.

5. Calculate a factorial of given number by using FOR loop.

6. Program development using BUILT –IN Exceptions, USER defined Exceptions, RAISE-APPLICATION ERROR.

7. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

8. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

9. Program development using creation of package specification, package bodies, private objects, package variables and cursors and calling stored packages.

10. Develop programs using CURSORS-Declaring, Opening, Fetching, and Closing a Cursor, including the use of CURSOR attributes.

11. Develop Programs using BEFORE and AFTER Triggers, and INSTEAD OF Triggers.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA512: Artificial Intelligence

Credits : 4

LTP 310

Course Description: The course aims to equip the students with a comprehensive study of the Artificial Intelligence. The course includes basic decision-making algorithms, including search based and problem-solving techniques, and first-order logic.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate fundamental understanding of artificial intelligence (AI).

CO2: Apply basic principles of AI in solutions that require problem solving, knowledge representation, and learning.

CO3: Attain the capability to represent various real-life problem domains.

CO4: Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search.

Course Content

Unit I

Overview of A.I: Introduction to AI, Importance of AI, Foundations of artificial intelligence, AI and its related field, AI techniques, Criteria for success.

Problems, problem space and search: Defining the problem as a state space search, Production system and its characteristics, Issues in the design of the search problem.

Heuristic search techniques: Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction.

Unit II

Knowledge representation: Definition and importance of knowledge, Knowledge presentation, various approaches used in knowledge representation, Issues in knowledge representation.

Using Predicate Logic: Representing Simple Facts in logic, representing instances and is-a relationship, Computable function and predicate.

Unit III

Natural language processing: Introduction syntactic processing, Semantic processing, Discourse and pragmatic processing.

Learning: Introduction learning, Rote learning, learning by taking advice, learning in problem solving, learning from example-induction, Explanation based learning

Unit IV

Pattern Recognition: Recognition and Classification Process-Decision Theoretic Classification, Syntactic Classification; Learning Classification Patterns, Recognizing and Understanding Speech.

Expert System: Introduction, Representing using domain specific knowledge, Expert system shells. LISP and other AI Programming Language

Recommended Books / Suggested Readings:

1. E. Rich and K. Knight, “Artificial intelligence", TMH, 2nd ed., 1999.

2. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1999.

3. Nils J Nilsson, “Artificial Intelligence-A new Synthesis" 2nd Edition (2000), Harcourt Asia Ltd.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA532: Artificial Intelligence Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students with a comprehensive study of the Artificial Intelligence. The course includes basic decision-making algorithms, including search based and problem-solving techniques, and first-order logic.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Develop simple applications using AI tools.

CO2: Attain the capability to represent various real-life problem domains using logic-based technique and use this to perform inference or planning.

CO3: Demonstrate fundamental understanding of the evaluation of Artificial Intelligence (AI) and its foundations.

CO4: Apply basic principles of AI in solutions that require problem solving, perception, knowledge representation, and learning.

Lab Exercises:

1. Write a python program to print the multiplication table for the given number.
2. Write a python program to check whether the given number is prime or not.
3. Write a python program to find factorial of the given number.
4. Write a python program to implement simple Chatbot.
5. Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing).
6. Write a python program to implement List methods (Add, Append, Extend & Delete).
7. Write a python program to Illustrate Different Set Operations.
8. Write a python program to generate Calendar for the given month and year.
9. Write a python program to implement Simple Calculator program.
10. Write a python program to Add Two Matrices.
11. Write a python program to Transpose a Matrix.
12. Write a python program to implement Breadth First Search Traversal.
13. Write a python program to implement Water Jug Problem.
14. Write a python program to remove punctuations from the given string.
15. Write a python program to sort the sentence in alphabetical order.
16. Write a program to implement Hangman game using python.
17. Write a program to implement Tic-Tac-Toe game using python.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA513: Cryptography & Information Security

Credits : 4

LTP 310

Course Description: The course aims to equip the students to provides the basic understanding of cryptography, how it has evolved, and some key encryption techniques used today. The course includes basics of Cryptography and Network Security.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Measure security of the data over the network.

CO2: Discuss the emerging areas of cryptography and network security.

CO3: Identify any network from the threats in the world.

CO4: Describe the concept of digital signatures, e-mail security, and web security.

Course Content

Unit I

Introduction to the Concepts of Security: The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks.

Unit II

Understanding Network Security: Defining Network Security, Security Services, Security Standards, Elements of Security, Security Threats to Computer Networks, Sources of Security Threats, Security Threat Motives, Security Threat Management.

Unit III

Symmetric Key Cryptography: DES, International Data Encryption Algorithm (IDEA), RC5, Blowfish, AES.

Asymmetric key cryptography: RSA algorithm, Digital Signatures, Message Authentication.

Cryptographic Hash Functions: Hash functions, Uses of hashing, MD5, SHA.

Unit IV

Network Security Practice: Authentication Applications, IP Security, System Security-Intruders, Malicious Software, Firewalls.

E-mail security: Pretty Good Privacy, working of PGP, S/MIME, MIME.

Web Security: Secure Socket layer, SSL session and connection, secure electronic transaction (SET).

Recommended Books / Suggested Readings:

1. Brijendra Singh, Cryptography & Network Security, PHI.

2. Pachghare, V.K., Cryptography and Information Security, PHI.

3. William Stallings, “Cryptography and Network Security –Principles and Practices”, Prentice Hall of India, Third Edition, 2003.

4. Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 2nd Edition, McGrawHill Education, 2014.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA533: Cryptography & Information Security Lab

Credits : 2

LTP 004

Course Description: The course aims to understand the concepts of various security Algorithms. The course includes algorithms DES, RSA, MD5, SHA-1

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Implement the cipher techniques.

CO2: Develop the various security algorithms.

CO3: Use different open-source tools for network security and analysis.

CO4: Describe various tools related to Network Security.

List of Practical:

1. write a program to implement the simple substitution technique named Caesar cipher.
2. write a program to implement the Playfair Substitution technique.
3. write a program to implement the hill cipher substitution techniques.
4. write a program to implement the rail fence transposition technique.
5. Write a program to implement the DES algorithm logic.
6. Write a program to implement the Blowfish algorithm logic.
7. Write a program to implement RSA Algorithm.
8. write a program to implement the MD5 hashing technique.
9. write a program to implement the SHA-I hashing technique.
10. To write a program to implement the signature scheme named digital signature standard.
11. To study various tools related to Network Security.
12. Installation of rootkits and study about the variety of options.
13. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA509: Software Testing

Credits : 3

LTP 300

Course Description: This course helps to understand the Concepts of Software Testing with various Testing Strategies and Testing Tools.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the significance of software testing

CO2: Describe the essentials of software testing.

CO3: Describe the software testing metrics.

CO4: Apply software testing tools.

Course Content

Unit I

Introduction: Software-Testing, Terminology and Methodology, Verification and Validation.

Levels of Testing: The Need for Levels of Testing, Unit Test, Unit Test Planning, Designing the Unit Tests. The Test Harness, Running the Unit tests and Recording results, Integration tests, Designing Integration Tests, Integration Test Planning, scenario testing, defect bash elimination -System Testing, types of system testing - Acceptance testing, performance testing - Regression Testing internationalization testing, ad-hoc testing - Alpha, Beta Tests, testing OO systems, usability, and accessibility testing.

Unit II

Dynamic Testing: Black Box Testing Techniques, White Box Testing Techniques, Static Testing, Validation Activities, Regression Testing.

Test Management: People and organizational issues in testing, organization structures for testing teams, testing services - Test Planning, Test Plan Components, Test Plan Attachments, Locating Test Items, test management, test process.

Unit III

Test Management: Software Metrics, Testing Metrics for Monitoring and Controlling the Testing Process, Efficient Test Suite Management.

Testing Object Oriented Software: Testing Web Based Systems, Debugging.

Unit IV

Overview of Testing Tools: Testing an application using Win Runner, Test Script Language, Architecture and use of Silk Test, Use of Load Runner and JMeter, Source Code Testing Utilities in Unix/Unix Environment.

Case study and open-source testing tools.

Suggested Reading

1. NareshChauhan, "Software Testing Principles and Practices", Oxford University Press, 2010.

2. Dr.K.V.K.K. Prasad, Software Testing Tools, Dreamtech press, 2008.

3. William E. Perry, Effective Methods for Software Testing, Third Edition, Wiley & Sons, 2006.

4. SrinivasanDesikan, Gopalaswamy Ramesh, Software Testing: Principles and Practices, Pearson Education, 2006.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA529: Software Testing Lab

Credits : 2

LTP 004

Course Description: This course helps to understand the Concepts of Software Testing with various Testing Strategies and Testing Tools.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the significance of software testing

CO2: Describe the essentials of software testing.

CO3: Describe the software testing metrics.

CO4: Apply software testing tools.

Lab Exercises:

1. Understand the Automation Testing Approach (Theory Concept) (INTRODUCTION TO SELENIUM)
2. Using Selenium IDE, write a test suite containing minimum 4 test cases.
3. Conduct a test suite for nay two web sites.
4. Install Selenium server and demonstrate it using a script in Java/PHP
5. Write and test a program to login a specific web page.
6. Write and test a program to update 10 student records into table into Excel file.
7. Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects).
8. Write and test a program to provide total number of objects present available on the page.
9. Write and test a program to get the number of list items in a list /combo box.
10. Write and test a program to count number of check boxes on the page checked and unchecked count.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA506: Advanced Java Programming

Credits : 4

LTP 310

Course Description: The course aims to equip the students with basic knowledge of advanced concepts of JAVA. The course includes JDBC, Servlets, Server-side scripting (JSP) and to understand the idea of network programming.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Use graphical user interface and Event handling in java.

CO2: Develop programs using the Java Collection API.

CO3: Use advanced technology in Java such as network programming, and Remote method Invocation.

CO4: Describe the advanced concepts such as Network Programming and RMI.

Course Content

Unit I

Collection Framework: List Interface, Set Interface, Stored Set Interface. Array List Class, Linked List Class, Hash Set Class, Linked Hash Set Class, Accessing a Collection Vis Iterator.

