# ORDINANCE

FOR

**B.TECH COMPUTER SCIENCE AND ENGINEERING**
**WITH SPECIALIZATION IN**
**DATA ANALYTICS**

GNA UNIVERSITY

*Inspiring Innovation.....*

(THIS ORDINANCE HAS BEEN APPROVED IN THE MEETING OF
BOARD OF STUDIES HELD ON DATED JUNE 8, 2022)

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

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

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

# B.TECH COMPUTER SCIENCE AND ENGINEERING(DATA ANALYTICS)

**SHORT TITLE AND COMMENCEMENT**

I. This ordinance shall be called the ordinance for the B. Tech Computer Science and Engineering with specialization in data analytics at GNA University, Phagwara.

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

**1. Name of Program: B.Tech. Computer Science and Engineering (DATA ANALYTICS)**

**2. Name of Faculty: Faculty of Engineering Design and Automation (FEDA)**

**3.Program Educational Objectives:** The program educational objectives of B. Tech programme of Computer Science & Engineering with specialization in data analytics at GNA University are:

**PEO1:** High-level accomplishment of key principles and practices of computation, mathematics and basic principles of engineering to guarantee that graduates are able to apply their software development skills in design and implementation of practical systems consisting of software and/or hardware components.

**PEO2:** Observe real-life problems and impart science-based engineering education to develop professional skills that will prepare the students for immediate employment in the industry. Graduates will be actively engaged in learning, understanding, design and applying new ideas and technologies as the field evolves along with participation in creative, synthetic and integrative activities of the relevant branch of engineering.

**PEO3:** Excellence in professionalism, moral and ethical conduct, understanding of social context and interpersonal skills with adaptable communication to develop a global view among graduates so that they can appreciate diversity in the world and in intellectual pursuits.

**3. Program Outcomes:**

The following are the program outcomes of the course:

**Po1: Engineering Knowledge:** Apply the knowledge of Mathematics, Science, Engineering Fundamentals, and an Engineering specialization to the solution of complex engineering problems.

**Po2: Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**Po3: Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**Po4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**Po5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**Po6: The engineer 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 engineering practice.

**Po7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**Po8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**Po9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**Po10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with 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.

**Po11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**Po12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change



**4. Program Specific Outcome**: By the completion of B.Tech CSE(CC) program the student will have following Program specific outcomes.

**PSO1: Foundation of Computer System:** Ability to understand the principles and working of computer systems. Students can assess the hardware and software aspects of computer systems.

**PSO2: Foundations of Hardware and Software development:** Ability to understand the structure and development methodologies of software systems. Possess professional skills and knowledge ofsoftware design process. Familiarity and practical competence with a broad range of programming language and open-source platforms.

**PSO3: Foundation of basic Sciences:** Ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable algorithm.

**PSO4: Applications of Computing and Entrepreneurship Ability:** Ability to use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.

**5. General Regulations for Faculty of Engineering, Design and Automation:**

**5.1** The University may introduce programs under Faculty of Engineering, Design and Automation which are specified under the UGC Act 1956. The Governing Body may approve the introduction, suspending or phasing out a program on their commendation of the Academic Council either on its own or on the initiative of faculty.

**5.2** The admissions to a Faculty of Engineering, Design and Automation programs shall be generally governed by the rules of the UGC/AICTE or another 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.

**5.3** The minimum entry qualification for admission to the students of Faculty of Engineering, Design and Automation 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 Engineering, Design and Automation shall be the Senior Secondary School Certificate (10+2) examination in non-medical, while deciding the admission procedure, the University may lay down compulsory subjects in qualifying examination for admission for various programs in the admission policy.

**5.4** 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.

**5.5** 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.

**5.6** 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.

**5.7** 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.

**5.8** 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.

**5.9** 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.

**6. General Regulations for the B.Tech. Computer Science and Engineering (Cyber Security):**

**6.1 Short Title and Commencement:** These regulations shall be called regulations for the UG program in Faculty of Engineering, Design and Automation of the University and shall come into force on such a date as the Academic Council may approve.

**6.2 Duration:** The duration of the UG program leading to degree of Bachelor of Technology shall be minimum four years and each year will comprise of two semesters. However, the duration may be extended up-to six years 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.