I/O Files in Java: Stream: Byte Stream Classes, Character Stream Classes, File IO basics, File operations Creating file Reading file, Writing file.

Unit II

Graphical User Interface: Event Driven Programming in Java, Event Handling Process, Event Handling Mechanism, Delegation Model of Event Handling, Event Classes, Event Sources, Event Listeners.

Java Swing: Swing Architecture, Introduction to Swing Component, Comparison of Swing Component and AWT Component, Creating a Swing Applet and Application, Swing's Architecture & background, Container and Frame, Basic Swing Programming: Swing lists, Swing tables, Swing tree.

Unit III

TJDBC Connectivity: Types of Drivers, Connectivity Model, JDBC/ODBC Bridge Communicating with Database.

Introduction to Servlets: Need for Servlets, Introduction to Servlets, Servlet Package, Life Cycle of a Servlet, Http Servlet Request, Http Servlet Response, Deploying Servlets and Servlet Contexts, accessing a Servlet Using an HTML Page.

Introduction to JSP: Need for JSP, JSP Request Response Class; Connectivity JSP Pages to Data Base.

Unit IV

Network Programming: Socket Fundamentals, TCP/IP and UDP Sockets in Java.

Java Remote Method Invocation (RMI): About Serialization, RMI concept, Server side and client side.

Recommended Books / Suggested Readings:

1. Naughton Patrick, Schild Herbertz, (2011), "The Complete Reference –Java", TMH Publication, 7th ed.

2. Naughton Patric, Morrision Michel, (2006), "Java Handbook", Osborne/McGraw-Hill, 5th ed.

3. Balaguruswami E, (2001), "Programming with Java", TMH, 3rd ed.

4. Decker & Hirshfied, (2000), "Programming Java", Vikas Publication 2nd ed.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA526: Advanced Java Programming Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to design and develop Web applications using advanced java programming concepts. The course includes advanced java programming.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Develop programs using Java Swing.

CO2: Recall to access database through Java programs, using Java Data Base Connectivity (JDBC).

CO3: Elaborate the remote methods in an application using Remote Method Invocation (RMI).

CO4: Develop web application using Java Servlet and Java Server Pages technology.

Lab Exercises:

1. Programs Based on the Concepts Collection Framework: Generic Classes and Collection API.
2. Write a Program in Java to implement Calculator using Swing technology.
3. Write a Program that displays two textboxes for entering a student's 'Roll-no and Name with appropriate labels and buttons.
4. Write a Java program that makes a connection with database using JDBC and prints metadata of this connection.
5. Include the database connectivity in the program no. 2,3 to insert, update, delete and display of student information.
6. Write a java program for one-way TCP communication for server and client, where server will response to client with current data and time.
7. Write a java program for two-way TCP communication for server and client. It should look like a simple chat application.
8. Create a simple calculator application that demonstrates the use of RMI. You are not required to create GUI.
9. Create Servlet That Prints Hello World.
10. Create Servlet That Prints Today's Date.
11. Create Servlet for login page, if the username and password is correct then prints message "Hello username" else a message" login failed".
12. Create a JSP that prints hello world.
13. Create JSP that prints current date and time.
14. Create a JSP that add and subtract two numbers.
15. Create a JSP for login module.
16. Create a web page that prints 1 to 10 using JSTL.
17. Create a custom JSP tag that prints current date and time. Use this tag into JSP page. Communicating with Database.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA510: R Programming

Credits : 2

LTP 004

Course Description: The course aims to equip the students to a R programming language / software environment for statistical analysis, graphics representation and reporting.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Identify the key components of R programming Language.

CO2: Define the concept of data Science.

CO3: Differentiate between vectors and arrays.

CO4: Outline the usage of data frames, lists, factors, tables and R structures.

CO5: Explain the need and utilization of various visualization tools.

Course Content

Unit I

R Programming Fundamentals: Introduction to R, Installing R, Windows/Linux/Mac Installation, setting up Path, Using Packages, and Running R: Interactive Mode, Batch Mode, Getting Help, Startup and Shut Down.

Scalars, Vectors, Arrays and Matrices, Declarations, Recycling, Common Vector Operations, Using all () and any (), Na and Null Values, Filtering, ifelse() Function.

Matrices and Arrays: Creating Matrices, General Matrix Operations, Applying Functions to Matrix Rows and Columns, Adding & Deleting Matrix Rows and Columns, Difference Between Matrix and Vector.

Unit II

Lists: Creating Lists, General List Operations, Accessing List Components and Values, Applying Functions to Lists, Recursive Lists. Data Frames: Creating Data Frames, Merging Data Frames, Applying Functions to Data Frames.

Factors and Tables: Introduction, Common Functions use with Factors, Working with Tables.

R Programming Structures: Control Statements, Arithmetic and Boolean Operators, Default Values for Arguments, Return Values, Recursion.

Unit III

Object Oriented Programming: Concept of Classes, S3 Classes, S4 Classes, S3 Versus S4 Classes, Managing Objects.

Input/Output: Accessing Keyboard and Monitor, Reading and Writing Files, Accessing the Internet. String Manipulation: Overview of String Manipulation Functions: grep (), nchar(), paste (), sprintf(), substr(), strsplit(), regexpr(), gregexpr(), Regular expression.

Unit IV

Graphics: Creating Graphs, Customizing Graphs, Saving Graphs to Files, Creating 3D Plots. Debugging: Principles of Debugging, Use of Debugging Tool, Using R Programming Debugging Facilities. [CO3] Simulation: Generating Random Numbers, Setting the Random Number Seed, Simulating a Linear Model, Random Sampling.

Recommended Books / Suggested Readings:

1. R for Data Science by Hadley Wickham, 1st edition, O'Reilly publisher
2. The Book of R by Tilman M. Davies, 1st edition, No Starch Pres publisher
3. R For Dummies by Andrie de Vries, 2nd edition, John Wiley & Sons publisher
4. Discovering Statistics Using R by Andy Field, 1st edition, SAGE Publications Ltd publisher
5. The Art of R Programming by Norman Matloff, 1st edition, No Starch Press publisher

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA530: R Programming Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to gain practical experience with basic coding concepts using R programming such as conditional statements, iteration, strings, functions etc.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Write, Test and Debug R Programs.

CO2: Develop applications to real time problems.

CO3: Use functions, vector, list and data frames for solving problems.

CO4: Use R for statistical Analysis.

Lab Exercises:

1. Install and configuration of R programming environment.
2. Built-in Functions in R Programming.
3. Operators
4. Control Structures
5. Matrices
6. Functions
7. Vector
8. Operations on List
9. Operations on Data Frames
10. Graphics and visualization

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA511: Cyber Security

Credits : 3

LTP 300

Course Description: The course aims to equip the students to provides the basic knowledge and skills in the fundamental theories and practices of Cyber Security. The course introduces concepts of Ethical Hacking.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the Cyber Security principles.

CO2: Discuss the vulnerabilities and threats posed by criminals, terrorist.

CO3: Describe ethics behind hacking and vulnerability disclosure.

CO4: Describe the Hacking and Web Application Based Threats.

Course Content

Unit I

Introduction: cyber security, history of cyber security, cyber security goals, cyber security principles, cyber security technologies, Cyber Security standards, Cyber Security Tools, Cyber Security Challenges, Cyber Security Risk Analysis.

Unit II

Hacking concepts: Hacking, Types of Hacking/Hackers, types of attackers, what is Cybercrime, Types of cybercrime, Classifications of Security attacks (Passive Attacks and Active Attacks) Essential Terminology (Threat, Vulnerability, Target of Evaluation, Attack, Exploit). Concept of ethical hacking, Phase of Ethical Hacking, Hacktivism, Sniffing tools.

Unit III

Password: About Password, Different types of passwords (Biometric, Pattern based Graphical password, Strong Password technique, Types of Password attacks.

Web Application Based Threats: Cross-site scripting, SQL injection, Command injection, Buffer overload, Directory traversal, Phishing scams, Zombies, Drive by downloads.

Unit IV

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 Card.

Stay Secure in digital World: How to stay secure in digital World, have strong password, encrypt your data, security suit software, firewall setup, update OS.

Recommended Books / Suggested Readings:

1. Certified Ethical Hacker Certification Exam by William Manning.

2. Fundamentals of Cyber Security by Mayank Bhushan, BPB Publications.

3. Pankaj Sharma. Information Security and Cyber Laws, Kataria, S. K., & Sons.

4. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security", Pearson Education India.

5. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla," Introduction to Information Security and Cyber Law" Willey Dreamtech Press.

6. Chander, Harish," Cyber Laws and It Protection", PHI Learning Private Limited, Delhi, India.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA531: Cyber Security Lab

Credits : 2

LTP 002

Course Description: The course aims to equip the students to provides the basic knowledge and skills in the fundamental theories and practices of Cyber Security. The course introduces the various tools used in cyber security.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Use the tools to support an ethical hacking.

CO2: Demonstrate intrusion detection system using various tools.

CO3: Demonstrate the gaining Access to a target/remote system.

CO4: Apply the techniques for real world problems in the domain.

List of Practical:

1. Perform an Experiment to Sniff Traffic using ARP Poisoning.
2. Demonstrate intrusion detection system using various tools (snort or any other s/w).
3. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures.
4. Study of Reconnaissance tools.
5. Perform a network Scanning using any tool.
6. Demonstrate the Gaining Access to a target/remote system.
7. Maintaining Access in the target system
8. Clearing Track after exploitation.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA512: Data Analytics

Credits : 4

LTP 310

Course Description: The course aims to make familiar with the systematic computational analysis of data or statistics. It is used for the discovery, interpretation, and communication of meaningful patterns in data. It also entails applying data patterns toward effective decision-making.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concepts of Data Analytics.

CO2: Demonstrate the analytical techniques used in decision making.

CO3: Describe the Data analytics using SQL.

CO4: Demonstrate Data Analytics using MS Excel.

Course content

Unit I

Introduction: Data Science and Data Analytics, features; Preprocessing on data; Cleaning of data; A Short Taxonomy of Data Analytics; Feature selection techniques like Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA); Components of Analytics - reporting and analysis. Handling Data Sources Different types of data sources: structured, unstructured and semi-structured data; Relational databases: normal forms, transactional data, Structured Query Language (SQL); NoSQL databases and its types; Handling semi structured data with JSON, CSV files, XML and more.

Unit II

Data Analytics using MS Excel: Basic data analytics operations in MS Excel like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak; Binary classification in MS Excel.

Unit III

Learning with data: AUC (Area under the receiver operating characteristic (ROC) curve, information measures using entropy, linear regression, basics of macros and VBA in excel. Advance topics of data analytics using excel like power pivot table, power query for data, importing data using excel. Industry use cases from data science like market basket analysis.

Unit IV

Data analytics using SQL: Basic data analytics operations in SQL like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak; Data mining models in SQL; association rules in SQL; linear regression in SQL; AUC and RoC in SQL; Unstructured data analysis in SQL.

Recommended Books / Suggested Readings:

1. Data Analytics Made Accessible by Dr. Anil Maheshwari
2. Numsense! Data Science for the Layman: No Math Added by Annalyn Ng and Kenneth Soo
3. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking by Foster Provost and Tom Fawcett
4. The Hundred-Page Machine Learning Book by Andriy Burkov
5. Data Analysis Using SQL and Excel, 2nd Edition by Gordon S. Linoff (2015), Wiley publication.
6. Microsoft Business Intelligence Tools for Excel Analysts 1st Edition by Michael Alexander, Jared Decker and Bernard Wehbe.
7. A general introduction to Data Analytics, Joao Moreira, Andre de Carvalho, Tomas Horvath, Wiley Publictaion.
8. Microsoft Excel 2007, Custom Guide Inc, 2007
9. Microsoft Office 2007 Fundamentals, 1st Edition by Laura Story, Dawna Walls
10. Learning SQL: Master SQL Fundamentals 2nd Edition by Alan Beaulieu
11. Headfirst SQL: Your Brain on SQL -- A Learner's Guide by Lynn Beighley (2007)

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA532: Data Analytics Lab

Credits : 2

LTP 002

Course Description: : The course aims to make familiar with the systematic computational analysis of data or statistics. It is used for the discovery, interpretation, and communication of meaningful patterns in data. It also entails applying data patterns toward effective decision-making.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concepts of Data Analytics.

CO2: Demonstrate the analytical techniques used in decision making.

CO3: Describe the Data analytics using SQL.

CO4: Demonstrate Data Analytics using MS Excel.

Lab Exercises:

1. Prepare an excel sheet to perform the following statistical analysis
    a. Find mean of the values
    b. Find mode of the values
    c. Calculate standard deviation
    d. Find largest and smallest values
2. Draw different types of charts for weather analysis of 5 successive years
3. Prepare an excel sheet for creating a pie chart for budget analysis
4. Prepare an excel sheet to illustrate the sorting, filtering, sub totals.
5. Prepare an excel sheet for restricting data entry using data validation feature
6. Create and demonstrate to analyze the data using a pivot table
7. Implement Binary classification in MS Excel.
8. Implement AUC (Area under the receiver operating characteristic (ROC) curve in Excel.
9. Explore information measures using entropy in Excel.
10. Implement linear regression in Excel.
11. Explore and implement basic macros in Excel.
12. Explore and implement various options of VBA in excel.
13. Implement basic data analytics operations in SQL like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak.
14. Implement association rules in SQL.
15. Implement linear regression in SQL.
16. Implement AUC and RoC in SQL.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA508: Computer Graphics

Credits : 4

LTP 310

Course Description: The course aims to equip the students to introduce computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends. The course includes Graphics Hardware, Scan Conversation Algorithm, 2-D/3D Graphics.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe basics of Computer Graphics, Input/output primitive and basic transformations, which can be applied on objects of graphics.

CO2: Describe graphical primitives and their algorithms.

CO3: Demonstrate an understanding of contemporary graphics hardware.

CO4: Demonstrate an understanding of contemporary graphics hardware.

Course Content

Unit I

Introduction to Computer Graphics: Applications of Computer Graphics. Types of Graphics. Graphics Hardware: The Functional Characteristics of the Systems are emphasized. Input Device: Keyboard Touch Panel, Light Pens, Graphic Tablets, Joysticks, Trackball, Data Glove, Digitizer, Image Scanner, Mouse, Voice Systems.

Unit II

Video Display Devices: Refresh Cathode–Ray Tube, Raster Scan Display, Random Scan Displays, Color CRT-Monitors, Direct View Storage Tube, Flat Panel Displays, 3-D Viewing Devices, Raster Scan Systems, Random Scan Systems, Graphic Monitors and Workstation, Color Models (RGB and CMY), Lookup Table.

Scan Conversation Algorithm: Process and need of Scan Conversion, Scan conversion algorithms for Line, Circle and Ellipse using direct method, Bresenham's algorithms for line & circle and Midpoint Ellipse Algorithm along with their derivations, Area Filling Techniques, Flood Fill Techniques, Character Generation.

Unit III

2-Dimensional Graphics: Cartesian and Homogenous Co-Ordinate Systems, Geometrical Transformation (Translation, Scaling, Rotation, Reflection, Shearing), Viewing transformation and clipping (line, polygon and text) using Cohen-Sutherland, Sutherland Hodgeman and Liang Barsky algorithm for clipping.

Unit IV

3-Dimensional Graphics: Introduction to 3-dimensional Graphics: Geometric Transformations (Translation, Scaling, Rotation), Mathematics of Projections (Parallel & Perspective). Color Shading. Introduction to Morphing techniques.

Recommended Books / Suggested Readings:

1. D. Hearn and M.P. Baker, Computer Graphics, PHI New Delhi.

2. R.L Phillips, Computer Graphics Principles & Practices, Second Edition, Pearson Education, 2007.

3. R.A. Plastock and G. Kalley, Computer Graphic, McGraw Hill, 1986.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA528: Computer Graphics Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to learn how to 'understanding of the Computer Graphics techniques concepts and algorithm. The course includes implementation of line drawing, circle drawing, polygon drawing, transformation of objects, scaling, viewing.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe practical fundamental of line drawing, circle drawing, polygon drawing and curve drawing.

CO2: Describe the concepts of different type of geometric transformation of objects in 2D and 3D.

CO3: Describe the practical implementation of modeling, rendering, viewing of objects in 2D and 3D.

CO4: Discuss about clipping algorithms. List out the shapes and filling algorithms.

Lab Exercises:

1. Implementation of Line Drawing algorithms: DDA, Bresenham and using them generates line with different styles like dotted, dashed, centered and thick line.
2. Implementation of Circle generation algorithm: Midpoint and using it generating concentric circles.
3. Implementation of Area Filling Algorithm: Boundary Fill, Flood Fill and Scan line Polygon Fill.
4. Program for performing Two Dimensional Transformations: Translation, Scaling, Rotation Reflection, Shear by using a homogeneous Matrix representation, use of a function for matrix multiplication is desirable, to perform composite transformation.
5. Program to represent a 3D object using polygon surfaces and then perform 3D transformation.
6. Flood fill algorithm.
7. Implementation of Cohen-Sutherland line clipping algorithm.
8. Implementation of Liang Barsky algorithm for line clipping.
9. Implementation of Sutherland-Hodgeman polygon clipping algorithm.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA513: Machine Learning with Python

Credits : 4

LTP 310

Course Description: The course aims to equip the students to design and analyses various machine learning algorithms and technique. The course introduces supervised and unsupervised learning paradigms of machine learning.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe machine learning concepts and range of problems that can be handled by machine learning.

CO2: Recall the concept of clustering.

CO3: Differentiate supervised and unsupervised learning.

CO4: Describe the concept of Reinforcement learning.

Course Content

Unit I

Overview: foundations, scope, problems, and approaches of Intelligent agents: reactive, deliberative, goal-driven, utility-driven, learning agents, Artificial Intelligence programming techniques. Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

Unit II

Introduction: Machine Learning, Characteristics of modern Machine Learning, why use Machine learning, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Machine Learning Process Flow. Supervised Learning: Supervised learning, types of supervised learning: classification, Regression. Basic Methods: Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression. Support Vector Machines, Illustration how Support Vector Machine works, Implementation of Support Vector Machine for Classification.

Unit III

Unsupervised Learning: Clustering, K-means Clustering, how does K-means algorithm work, C-means Clustering, Hierarchical Clustering, How Hierarchical Clustering works.

Unit IV

Reinforcement learning: Reinforcement Learning, Elements of Reinforcement Learning, Epsilon Greedy Algorithm, Markov Decision Process (MDP).

Recommended Books / Suggested Readings:

1. Machine Learning by Tom M. Mitchell. 2014 Reprint. McGraw-Hill Science.

2. Reinforcement Learning: An Introduction by Richard S Sutton and Andrew G. Barto. (2016). MIT Press.

3. Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz (2015).

4. Simpler: Using Machine Learning Algorithms in R by Darrin Thomas (2017).

5. Introduction to Machine Learning by Ethem Alpaydin. PHI Publisher.

6. Machine Learning, A practical approach on the statistical leaarning theory by Rodrigo fernandes de Mello and Moacir Antonelli Ponti.

7. Machine Learning A probabilistic prospective by Kevin P. Murphy.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA533: Machine Learning with Python Lab

Credits : 2

LTP 004

Course Description: The course aims to understand the concepts of Machine concepts using Python. The course includes techniques of machine learning using python.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the List, Tuples and Dictionaries in Python.

CO2: Express different Decision-Making statements and Functions.

CO3: Interpret Object oriented programming in Python

CO4: Summarize different File handling operation.

CO5: Design and develop Machine learning techniques using Python.