**6.3 Starting or Phasing out of Program:** The University may offer such Under graduate programs in Engineering leading to award the degree of Bachelor of Technology, as per no men cloture lay by the UGC/AICTE 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.

**6.4 Admissions:** Admission in Engineering programs 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 or direct entry into II year through lateral entry scheme etc. shall be defined in the admission policy.

**6.5 Eligibility for Admission:** 10+2 (Non –Medical) with 55% equivalent with (45 % for SC/ST/OBC) marks in aggregate from any recognized board. The Lateral Entry into this programme enables candidates with a 3 years diploma in Engineering (any stream) or an equivalent degree to get admitted directly to 2nd Year (3rd semester).

**6.6 Semester System:** The Engineering 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.

**6.7 Semester Duration:** Total duration of the Program shall be of four years and each year will comprise of two semesters. In addition, each semester shall normally have 90 working days.

**7.Curriculum:** The four years curriculum has been divided into eight semesters and shall include lectures/ tutorials/ Lab work/ field work/ outreach activity/ project work/ viva/ seminars/ presentations/ term papers/ assignments etc. or a combination of some of these. The curriculum will also include other curricular, co-curricular and extra-curricular activities as may be prescribed by the university from time to time.

**8. 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:

**Course Categories:**

| | | |
|---|---|---|
| I. | BSC: | Basic Science Courses |
| II. | ESC: | Engineering Science Courses |
| III. | HSMC: | Humanities and Social Sciences including Management courses |
| IV. | PCC: | Professional core courses |
| V. | PEC: | Professional Elective courses |
| VI. | OEC: | Open Elective courses |
| VII. | MC: | Mandatory courses (Audit Course) |
| VIII. | PROJ: | Project |

**I. Basic Science Courses:** A Basic Science Course includes Mathematics, Physics, Chemistry and English to all the 1st year engineering streams.

**II. Engineering Science Courses:** These are the courses which are extension of basic science course to be used in the Engineering.

**III. Professional Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement to complete the requirement of program in as a discipline of study.

**IV. Professional 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/ skills called an Elective Course.

**i. Discipline Specific Elective (DSE) Course:** The main discipline/subject of study may order elective courses, is referred to as Discipline Specific Elective. The University/Institute may also order discipline related Elective courses from unrelated discipline (to be ordered by main discipline/subject of study).

**ii. Open Elective Course (OEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to add generic proficiency to the students.

**Note: A core course ordered 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 Generic Elective. Elective Course(s) may also be called an "Open Elective"**

**V. Mandatory Course (MC) or Audit Course (AC)**

The introduction of two Audit courses covering subjects of developing desired attitude among the learners is on the line of initiatives such as Unnat Bharat Abhiyan, Yoga, Value education, Disaster management, Sanskrit, Pedagogy, Constitution of India, Personality development through Indian culture, Environmental Science etc.

**9. Medium of Instructions:**

**9.1.** The medium of instructions and examination will be English.

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

**10. Mode:**

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

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

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

11.2. Dean of Faculty may give a further relaxation of attendance up to 10% 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.

11.3. Further, relaxation up to 5% may be given by the Vice Chancellor to make a student eligible under special circumstances only.

11.4. 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.

11.5. 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 be counted as an absence. However, such absence shall not exceed four weeks per semester of the total period of instructions. Such type of facility should not be availed twice during the study.

**12. 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 Lab contact hours in a week.

A letter grade, corresponding to a specified number of grade points, is awarded in each course for which a student is registered. On obtaining a passing 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.