Lab Exercises:

1. Python Programs based on Operators and Expressions.
2. Python Programs based on if and else if statements.
3. Python Programs based on loops.
4. Python Programs based on Sequences and File Operations.
5. Python Programs based on Working with Files.
6. Python Programs based on Errors and Exception Handling.
7. Python Programs based on Dictionaries and Sets.
8. Python Programs based on Using Modules.
9. Python Programs based on Regular Expressions.
10. Python Programs based on Object Oriented Programming.
11. Projects uses various Machine learning techniques:
    a) Social Media Sentiment Analysis.
    b) Sales Forecasting.
    c) Weather Prediction.
    d) Diabetes Prediction.
    e) Smart attendance System (Face recognition).
    f) Text to speech.
    g) Any Other.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA514: Information Security

Credits : 4

LTP 310

Course Description: To provide the student with an overview of the field of Information Security and Assurance. Students will be exposed to the spectrum of Security activities, methods, methodologies, and procedures. This course includes inspection and protection of information assets, detection of and reaction to threats to information assets.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss the basics of information security.

CO2: Illustrate the legal, ethical and professional issues in information security.

CO3: Describe the Security in Networks.

CO4: Design and implementation of Security Techniques.

Course Content

Unit I

Introduction, Definition of security, Assessing security, Security terminology, Historical developments, Structure of security, Introduction to Information Security, The Need for Security, Legal, Ethical, and Professional Issues in Information Security.

Unit II

Cryptography: Applications of cryptography, Terminology, Evolution of cryptography, Caesar ciphers, one-time pads, substitution and transposition ciphers, One-time Pad, Block cipher and Stream Cipher, Operation of DES, AES, Public-key cryptosystems, Minimum privilege, Compartmentalization

Unit III

Denial of Service attacks, Security vs. ATM, IP, wireless mobile networks, QoS, Traffic modeling, Network topology, Security Protocols, Zero-knowledge proofs, Subliminal channels, Oblivious transfer.

Authentication and Digital Signatures: Use of Cryptography for authentication, Secure Hash function, Key management -Kerberos.

Unit IV

Program Security: Non-malicious Program errors -Buffer overflow, Incomplete mediation, Time-of-check to Time-of-use Errors, Viruses, Trapdoors, Salami attack, Man-in-the middle attacks, Covert channels.

Security in Networks: Threats in networks, Network Security Controls -Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls: Design and Types of Firewalls, Personal Firewalls, IDS, Email Security -PGP, S/MIME.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA534: Information Security Lab

Credits : 4

LTP 310

Course Description: To provide the student with an overview of the field of Information Security and Assurance. This course introduces the inspection and protection of information assets, detection of and reaction to threats to information assets.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Implement the cryptographic algorithms.

CO2: Implement the security algorithms.

CO3: Perform encryption and decryption using different techniques.

CO4: Use of Network tools and Password cracking tools.

Lab Exercises:

1. Demonstrate the use of Network tools: ping, ipconfig, ifconfig, tracert, arp, netstat, whois
2. Use of Password cracking tools: John the Ripper, Ophcrack. Verify the strength of passwords using these tools.
3. Perform encryption and decryption of Caesar cipher. Write a script for performing these operations.
4. Perform encryption and decryption of a Rail fence cipher. Write a script for performing these operations.
5. Use nmap/zenmap to analyse a remote machine.
6. Use Burp proxy to capture and modify the message.
7. Demonstrate sending of a protected word document.
8. Demonstrate sending of a digitally signed document.
9. Demonstrate sending of a protected worksheet.
10. Demonstrate use of steganography tools.
11. Demonstrate use of gpg utility for signing and encrypting purposes.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA607: Programming with C#

Credits : 4

LTP 310

Course Description: The course aims to equip the students with a comprehensive study of the C# Programming. The course includes # basics, Objects and Types, Inheritance.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the fundamentals concept of C#.

CO2: Develop a proficiency in the C# programming language.

CO3: Identify C# Language Structure and C# Variables.

CO4: Determine classes, objects, inheritance and polymorphism.

Course Content

Unit I

Introducing C#: Evolution of C#, Characteristics of C#, Applications of C#, Overview of C#, Literals, Variables and Data Types. Operators and Expressions, Decision Making and Branching and Looping.

Unit II

Methods in C#: Declaring Methods, Main Method, Invoking Method, Nesting of Methods, Pass by Value, Pass by Reference.

Handling Arrays: One Dimensional Arrays, Two Dimensional Arrays, jagged arrays, assigning array references, Using the length property, implicitly typed array.

Creating Strings: String Methods, Comparing Strings.

Unit III

Structures and Enumerations: Structures, structs with methods, Nested Structs Enumerations, Enumerator Initialization.

Classes and Objects: Basic Principles of OOP Defining a Class, Creating Objects.

Constructors: Overloaded Constructors, Copy Constructors, Destructors.

Unit IV

SInheritance and Polymorphism: Classical Inheritance-Containment Inheritance, defining a Subclass-Defining Subclass Constructor, Multilevel Inheritance, Overriding Methods, Defining an Interface-Implementing Interface, Overloaded Operators, Overloaded Unary Operator, Overloaded Binary Operator.

Recommended Books / Suggested Readings:

1. E. Balagurusamy, PROGARAMMING IN C#, Tata McGraw-Hill Publishing Company Limited, New Delhi.

2. Yashwant Kanetkar, Let Us C#, Tata McGraw-Hill Publishing Company Ltd, New Delhi

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA627: Programming with C# Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students with a comprehensive study of the C# Programming.

The course includes # basics, Objects and Types, Inheritance.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Implement the concepts of objects and Types, Inheritance.

CO2: Develop programs in C#.

CO3: Use appropriate data sources in C# applications.

CO4: Develop, implement and creating Applications with C#.

Lab Exercises:

1. To Check whether a number is Palindrome or not.
2. Write a C# program to demonstrate a basic calculator using command line arguments.
3. To find the roots of Quadratic Equation.
4. C# Program to Display the ATM Transaction.
5. Write a C# program to show the machine details like machine name, Operating System, Version, Physical Memory and calculate the time since the Last Boot Up.
6. Write a Program in C# to demonstrate boxing and unboxing
7. To demonstrate Operator overloading.
8. To write a C# program using Branching and Looping statements.
9. To write a C# program using Arrays and Strings methods.
10. To multiply to matrices using rectangular arrays.
11. To write a C# program using Structures and enumerations
12. To reverse a given string using C#.
13. To write a C# program using inheritance concepts.
14. To write a C# program using Polymorphism.
15. To write a C# program using interfaces.
16. To write a C# program by using operator overloading.
17. To write a C# program using delegates, events, errors and exceptions.
18. Use Try, Catch and Finally blocks to demonstrate error handling.
19. Demonstrate Use of Virtual and override key words in C# with a simple program.
20. C# Program to Demonstrate Tower of Hanoi
21. C# Program to Create a HangMan Game.
22. C# Program to Perform a Number Guessing Game.
23. C# Program to Prefix Game.
24. C# Program to Display the IP Address of the Machine.
25. C# Program to Illustrate how User Authentication is Done.
26. C# Program to Establish Client Server Relationship.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA602: Cloud Computing

Credits : 4

LTP 310

Course Description: The course aims to Understand the working concept of cloud computing. The course includes basic concepts of cloud types, services and security etc.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss the underlying principles of Cloud Technology and various types of cloud computing architecture and types.

CO2: Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO3: Explain the core issues of cloud computing such as security, privacy and interoperability.

CO4: Discuss about cloud computing companies and migrating to cloud.

Course Content

Unit I

Introduction to Cloud Computing: History and Evolution of Cloud Computing, Types of clouds, Private Public and hybrid clouds, Cloud Computing architecture, Cloud computing infrastructure, Merits of Cloud computing, Cloud computing delivery models and services (IaaS, PaaS, SaaS), obstacles for cloud technology, Cloud vulnerabilities, Cloud challenges, Practical applications of cloud computing.

Unit II

Virtualization: Basics of Virtualization, Types of Virtualizations, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data-center Automation.

Unit III

Programming Model: Parallel and Distributed Programming Paradigms, MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache, Mapping Applications, Programming Support, Google App Engine, Amazon AWS, Cloud Software Environments: Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim.

Unit IV

Cloud Security: Infrastructure Security Network level security, Host level security, Application-level security Data security and Storage Data privacy and security Issues.

Migrating to The Cloud: Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud.

Recommended Books / Suggested Readings:

1. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, John Wiley and Sons Publications.

2. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India, Feb 2013.

3. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-2980-3, New Delhi, India, 2011.

4. Dr. Saurabh Kumar, Cloud Computing: Insights into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

5. Kumar Saurabh, "Cloud Computing –insights into New-Era Infrastructure", Wiley India,2011.

6. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly.

7. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.

8. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The	

BCA622: Cloud Computing Lab

Credits : 2

LTP 004

Course Description: The course aims to students to able to design and deploy Cloud Infrastructure. The course includes various principles and paradigms of cloud computing.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Configuration of the virtual machines on the cloud and building of a private cloud.

CO2: Use of cloud computing tools offered by industry leaders.

CO3: Identify the architecture, infrastructure and delivery models of cloud computing.

CO4: Select the appropriate cloud player, Programming Models and approach.

CO5: Develop and deploy cloud applications using popular cloud platforms.

Lab Exercises:

1. Sketch out and analyze architecture of Aneka / Eucalyptus / KVM identify different entities to understand the structure of it.
2. Sketch out and analyze architecture of Microsoft Azure.
3. Sketch out and analyze architecture of Amazon Web Service (AWS).
4. Categorize Microsoft Azure Services and discuss on each.
5. Present a report on google cloud and other cloud services.
6. Categorize Amazon Web Service (AWS) and implement its various cloud entities using its Cloud Toolbox support.
7. Create a sample mobile application using Amazon Web Service (AWS) account as a cloud service. Also provide database connectivity with implemented mobile application.
8. Setting up a private cloud using open-source tools (Eucalyptus/Open Stack etc.).
9. Explain the process of migrating to cloud with a case study.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA608: Data Science

Credits : 4

LTP 310

Course Description: The course aims to equip the students with a comprehensive study of the Introduction to Data Sciences. The course includes Data Visualization, R programming.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explain data science and its fundamentals.

CO2: Provide data science solution to business problems and visualization.

CO3: Apply principles of Data Science to the analysis of business problems.

CO4: Demonstrate proficiency with statistical analysis of data.

Course Content

Unit I

Introduction to Data Science: Definition, working, benefits and uses of Data Science, Data science vs BI, The data science process, Role of a Data Scientist.

Unit II

Data Scientist's Toolbox: Turning data into actionable knowledge, introduction to the tools that will be used in building data analysis software: version control, markdown, git, GitHub, R, and RStudio.

R Programming Basics: Overview of R, R data types and objects, reading and writing data, Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools, Simulation, code profiling.

Unit III

Getting and Cleaning Data: Obtaining data from the web, from APIs, from databases and from colleagues in various formats, basics of data cleaning and making data tidy.

Data Visualization: basics, techniques, types, applications, tools, Data Journalism, Interactive dashboards.

Unit IV

Exploratory Data Analysis: Essential exploratory techniques for summarizing data, applied before formal modeling commences, eliminating or sharpening potential hypotheses about the world that can be addressed by the data, common multivariate statistical techniques used to visualize high-dimensional data

Recommended Books / Suggested Readings:

1. D. Cielen, Arno D. B. Meysman, M. Ali, Introducing Data Science, Dreamtech Press.

2. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" by Schroff/O'Reilly, 2013.

3. Foster Provost, Tom Fawcett, "Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking" by O'Reilly, 2013.www.w3schools.com.

4. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight" by John Wiley &Sons, 2013.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA628: Data Science Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students with a comprehensive study of the Introduction to Data Sciences. The course includes new language R used for data science.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Use R for simple programming tasks.

CO2: Use R Graphics and Tables to visualize results of various statistical operations on data.

CO3: Apply the knowledge of R gained to data Analytics.

CO4: Apply R programming for problem solving.

Lab Exercises:

1. Installation of R programming language.
2. Write a program that prints „Hello World„ to the screen.
3. Write a program that asks the user for a number n and prints the sum of the numbers 1to n.
4. Write a program that prints a multiplication table for numbers up to 12.
5. Write a function that returns the largest element in a list.
6. Write a function that computes the running total of a list.
7. Write a function that tests whether a string is a palindrome.
8. Implement linear search.
9. Implement binary search.
10. Implement matrices addition, subtraction and Multiplication.
11. Fifteen students were enrolled in a course. There are ages were20 20 20 20 20 21 21 21 22 22 22 22 23 23 23.

    a. Find the median age of all students under 22 years

    b. Find the median age of all students.

    c. Find the mean age of all students.

    d. Find the modal age for all students.

    e. Two more students enter the class. The age of both students is 23. What is now mean, mode and median?

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA609: Network Security

Credits : 4

LTP 004

Course Description: Network security is a broad term that covers a multitude of technologies, devices and processes. This course includes Network security, Network services vulnerabilities.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the switch level network configuration.

CO2: Describe the IP routing basics, configure network services.

CO3: Discuss the penetration testing; knowledge of vulnerability mitigation techniques.

CO4: Describe the security level attainable by wireless networks.

Course Content

Unit I

Network communications: Switch management, LANs and virtual LANs, ARP and IP protocols, routing, spanning tree protocol, link aggregation protocol.

Unit II

Network security: IP Routing, Firewalls, ACLs, network address translation, virtual networking, network services (DHCP, DNS), Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, Security at the Network Layer: IPSec, System Security.

Unit III

Network services vulnerabilities: ARP spoofing, network scanning and fingerprinting, vulnerability exploitation

Unit IV

Wireless network security: Connecting to WEP/WPA PSK secured networks, monitoring and diverting wireless traffic.

Recommended Books / Suggested Readings:

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall of India, Third Edition, 2003.

2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 2003.

3. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2001.

4. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Third Edition, Pearson Education, 2003.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA629: Network Security Lab

Credits : 4

LTP 004

Course Description: Network security is a broad term that covers a multitude of technologies, devices and processes. This course includes File System, Network Services.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concept of File System.

CO2: Implement the Network Services.

CO3: Demonstrate the security attacks in virtual / real environment.

CO4: Implement DHCP server, firewall and DNS server.

Lab Exercises:

1. Understanding the File System
   a. Adding users, groups, adding users to groups
   b. Creating files, directories, assigning access rights
   c. Listing directories and files access rights
   d. All basic filesystem operations: copying, finding files, moving files, editing files
   e. Basic understanding of linux filesystem tree (where the thing usually is), what is home folder, what is root folder
2. Getting Familiar with Equipment
   a. How to connect everything, Switch CLI
   b. Configuring IP address on host
3. Network Services
   a. configuring file sharing with samba
   b. testing file sharing under multiple users
   c. Configuring DNS server
4. Nat, Firewall, Network Services
   a. Configure switches with VLANs
   b. Configure IPs
   c. Configure DHCP server
   d. Configure NAT
   e. Configure firewall
5. Packet sniffing using Wireshark and reading the captured data.
6. Demonstrate the security attacks in virtual / real environment.
7. Blocking and Allowing the service in firewalls.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA610: Programming with C#.NET

Credits : 2

LTP 004

Course Description: The course aims to equip the students with a comprehensive study of the C# Programming. The course includes # basics, Objects and Types, Inheritance.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss the components of .Net Framework.

CO2: Implement the desktop application using C# Win-form application.

CO3: Implement web application using C# .net.

CO4: Describe the basic database application using ADO.net technology.

Course Content

Unit I

Introduction to .NET Framework: Understanding .NET Framework, .NET Framework Version History, .NET Framework Architecture, Common Language Runtime (CLR), CLR Components, Microsoft Intermediate language (MSIL), Common Type System (CTS), Common Language Specification (CLS), Relationship Between CTS and CLS, Framework Class Library (FCL), Just in Time Compilation (JIT).

Unit II

Application Development On .Net: Building windows application, creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box (Modal and Modeless). ASP.NET Controls: HTML Server Controls, Web Server Controls, Validation Controls.

HTTP Request and HTTP Response State Management Master Page and Theme.

Unit III

Database: Accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, Data Binding, Importing the SqlClient Namespace, Defining the Database Connection, Managing Content Using Grid View and Details View. Designing: Master Pages, Themes

Unit IV

Debugging and Diagnostics: Debugging, Build Configuration (Debug and Release), List of Debugging Windows, Break Point Hit Count and Condition, Debugging Exception, Debug and Trace Classes, Types of Listeners.

Recommended Books / Suggested Readings:

1. Beginning ASP.NET 4: in C# and VB (Wrox), ImarSpaanjaars, Paperback Edition

2. Sams Teach Yourself ASP.NET 4 in 24 Hours, Complete Starter Kit Scott Mitchell C# 8.0 and .NET, Core 3.0 is a book written by Mark J. Price.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA630: Programming with C#.NET Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students with a comprehensive study of the C# Programming. The course includes # basics, Objects and Types, Inheritance.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Develop the web application using C# .net.

CO2: Develop the windows form application using C#

CO3: Develop an application using ADO.net.

CO4: Design a Master Pages for web application.

Lab Exercises:

1. Create an application that allows the user to enter a number in the textbox named getnum. Check whether the number in the textbox "getnum" is palindrome or not. Print the message accordingly in the label control named lbldisplay when the user clicks on the button "check".

2. Create an application which will ask the user to input his name and a message, display the two items concatenated in a label, and change the format of the label using radio buttons and check boxes for selection, the user can make the label text bold, underlined or italic and change its color. include buttons to display the message in the label, clear the text boxes and label and exit.

3. Populate the list of employees is in a listbox. Write an application to add selected or all records from listbox (assume multi-line property of textbox is true).

4. Create a Windows Forms app in Visual Studio with C#

5. Programs using ASP.NET Server controls: Create the application that accepts name, password, age, email id, and user id. All the information entry is compulsory. Password should be reconfirmed. Age should be within 21 to 30. Email id should be valid. User id should have at least a capital letter and digit as well as length should be between 7 and 20 characters.

6. Database programs with ASP.NET and ADO.NET:

a. Create a Web App to display all the Empname and Deptid of the employee from the database using SQL source control and bind it to GridView. Database fields are (DeptId, DeptName, EmpName, Salary).

b. Create a web application to insert 3 records inside the SQL database table having following fields (DeptId, DeptName, EmpName, Salary). Update the salary for any one employee and increment it to 15% of the present salary. Perform delete operation on 1 row of the database table.

7. Design a Master Pages for a website.

8. Demonstrate the Debugging process and Breakpoint.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA604: Data Warehouse and Mining

Credits : 4

LTP 310

Course Description: The course aims to equip the students to inculcate knowledge on data mining query languages. The course includes Data warehouse, Data cube, OLAP, OLTP, Classification, Clustering, Data Mining techniques.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe data mining principles and techniques.

CO2: Implement classical algorithms in data mining and data warehousing.

CO3: Discuss data mining techniques as well as methods in integrating and interpreting the data sets and improving effectiveness, efficiency and quality for data analysis.

CO4: TAssess the strengths and weaknesses of the algorithms, identify the application area of algorithms, and apply them.

Course Content

Unit I

Data Warehousing: Data warehouse definition, characteristics, Data warehouse role and structure, OLAP Operations, Data mart, Different between data mart and data warehouse, approaches to build a data warehouse, Building a data warehouse, Metadata & its types.

Unit II

High dimensionality Data: introduction about data, attributes of data, dataset, storage, issue concerning the amount and quality of data, high dimensionality Data, dynamic data, imprecise data, incomplete data, redundant data, missing values, noise.

Unit III

Data Mining: Introduction to Data Mining, the knowledge discovery process, knowledge discovery process models, Pattern Evaluation Measures, Data Mining System Types, Data Pre-processing: data cleaning, data integration, data reduction, and data transformation, Data Mining Applications.

Frequent Patterns for Data Mining: Basic concepts and algorithms of mining frequent patterns: Market Basket Analysis, Frequent Pattern Mining: FP-Growth Algorithm, Apriori Algorithm.

Unit IV

Classification: Overview of classification, Classification process, Decision tree, Decision Tree Induction, Attribute Selection Measures. Overview of classifier's accuracy, evaluating classifier's accuracy, Techniques for accuracy estimation, Increasing the accuracy of classifier. Clustering: Introduction to Clustering, Types of clusters, Clustering methods, Data visualization & various data visualization tools.