**12.1 Earned Credits (EC):** The credits assigned to a course in which a student has obtained 'D' (a 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.

| Definition of Credit | |
|---|---|
| 1 Hr. Lecture (L) per week | 1 credit |
| 1 Hr. Tutorial (T) per week | 1 credit |
| 2 Hours Practical (Lab) per week | 1 credit |

**13. Program Structure: As per GNA University**

**Details of Courses under B.TECH (COMPUTER SCIENCE AND ENGINEERING)**

| S.No | Course | Theory (A) | Theory & Tutorials B | Theory & Tutorials C | Practical/ Training (D) | Total |
|---|---|---|---|---|---|---|
| 01. | Basic Science Courses (BSC) | NIL | 4x5=20 (LTP-310) | NIL | 1x2=02 (LTP-002) | 22 |
| 02. | Engineering Science Courses(ESC) | NIL | 4x2=08 (LTP-310) | 5x4=20 (LTP-302) 3x1=03 (LTP-104) | 1x1=01 (LTP-002) 3x1=03 (LTP-004) | 34 |
| 03. | Humanities and Social Science Including Management Courses (HSMC) | 2x3=06 (LTP-300) | NIL | 2x3=06 (LTP-202) | NIL | 12 |
| 04. | Professional Core Courses(PCC) | NIL (LTP-300) | NIL | 4x16=64 (LTP-302) | NIL | 64 |
| 05. | Professional Elective Courses(PEC) | 3x5=15 (LTP-300) | NIL | 3x4=12 (LTP-302) | NIL | 27 |
| 06. | Open Elective Courses(OEC) | 2x3=06 (LTP-300) | NIL | NIL | NIL | 6 |
| 07. | Mandatory Courses(MC) | 1x2=02 (LTP-200) | NIL | NIL | NIL | 2 |
| 08. | Project (PROJ) | NIL | NIL | NIL | 1x1=01 3x1=03 | 4 |
| | Total Credits | 29A | 28B | 105C | 9D | 171 |



**Semester I (First year)**

| Sr. No | Category | Course Code | Course Title | Teaching Scheme L | T | P | Examination Scheme Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | BSC | *BTP101 | Engineering Physics | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| | | *BTP102 | Semiconductor Physics | | | | | | | |
| 2. | BSC | BTM101 | Calculus and LinearAlgebra | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| | | +BTM102 | Mathematics-I | | | | | | | |
| 3. | ESC | BEE101 | Basic Electrical & Electronics Engineering | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| 4. | HSMC | COM101 | English Communication | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| 2. | BSC | *BTP121 | Engineering Physics Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| | | **BTP122 | Semiconductor Physics Laboratory | | | | | | | |
| 3. | ESC | BEE121 | Basic Electrical & Electronics Engineering Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 4. | ESC | BCS101 | Programming for Problem Solving | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 3. | HSMC | COM121 | English Communication Lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 4. | ESC | BCS121 | Programming for Problem Solving Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 4. | MC | ENS001 | Environmental Science | 2 | - | - | 40 | 00 | 40 | S/US (Non- Credit) |
| Total Credits | | | | 16 | 3 | 8 | 360 | 380 | 740 | 21 |

***The Course Engineering Physics (BTP101) and Engineering Physics Lab (BTP121) are offered to B. Tech (Mechanical, Civil, Aerospace, Electronics and Communication & Mechatronics Engineering)**

****The Course Semiconductor Physics (BTP102) and Semiconductor Physics Lab (BTP122) are offered to B. Tech Computer Science Engineering, B.Tech Mechanical and Automation Engineering and B.Tech. Robotics and Automation Engineering).**

**+The course Mathematics – I (BTM102) is offered in B. Tech. Computer Science and Engineering only.**

**Semester II (First year)**

| Sr. No | Category | Course Code | Course Title | Teaching Scheme | | | Examination Scheme | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Internal | External | | |
| 1. | BSC | BTC101 | Engineering Chemistry | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| 2. | BSC | BTM201 | Calculus, Ordinary Differential Equations and ComplexVariables | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| | | *BTM202 | Mathematics-II | | | | | | | |
| 3. | ESC | BCS 302 | Object Oriented Programming Language using C++ | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 4. | ESC | BME102 | Engineering Drawing and Graphics | 1 | 0 | 4 | 40 | 60 | 100 | 3 |
| 5. | HSMC | COM201 | Business Communication | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| 6. | BSC | BTC121 | Chemistry Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 7. | ESC | BME123 | Workshop /Manufacturing Practices | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| 8. | HSMC | COM221 | Business Communication Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 9. | ESC | BCS322 | Object Oriented Programming Language using C++ Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 10. | HSMC | UHV001 | Universal Human Values | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **Total Credits** | | | | **15** | **2** | **14** | **390** | **460** | **850** | **24** |