Recommended Books / Suggested Readings:

1. Core PHP Programming by Leon Atkinson: Pearson Publishers.
2. PHP A Beginner's Guide, VIKRAM VASWANI, Tata McGraw-Hill, 2008.
3. The PHP Complete Reference, Steven Holzner –Tata McGraw-Hill Edition,2010
4. The complete Reference PHY by SteverHolzner: McGrow Hill
5. PHP 5.0 and MySQL Bible Tim Converse, Joyce Park, Clark Morgan, Publishers: John Wiley & Sons.
6. Beginning PHP 5.0 Database by Christopher Scollo, Harish Rawat, Deepak Thomas, and Publisher: WROX press.
7. PHP – A beginners Guides BY: Ashok Appu Publisher: Wiley.
8. MySQL Bible by Steve Suehring Publisher: John Wiley &Sons.
9. PHP Black Book by Peter Moulding.
10. PHP 5 and MySQL – Tim converse, Joyce Park and Clark Morgan - Bible Wiley.
11. Beginning PHP 5.3 by matt Doyle – By Word publication.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA624: Data Warehouse and Mining Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students to introduce data mining techniques including predictive, descriptive and their effective use in discovering interesting hidden patterns in large volume of data generated by businesses, science, web, and other sources.

The course focuses on the main process of data mining such as data preparation, classification, clustering, association analysis, and pattern evaluation.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Synthesize the data mining fundamental concepts and techniques from multiple perspectives.

CO2: Develop skills and apply data mining tools for solving practical problems

CO3: Advance relevant programming skills.

CO4: Implement different tools.

List of Practical:

1. Introduction to WEKA and R tools.
2. Installation of Weka/ R Tools.
3. Fundamental programming using WEKA/ R tool.
4. Implementing data preprocessing.
5. Implementing apriori algorithm
6. Introduction to the classification of Mining Techniques
7. Performance of clustering algorithms on various data sets.
8. Study of AR miner Tool.
9. Study of DB miner Tool.
10. Comparison of various databases such as Oracle, Sybase.
11. Comparison of various data mining tools.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA601: Big Data Analytics

Credits : 4

LTP 310

Course Description: The course aims to know the fundamental concepts of big data and analytics. The course includes tools and practices for working with big data.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Identify and distinguish big data analytics applications.

CO2: Demonstrate big data tools and its analysis techniques.

CO3: Analyze data by utilizing clustering algorithms.

CO4: Perform analytics on data streams.

Course Content

Unit I

Introducing Big Data

Introduction: Introduction to Big Data- Big data definition, enterprise / structured data, social / unstructured data, unstructured data needs for analytics, Industries using Big Data, Big Data challenges. Big Data and its importance, Characteristics of Big Data, Technology used for Big Data Analytics. Case Study for Netflix.

Unit II

Introduction to Hadoop: Hadoop, Hadoop Architecture, Hadoop Distributed File System (HDFS), Map Reduce, Working of Map Reduce, Hadoop Ecosystem, Hadoop Applications.

Frequent Item sets and Clustering: Mining Frequent item sets, Market based model, Apriori Algorithm, Overview of Clustering, Clustering Techniques, K-means.

Unit III

Mining Data Streams: Introduction to Streams Concepts, Stream data model and architecture, Stream Computing, Sampling data in a stream, Filtering streams, Graph Analytics for Big Data: Graph Analytics.

Data Analytics with R: Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Big Data Analytics with R

Unit IV

NOSQL: Introduction, Overview, and History of NoSQL Databases Definition of the Four Types of NoSQL Database, Why NoSQL? Types of NoSQL Databases.

Apache Spark: Spark, Features of Apache Spark, uses of Spark, Spark Architecture, Spark Components.

Recommended Books / Suggested Readings:

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.
2. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers" CRC Press, 2015.
3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
4. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
5. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge UniversityPress, 2012.
6. Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
7. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013).
8. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R.
9. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, MC Press, 2012.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA621: Big Data Analytics Lab

Credits : 2

LTP 004

Course Description: The course aims to demonstrate an understanding of Big Data Analytics concept. The course includes various big data an analytics tool.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explore the fundamental concepts of big data analytics.

CO2: Describe the various big data Analytics tools used in big data.

CO3: Provide the solution of Big Data.

CO4: Discuss Cassandra and MongoDB technology.

Lab Exercises:

1. Study of various Big Data Analytics Tools.
2. Set up Hadoop and its development environment.
3. Execute various HDFS commands.
4. Installation of Cassandra.
5. Cassandra Commands.
6. Introduction to MongoDB and its Installation on Windows & Linux.
7. Description of mongo Shell create database and show database.
8. Commands for MongoDB and to study operations in MongoDB: Insert, Query, Update, Delete and Projection.
9. Where Clause equivalent in MongoDB.
10. To study operations in MongoDB AND in MongoDB, OR in MongoDB, Limit Records and Sort Records.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA611: Cyber Forensics

Credits : 4

LTP 400

Course Description: The course aims to equip the students with cyber forensics concept such as acquisition and analysis. The course includes IP, Firewall, Computer forensics and Data hiding.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss the security issues of network layer and transport layer.

CO2: Apply security principles in the application layer.

CO3: Analyze and validate forensics data.

CO4: Demonstrate forensics tools.

Course Content

Unit I

Network Layer Security &Transport Layer Security: IPsec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPsec. Transport layer Security: SSL protocol, Cryptographic Computations – TLS Protocol.

Unit II

E-Mail Security & Firewalls: PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

Unit III

Introduction to Computer Forensic: Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

Unit IV

Evidence Collection and Forensics Tools: Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

Analysis and Validation: Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

Recommended Books / Suggested Readings:

1. Man, Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.

2. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.

3. John R. Vacca, "Computer Forensics", Cengage Learning, 2005

4. Richard E. Smith, "Internet Cryptography", 3rd Edition Pearson Education, 2008.

5. Marjie T. Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall, 2013.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA631: Cyber Forensics Lab

Credits : 4

LTP 002

Course Description: The course aims to equip the students with cyber forensics concept such as acquisition and analysis. The course includes IP, Firewall, Computer forensics and Data hiding.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss the security issues of network layer and transport layer.

CO2: Apply security principles in the application layer.

CO3: Analyze and validate forensics data.

CO4: Demonstrate forensics tools.

Lab Exercises:

1. Study of Computer Forensics and different tools used for forensic investigation
2. How to Recover Deleted Files using Forensics Tools
3. Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.
4. How to Extract Exchangeable image file format (EXIF) Data from Image Files using Exifreader Software
5. How to make the forensic image of the hard drive using EnCase Forensics.
6. How to Restore the Evidence Image using EnCase Forensics
7. How to Collect Email Evidence in Victim PC
8. How to Extract Browser Artifacts
9. How to View Last Activity of Your PC
10. Find Last Connected USB on your system (USB Forensics)
11. Comparison of two Files for forensics investigation by Compare IT software
12. Live Forensics Case Investigation using Autopsy

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA612: DevOps

Credits : 4

LTP 310

Course Description: The course aims to equip the students with the concept of DevOps including the version control with git, virtualization.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the version Controls of software with Git.

CO2: Apply virtualization concept with Docker.

CO3: Apply the skills for the user profile management.

CO4: Discuss the skills for system monitoring.

Course Content

Unit I

Introduction to DevOps: DevOps, History of DevOps, Dev and Ops, DevOps definitions, DevOps and Software development Life Cycle, DevOps main objectives, Tools (Jenkins, Chef, Docker, Vagrant etc.). Version control with Git: Git for organization, Installing Git, Common commands. Subversion Controls/Git, working with local repositories, Working with remote repositories: branching, merging, cloning, fetch/pull.

Unit II

Virtualization & Containerization: Docker Installation, working with Docker Containers, Docker Command Line Interphase, Docker Compose, Docker Hub, Docker File & Commands. Build, deploy and manage web or java application on Docker. S**oftware Configuration Management:** Introduction to Chef/Puppet/Ansible, Chef Distribution Kit, Chef Concepts: Environments, Attributes, Resources, Cookbook, Run list, Recipes, Supermarket.

Unit III

Nexus Artifacts/ Proxy Tools: Introduction to Nexus, Installation and Configuration, Repository Management, Proxy Management, Integration with Maven. **Jenkins Framework:** Jenkins Installation, User Profile, User Management, Security Management, Plugins Management, Builds Setup, Integration with Git, Integration with Maven, Integration with Tomcat, Integration with Maven

Unit IV

System Monitoring: Introduction to Vagrant: Vagrant Terminologies, Installation of Vagrant, Vagrant Proxy Project, Vagrant hands-on. Introduction to Nagios, Concepts behind Nagios, Nagios Installation, Hands-on. Build Automation: Introduction with Maven, Maven structure, Maven Phases, Installation of Maven, Configuration, jar/war project structure.

Recommended Books / Suggested Readings:

1. DevOps: A software architect's perspective by ingo M. Weber, Len Bass and Liming Zhu

2. Building a DevOps: Building a Culture of collaboration, Affinity and Tooling at Scale by Katherine Daniels and Jennifer Davis

3. Practical DevOps by Joakim Verona

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA632: DevOps Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students with the concept of DevOps including the Docker.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the version Controls of software with Git.

CO2: Apply virtualization concept with Docker.

CO3: Apply the skills for the user profile management.

CO4: Discuss the skills for system monitoring.

Lab Exercises:

1. To install Docker and execute basic command in Docker.
2. To build image from docker file.
3. To deploy java application into Docker.
4. To perform installation of Git and work on local and remote Git repositories.
5. To fetch and synchronize Git repository.
6. To perform basic branching and merging in Git.
7. To install Jenkins and build a job in Jenkins.
8. To create a CI/CD pipeline in Jenkins.
9. To perform continuous testing of web application using Selenium.
10. To install puppet agent and puppet master on two separate virtual machine and establish connection between them.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA613: Internet of Things

Credits : 4

LTP 310

Course Description: The course aims to make the students familiar with trending technology of IoT. The course includes IoT Architectural Overview, Elements of IoT Hardware Components, IoT Application Development Solution framework for IoT applications.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the internet of Things and its hardware and software components.