**+The course Mathematics - II (BTM202) is offered in B. Tech. Computer Science and Engineering only.**

**Note: Student will take 4 weeks in-house summer training after 2nd semester. The assessment for this will be included in the 3rd Semester.**

**Semester III (Second year)**

| Sr. No | Category | Course Code | Course Title | Teaching Scheme | | | Examination Scheme | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Internal | External | | |
| 1. | PCC | BCS301 | Data structure & Algorithms | 3 | 0 | 0 | 40 | | 100 | 3 |
| 2. | PCC | BCS209 | Basics of Python | 3 | 0 | 0 | 40 | | 100 | 3 |
| 3. | ESC | BEE302 | Digital Circuit and Logic Design | 3 | 0 | 0 | 40 | | 100 | 2 |
| 4. | BSC | BTM302 | Mathematics-III | 3 | 1 | 0 | 40 | 20 | 50 | 1 |
| 5. | HSMC | DOS001 | Foundation Course in Humanities (Development of Philosophy/ Societies) | 3 | 0 | 0 | 40 | | 100 | 2 |
| 6. | PCC | BCS321 | Data Structure & Algorithms Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 7. | PCC | BCS222 | Python Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 8. | PROJ | BCS300 | Institutional Training | - | - | - | 40 | - | 40 | S/US |
| 9. | PEC | BTCY301 | Introduction to Big Data | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 10. | ESC | BEE322 | Digital Circuit and Logic Design Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 11. | PCC | BSC501 | Computer Networks | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 12. | PCC | BCS521 | Computer Networks Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| **Total** | | | | **21** | **1** | **8** | **440** | **560** | **940** | **26** |

***Students will take online course of Data Analytics (36 hours)***

**Semester IV (Second year)**

| Sr. No | Category | Course Code | Course Title | Teaching Scheme | | | Examination Scheme | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Internal | External | | |
| 1 | PCC | BCS401 | Operating Systems | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 2 | PEC | BTDA301 | Python for Data Science | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 3 | ESC | BEE302 | Computer Organization & Architecture | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 4 | BSC | BTM402 | Discrete Mathematics | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| 5 | PCC | BCS402 | Java Programming | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 6 | PEC | BTCY401 | Online Course: Cloud Security and Security Operations | 0 | 0 | 0 | - | - | - | S/US (Non- Credit) |
| 7 | PCC | BCS502 | Database Management Systems | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 8 | PCC | BCS421 | Operating Systems Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 9 | PCC | BCS522 | Database Management Systems Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 10 | PEC | BTDA311 | Python for Data Science Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 11 | PCC | BCS422 | Java Programming Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 12 | ESC | BCS333 | Computer Organization & Architecture Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| **Total Credits** | | | | **18** | **1** | **10** | **390** | **460** | **850** | **24** |

**** Students will take 4-6 weeks summer training in Industry after 4thsemester and mid term evaluation will be done by an Industry Expert.***

### Semester V (Third year)

| Sr. No | Category | Course Code | Course Title | Teaching Scheme | | | Examination Scheme | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Internal | External | | |
| 1 | PCC | BCS602 | Software Engineering | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 2 | PCC | BCS503 | Formal Language & Automata Theory | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 3 | PCC | BCS504 | Web Technologies | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 4 | PCC | BCS604 | Computer Graphics | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 5 | PEC | B*** | Elective – I<br>1.BusinessIntelligence and Analytics<br>2.Machine Learning<br>Image Analytics | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 6 | OEC | ****** | Open Elective – I | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 7 | PCC | BCS622 | Software Engineering Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 2 |
| 8 | PCC | BCS525 | Web Technologies Laboratory | 0 | 0 | 2 | 40 | 60 | 100 | 1 |
| 9 | PROJ | BCS500 | Summer Internship* | - | - | - | 50 | 50 | 100 | 2 |
| 10 | PEC | B*** | Elective – I Laboratory | 0 | 0 | 2 | 40 | 60 | 100 | 1 |
| 11 | PCC | BCS 624 | Computer Graphics Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 12 | PCC | | Placement Preparation – I | 0 | 0 | 2 | - | - | - | S/US |
| **Total Credits** | | | | **18** | **0** | **10** | **430** | **630** | **1000** | **24** |