CO2: Describe the Interface I/O devices, sensors & communication modules.

CO3: Discuss the remotely monitor data and control devices.

CO4: Develop real life IoT based projects.

Course Content

Unit I

Introduction to IoT Architectural Overview: Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

Unit II

Elements of IoT Hardware Components: Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python /Node.js /Arduino) for Communication, Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

Unit III

IoT Application Development Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

Unit IV

IoT Case Studies IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

List of suggested books:

1. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, "A Hands-on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill 7.
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA633: Internet of Things Lab

Credits : 2

LTP 002

Course Description: The course aims to make the students familiar with trending technology of IoT.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: List out the different IOT applications and importance of IOT.

CO2: Describe the Arduino platform and programming.

CO3: Describe data and control devices.

CO4: Develop real life IoT based projects.

Lab Exercises:

1. Introduction to Arduino platform and programming
2. Introduction to the electrical and electronic component.
3. Introduction to the sensors.
4. Blink the LED on Pin 13
5. Build a circuit with an external LED
6. The Potentiometer
7. The Pushbutton
8. Procedures to Reuse Code
9. Design an IOT based system

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA614: Data Visualization

Credits : 2

LTP 002

Course Description: The course aims to equip the students with a comprehensive study of the Introduction to Data Visualization. The course includes HTML5, D3.js, Data Visualization.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explain Data Visualization and its fundamentals.

CO2: Provide data science solution to business problems and visualization.

CO3: Apply principles D3.js of to the analysis of business problems.

CO4: Demonstrate proficiency with statistical analysis of data.

Course Content

Unit I

Introduction to Data Visualization: Acquiring and Visualizing Data, Simultaneous acquisition and visualization, Applications of Data Visualization, Keys factors of Data Visualization Exploring the Visual Data Spectrum: charting Primitives (Data Points, Line Charts, Bar Charts, Pie Charts, Area Charts), Exploring advanced Visualizations (Candlestick Charts, Bubble Charts, Surface Charts, Map Charts, Infographics).

Unit II

Basics of Data Visualization: Tables, Reading Data from Standard text files (.txt, .csv, XML), Displaying JSON content Outputting Basic Table Data (Building a table, Using Semantic Table, Configuring the columns), Assuring Maximum readability (Styling your table, increasing readability, adding dynamic Highlighting), Including computations, using data tables library, relating data table to a chart.

Visualizing data Programmatically: Creating HTML5 CANVAS Charts (HTML5 Canvas basics, Linear interpolations, A Simple Column Chart, Animations), Starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations).

Unit III

Introduction to D3.js: Getting setup with D3, making selections, changing selection's attribute, Loading and filtering External data: Building a graphic that uses all of the population distribution data, Data formats you can use with D3, creating a server to upload your data, D3's function for loading data, Dealing with Asynchronous requests, Loading and formatting Large Data Sets.

Unit IV

Advanced Data Visualization: Introduction, Dashboard design issues and assessment of needs, Considerations for designing dashboard-visual perception, achieving eloquence, Advantages of Graphics _Library of Graphs, Designing Bullet Graphs, Designing Sparklines, Dashboard Display Media, Critical Design Practices, putting it all together - Unveiling the dashboard.

List of suggested books:

1. Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures by Claus O. Wilke

2. Reimagining Data Visualization Using Python by Seema Acharya

3. Introduction to Data Visualization & Storytelling: A Guide For The Data Scientist (Visual Thinking) by Jose Berengueres and Marybeth Sandell

4. Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics, and transform your organization, 4th Edition by Joshua N. Milligan

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA634: Data Visualization Lab

Credits : 2

LTP 002

Course Description: The course aims to equip the students with a comprehensive study of the Introduction to Data Visualization. The course includes HTML5, D3.js, Data Visualization.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the main concepts of data visualization

CO2: Create ad-hoc reports, data visualizations, and dashboards using Tableau.

CO3: Interpret a data visualization.

CO4: Identify stories and insights in data.

Lab Exercises:

1. Introduction to Tableau: Start Page, Show Me, Connecting to Excel Files, Connecting to Text Files, Creating and Removing Hierarchies.

2. Tableau Basic Reports: Parameters, Grouping Example, Edit Groups, creating a First Report, Data Labels, Create Folders, Sorting Data.

3. Tableau Charts: Area Chart, Bar Chart, Box Plot, Bubble Chart, Bump Chart, Bullet Graph, Circle Views, Dual Lines Chart, Funnel Chart, Gantt Chart, Grouped Bar or Side by Side Bars Chart, Heatmap, Histogram, Line Chart, Pie Chart, Scatter Plot.

4. Data and Figures: Importing and reading the Dataset, convert data to Custom SQL, Setting Figure Aesthetics, Working with colors.

5. Learn Tableau Dashboards: Create a Dashboard, Format Dashboard Layout, create a Device Preview of a Dashboard, Create Filters on Dashboard, Dashboard Objects.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA605 Ethical Hacking

Credits : 4

LTP 310

Course Description: The course aims to equip the students to think critically and perform cooperatively in team projects. The course includes basics principle of hacking.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the core concepts related to malware, hardware.

CO2: Describe ethics behind hacking and vulnerability disclosure.

CO3: Appreciate the vulnerabilities related to computer system and network.

CO4: Discuss the Ethical Hacking Laws and Tests.

Course Content

Unit I

Introduction to Ethical Hacking: Hacking Methodology, Process of Malicious Hacking, Foot printing and Scanning: Foot printing, Scanning. Enumeration: Enumeration. System Hacking and Trojans: System Hacking, Trojans and Black Box Vs White Box Techniques.

Unit II

Hacking Methodology: Denial of Service, Sniffers, Session Hijacking and Hacking Web Servers: Session Hijacking, Hacking Web Servers. Web Application Vulnerabilities and Web Techniques Based Password Cracking: Web Application Vulnerabilities, Web Based Password Cracking Techniques.

Unit III

Web and Network Hacking: SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security. Linux Hacking: Linux Hacking. Evading IDS and Firewalls: Evading IDS and Firewalls.

Unit IV

Report writing & Mitigation: Introduction to Report Writing & Mitigation, requirements for low level reporting & high-level reporting of Penetration testing results, Demonstration of vulnerabilities and Mitigation of issues identified including tracking. Ethical Hacking Laws and Tests: An introduction to the legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance.

List of suggested books:

1. Brijendra Singh, Cryptography & Network Security, PHI.

2. Pachghare, V.K., Cryptography and Information Security, PHI.

3. William Stallings, “Cryptography and Network Security –Principles and Practices”, Prentice Hall of India, Third Edition, 2003.

4. Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 2nd Edition, McGrawHill Education, 2014.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA625: Ethical Hacking Lab

Credits : 2

LTP 004

Course Description: The course aims to equip the students with a comprehensive study of Ethical Hacking. The course includes Intrusion Detection, Policy Creation, Social Engineering, Buffer Overflows and different types of Attacks and their protection mechanisms.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concepts of ethical hacking.

CO2: Discuss about various hacking tools.

CO3: Describe and perform vulnerability and pen testing assessments and exercises.

CO4: Describe the password cracking tools.

Lab Exercises:

1. To study various Hacking tools.
2. To study various Potential Security Threats.
3. Passive Reconnaissance using "Who is" and Online tools.
4. Active Reconnaissance using "Sampad" and web site details.
5. Full Scan, Half Open Scan and Stealth scan using "nmap".
6. UDP and Ping Scanning using "Advance Lan Scanner" and "Superscan".
7. Packet crafting using "Packet creator" tools.
8. Password Revelation from browsers and social networking application.
9. Creating and analyzing spoofed emails.
10. Creating and Analyzing Trojans.
11. Configure ARP entries in Windows.
12. To study various password cracking tools.
13. Crack Wireless Password
14. OS password cracking

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

BCA529: Minor Project

Credits : 2

LTP 004

Course Description: The course aims to equip the students to provide an opportunity to apply the knowledge gained through various courses in solving a real-life problem.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand the team working and team management.

CO2: Learn how to develop components & systems in isolation which meets a common goal.

CO3: Understand practical application of engineering principles for designing fabrication and testing of working models.

CO4: Design a system, model, component or a process to meet desired/industrial/R&D needs.

Guidelines for Minor Project

The minor project is considered as a steppingstone in implementing Major projects. Hence students should plan and organize their minor projects meticulously and necessary discussions and planning should be done so as to achieve this objective. The following guidelines should be adhered to:

1. Team size should preferably be three with a maximum limit of 4 members.
2. Individual projects may be permitted in exceptional cases, for valid reasons.
3. Minor Projects should be purely internal in nature.
4. No restriction on tools/platform/language chosen should be made.
5. Minor Projects 2 normal applications and one database related application is must.
6. Students must ensure that they have to submit their synopsis of Project within 15 days from the start of the project.
7. Two interim reports (one after analysis and another after design) should be submitted to internal guides.
8. The number of records to be submitted is limited to team size + one (Departmental copy). Hard binding of reports is mandatory.
9. The report format guidelines used to document Minor Projects should be followed for making the final report and evaluation will be made on the same grounds.

Evaluation of Minor Project:

External Evaluation:

Criteria for external evaluation of Minor Project, External evaluation is done by an external examiner appointed by the HOD/DEAN of the department. The following components are to be assessed for the End Semester External Evaluation of the Minor Project:

Project Demonstration	20 marks
Presentation	20 marks
Viva -voce	20 marks
Total marks	60 marks

Internal Evaluation:

Criteria for internal evaluation of Minor Project, Internal evaluation is being done by conducting a Viva by a team of evaluators comprising of the concerned guides and/or Head of the Department. The following are the components for internal evaluation of the Minor Project:

Presentation /Internal Viva	10 marks
Individual involvement & teamwork	10 marks
Attendance	5 marks
Project Report	15 marks

BCA530: Industrial Training

Credits : 2

Course Description: The course aims to equip the students with a professional environment and/or style typical of a global IT industry. The course includes Project feasibility, Process Modeling, System Design, Program design, Program coding and unit testing, System integration, System implementation and acceptance testing.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand the team working and team management.

CO2: Learn how to develop components & systems in isolation which meets a common goal.