### Semester VI (Third year)

| Sr. No | Category | Course Code | Course Title | Teaching Scheme | | | Examination Scheme | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Internal | External | | |
| 1 | PCC | BTDA608 | Introduction to Hadoop | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 2 | PCC | BCS601 | Compiler Design | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 3 | PCC | BCS603 | Design and Analysis of Algorithms | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 4 | PEC | BCS*** | Data Visualization and Handling | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 5 | PEC | BCS*** | Elective – II<br>1.Statistical Inference for Data Science<br>2.Block Chain Technology<br>3.Information Security<br>Stream Processing and Analytics | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 6 | PEC | BCS*** | Elective – III<br>1.Data Warehousing and Data Mining<br>2.SAS Programming<br>3.Simulation and Modelling<br>IOT Cloud and Data Analytics | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 7 | PROJ | BCS721 | Project I | 0 | 0 | 2 | 40 | 60 | 100 | 3 |
| 8 | PCC | BCS621 | Complier Design Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 9 | PCC | BTDA618 | Hadoop Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 10 | PEC | B*** | Elective-III Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| 11 | PCC | | Placement Preparation II | 0 | 0 | 2 | | | | S/US |
| **Total Credits** | | | | **18** | **0** | **12** | **400** | **500** | **900** | **24** |

### Semester VII (Fourth year)

| Sr. No | Category | Course Code | Course Title | Teaching Scheme | | | Examination Scheme | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Internal | External | | |
| 1 | PCC | BCS701 | Artificial Intelligence | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 2 | PCC | BCS942 | Computer Vision | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 3 | PEC | BTCC701 | DEVOPS | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 4 | PEC | BCS*** | Elective-IV<br>1.Big Data and Analytics<br>2.Time Series Analysis and Forecasting<br>3.Distributed Database System | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| 5 | PEC | BCS*** | Elective-V<br>1.Natural Language Processing<br>2.Digital Image Processing<br>Predictive Modeling and Analytics | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| | OEC | BCS*** | Open Elective – II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| | PROJ | BCS721 | Major Project | 0 | 0 | 6 | 50 | 50 | 100 | 3 |
| | PROJ | BCS700 | Summer Internship* | - | - | - | 50 | 50 | 100 | 2 |
| | PCC | BCS712 | Artificial Intelligence Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| | PCC | BCS932 | Computer Vision Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| | PEC | BTCY711 | DEVOPS Laboratory | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| **Total Credits** | | | | **18** | **0** | **12** | **430** | **520** | **950** | **26** |

*Students will take minimum of 4 weeks summer training in Industry after 6 th semester

### Semester VIII (Fourth year)

| Sr. No | Category | Course Code | Course Title | Teaching Scheme | | | Examination Scheme | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Internal | External | | |
| 1 | PROJ | BTCS801 | Semester Training | 0 | 0 | 0 | 500 | 500 | 1000 | 16 |
| Total Credits | | | | 18 | 0 | 10 | 430 | 630 | 1000 | 16 |

### LIST OF ELECTIVES

**Elective–I**

| Pre Requisite | Course Code | Course Title |
|---|---|---|
| N.A | BTDA501 | Business Intelligence and Analytics |
| N.A | BCS744 | Machine learning |
| N.A | BTDA502 | Image Analytics |

**Elective –II**

| Pre Requisite | Course Code | Course Title |
|---|---|---|
| N.A | BTDA602 | Statistical Inference for Data Science |
| N.A | BTCC602 | Block Chain Technology |
| N.A | BTCC603 | Information Security |
| BTCC201 | BTDA603 | Stream Processing and Analytics |

**Elective –III**

| Pre Requisite | Course Code | Course Title |
|---|---|---|
| N.A | BCS647 | Data Warehousing and Mining |
| N.A | BTDA604 | SAS Programming |
| N.A | BTCC619 | Simulation and Modelling |
| N.A | BTDA605 | IOT Cloud and Data Analytics |

**Elective –IV**

| Pre Requisite | Course Code | Course Title |
|---|---|---|
| N.A | BTDA602 | Big Data and Analytics |
| N.A | BTDA603 | Time Series Analysis and Forecasting |
| N.A | BCS749 | Distributed Database Systems |