CO3: Understand practical application of engineering principles for designing fabrication and testing of working models.

CO4: Design a system, model, component or a process to meet desired/industrial/R&D needs.

Course Contents:

Summer Professional Training is an important part of BCA course curriculum. It provides an opportunity to BCA students to write a summer training report on latest trends/technology related to software project. Following are guidelines for summer training report writing and assessment:

General Instructions:

1. Summer training report should not be less than 50 pages.
2. Proper guidelines to be followed for preparation of summer training report.
3. Proper dress code is mandatory for presenting and attending summer training PPT presentations.
4. Attendance is compulsory for all students.
5. If a student is absent for his presentation as per schedule, he/she must assess later on with reduced weightage in the presentation assessment.
6. Always prepare a draft report first and print it out.
7. Read it yourself first and correct any typographical or grammatical errors.

8.Read it yourself first and correct any typographical or grammatical errors.

Main Components of a Report:

1. Cover page.
2. Abstract
3. Acknowledgement and declaration.
4. Certificate.
5. Table of contents/Index page.
6. conclusions.
7. References.

Typing Instructions for Summer Training Report:

- Specification for Fonts:
  - Font Face: Times new Romano.
  - Font Size: As per following preview:
  - Headings (Size 16 Bold).
  - Sub-Heading (Size 14 Bold and Italic).
  - Contents (Size 12Normal)
  - Line spacing: 1.5.
  - Text Alignment: Both left and right justified.
  - Page Dimensions: Standard A4 size (297mm x 210mm).
  - Margins:
    - Top margin: 0.75”
    - Bottom margin: 0.75”
    - Left margin: 1”
    - Right margin: 0.75”
  - Footer: Page number should be bottom centered.
  - Sections should be numbered as for example,1. Introduction.
  - Subsections should be numbered as for example,3.1 Simulation Toltec.
  - Paragraphs and sentences should be short.
  - Start of a paragraph should not be intended, rather, give one-line space between two paragraphs.
  - A sub heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page.
  - The last word of any page should not be split using a hyphen.

• References:

• Book titles must be in capitals.

• Reference numbers should be marked liberally inside the text of the report-e.g., ...as given in [3].

• References should either be in chronological order or in the order in which they appear in Evaluation of Professional Training

Internal/External Evaluation:

Criteria for Internal/external evaluation of Professional Training, External evaluation is done by one external examiner and one internal examiner are appointed by the HOD/DEAN of the department. The following components are to be assessed for the End Semester External Evaluation of the Professional Training:

Training Report	25 marks
Presentation	20 marks
Training Viva	25 marks
Depth of knowledge and skills	15 marks
Quality of content presented	15 marks
Total marks	100 marks

BCA625: Major Project

Credits : 3

LTP 006

Course Description: The course aims to equip the students to provide an opportunity to apply the knowledge gained through various courses in solving a real-life problem.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand the team working and team management.

CO2: Learn how to develop components & systems in isolation which meets a common goal.

CO3: Understand practical application of engineering principles for designing fabrication and testing of working models.

CO4: Design a system, model, component or a process to meet desired/industrial/R&D needs.

Guidelines for Major Project

Hence students should plan and organize their minor projects meticulously and necessary discussions and planning should be done so as to achieve this objective. The following guidelines should be adhered to:

1. Group Size: Maximum 4, most preferably:3.

2. Certificate should include the names of all members.

3. The minimal phases for the project are Project feasibility, Investigation of system requirements, Data and Process Modelling, System Design, Program design, Program coding and unit testing, System integration, System implementation and acceptance testing.

4. Planning the Project: The Major Project is an involved exercise which has to be planned well in advance. The topic should be chosen in Semester 5 itself. Related reading, training and discussions should start from semester 5 itself.

5. Attendance is compulsory for all students.

6. If a student is absent for his presentation as per schedule, he/she must assess later on with reduced weightage in the presentation assessment.

1. **Selection of project work:** Project work could be of 3 types:

a) Developing solution for a real-life problem: In this case, a requirement for developing a computer-based solution already Exists and the different stages of system development life

cycle is to be implemented successfully. Examples are Accounting Software Package for a particular organization, Computerization of administrative functions of an organization, Web Based application, website design and development and many more. The scope for creativity and exploration in such projects is limited, but if done meticulously, valuable experience in the industrial context can be gained.

b) Innovative Product development: These are projects where a clear-cut requirement for developing a computer-based solution may not be existing, but a possible utility for the same is conceived by the proposer. An Example is innovative Android applications, Networking, Computer Music Software for Indian Music, Heat Engines Simulation Software for eLearning, Digital Water Marking Software and many more.

c) Research level project: These are projects which involve research and development and may not be as structured and clear cuts in the above case. Examples are Character Recognition, Speech Recognizer, Biometric Systems, Machine Translation System etc.

8. Students must ensure that they have to submit their synopsis of Project within 15 days from the start of the project.

9. Two interim reports (one after analysis and another after design) should be submitted to internal guides.

10. The number of records to be submitted is limited to team size + one (Departmental copy). Hard binding of reports is mandatory.

11. The report format guidelines used to document Major Projects should be followed for making the final report and evaluation will be made on the same grounds.

Typing Instructions for Major Project Report:

- Specification for Fonts:
- Font Face: Times new Romano
- Headings (Size 16 Bold).
- Sub-Heading (Size 14 Bold and Italic).
- Contents (Size 12Normal)
- Line spacing: 1.5.
- Text Alignment: Both left and right justified

- Page Dimensions: Standard A4 size (297mm x 210mm).
- Margins:
  - Top margin: 0.75”
  - Bottom margin: 0.75”
  - Left margin: 1”
  - Right margin: 0.75”
    - Footer: Page number should be bottom centered.
    - Sections should be numbered as for example,1. Introduction.
    - Subsections should be numbered as for example,3.1 Simulation Toltec.
    - Paragraphs and sentences should be short.
    - Start of a paragraph should not be intended, rather, give one-line space between two paragraphs.
    - A sub heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page.
    - The last word of any page should not be split using a hyphen.
    - References:
    - Book titles must be in capitals.
    - Reference numbers should be marked liberally inside the text of the report-e.g., ...as given in [3].
    - References should either be in chronological order or in the order in which they appear in the text.

Evaluation of Major Project:

External Evaluation:

External Evaluation:

Criteria for external evaluation of Major Project, External evaluation is done by an external examiner appointed by the HOD/DEAN of the department. The following components are to be assessed for the End Semester External Evaluation of the Minor Project:

Project Demonstration	20 marks
Presentation	20 marks
Viva -voce	20 marks
Total marks	60 marks

Internal Evaluation:

Criteria for internal evaluation of Major Project, Internal evaluation is being done by conducting a Viva by a team of evaluators comprising of the concerned guides and/or Head of

the Department. The following are the components for internal evaluation of the Minor Project:

Presentation /Internal Viva	10 marks
Individual involvement & teamwork	10 marks
Attendance	05 marks
Project Report	15 marks
Total marks	40 marks

**Kindly note the format to be followed is same as last year.

The whole text should be justified.

Font: Times New Roman

Main Heading Font Size: 14

Subheadings: 12

Font Size: 12 (Text)

Left margin: 1.25"

Right margin: 1"

BCA750: Research Project-I & BCA850: Research Project-II

Credits : 4

LTP 008

Course Description: The course aims to equip the students to provide an opportunity to apply the knowledge gained through various courses in solving a research problem.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Articulate a clear research question or problem

CO2: Define, articulate and use terminology, concepts, and theory in their field and know how to use them.

CO3: Apply problem solving skills to constructively address research on computer science problem.

CO4: Design a system, model, component or a process to meet desired/industrial/R&D needs.

Guidelines for BCA Research Project

Project Course shall be evaluated for 200 marks, out of which, 80 marks shall be for Sessional Evaluation and 120 marks for the End Examination (Viva–Voce). Every student shall be required to submit a research project synopsis on a topic approved by the Department Project Review Committee (DPRC).

1. A DPRC shall be constituted with the Dean/Head of the Department, Supervisor and two senior faculty members.

2. A student has to submit area of interest to the Coordinator in the 1st week of commencement of the Semester.

3. Class Coordinator has to collect area of interest from students and the faculty. He/she has to allot the guide in consultation with HOD. The priority will be given based on the performance of the student in the examinations conducted till date.

4. A student has to submit, in consultation with his project supervisor, the title, abstract and plan of action of his project work before DPRC for approval. The student can initiate the Project work, by obtaining the approval from the DPRC. The project duration is for the semester.

5. If a student wishes to change his supervisor or topic of the project, he can do so with the

approval of the DPRC. However, the DPRC shall examine whether or not the change of topic / supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

6. A student shall submit his status report with at least 2 reviews per Semester conducted by the DPRC.

7. The Sessional Evaluation shall be made on the basis of reviews and on the progress of the work evaluated by DPRC.

8. Two copies of the Project report certified by the supervisor and HOD shall be submitted to the Department after getting plagiarism check (Similarity index should be less than 15%).

2. The external examiner shall be appointed by the Dean/HOD.

Organization of Research Project Report

1. Title page
2. Certificate
3. Certificate issued by outside organization (if any)
4. Acknowledgements
5. Abstract
6. Index
7. List of Figures
8. List of Tables
9. Body of the Research Project Report as follows:

1. Introduction to the problem
2. State of the Art/Literature Survey
3. Present Work with diagrams
4. Implementation
5. Results along with test cases
6. Conclusions and Future Work
7. Bibliography/References
8. Appendix - I

Guidelines

- Every copy should be accompanied by a softcopy in CD along with required software and tools
- No. of copies are 03(three) 1 for Department, 1 for Library and 1 copy for student.

The following should be used for thesis preparation

- Black cover with Gold printing should be used for binding.
- A4 executive bond paper should be used.
- Page No's should be in the centre with font size 11 and font style Times New Roman.
- A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch).
- All the text should be in Times New Roman style with 1.5 paragraph spacing.
- Chapter Names – Size 16 Bold
- Topics of Chapter – Size 14
- Sub Topics – Size 12
- Any Other text – Size 11