**Elective–V**

| Pre Requisite | Course Code | Course Title |
|---|---|---|
| N.A | BTCC609 | Natural Language Processing |
| N.A | BCS751 | Digital Image Processing |
| N.A | BTDA606 | Predictive Modeling and Analytics |

**LIST OF OPEN ELECTIVES**

**Open Elective–I& II**

| Sr No. | Course Code | Course Title | L | T | P | Cr |
|---|---|---|---|---|---|---|
| 1 | BEE036 | Internet of Things | 3 | 0 | 0 | 3 |
| 2 | VAE031 | Values and Ethics | 3 | 0 | 0 | 3 |
| 3 | FME031 | Fundamentals of Management for Engineers | 3 | 0 | 0 | 3 |
| 4 | BSOP401 | MATLAB for Engineers | 3 | 0 | 0 | 3 |
| 5 | BSOP402 | Content Management System | 3 | 0 | 0 | 3 |
| 6 | BSOP403 | Digital Marketing | 3 | 0 | 0 | 3 |
| 7 | BCS543 | Dot Net Technologies | 3 | 0 | 0 | 3 |
| 8 | BSOP404 | Statistics for Engineers | 3 | 0 | 0 | 3 |

**14. Minor/Major Project:**

The objective of Minor/Major Project is to enable the student to take up investigative study in the broad field of Computer Science and Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;

2. Working out a preliminary Approach to the Problem relating to the assigned topic;

3. Conducting preliminary Development/Analysis/ Modeling/ Simulation/ Experiment/ Design/ Feasibility;

4. Preparing a Written Report on the Study conducted for presentation to the Department;

5. Final Seminar, as oral Presentation before a departmental committee.

The objective of Major Project is to enable the student to extend further the investigative study taken up under Minor Project, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.

**14.1 Trainings:** The 4 weeks in-house/summer and 6-8 weeks summer internships are mandatory before completion of the course. This will equip the students with practical understanding and training about industry practices in a suitable industry or organization.

**14.2 Examination/ Evaluation System:**

**a) Internal Assessment,** which includes attendance, mid semester examination and/or other components (Project 1, Project 2, Mid Term Exam, Attendance, Class Test) carrying a weight age of 40%. This is applicable for all theory courses.

**b) Practical 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 weight age 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/Seminar/Practical as may be decided.

**c) External Assessment** i.e., End Semester Examination, carrying a weight age of 60%.

**a) End Semester Examination:** Controller of Examination shall conduct these examinations. The University shall release the examination dates and schedule.

**b)** Similar division of marks may be created for special courses like Major Projects, seminars, term papers, internship etc. by respective faculty but same shall also be predefined.

**c)** 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 overall percentage in the concerned subject remains less than 40%, then student has to repeat End Semester Examination in that subject.

**d) 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.

**e) Makeup Examinations for Mid Semester Examination:** A student may apply for a makeup examination 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.
- **f) 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 ofthe 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 ofthe class as in the regular semester for award of grade.
- **g) 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.
- **h) 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.
- **Supplementary Examination:**
- **a.**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 previous semester.
- **b. Eligibility:** Student with 'F' grade is eligible to appear in the Supplementary Examination.
- **c. Re-appear:** Student with backlog of one semester will be carried forward to next semester. Re- appear examinations will be conducted twice in a year after ESE of every semester.
- **d. Supplementary for Projects:** There shall be no supplementary examinations for the projects, except makeup examination for missing the final viva as per rules outlined above.
- **c. Grading System: 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 | - |



**a. Description of Grades:**

**A. D Grade:** The D grade 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 the 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 the 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 makeup Examination etc. based on which the grade is to be decided along with other components of the evaluation during the semester 2/4. 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 a student falling below the laid down attendance requirement. Students having X grade shall be required to re-register for the course, when offered next.NB: The CGPA can be converted to percentage by using the given formula: CGPA x 10 = % e.g. 7.8 x 10 = 78%

**14.3 Cumulative Grade Point Average (CGPA),** it is a measure of the overall cumulative performance of a student for all semesters. The CGPA is the ratio of total credit points securedby 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.

**14.4** 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 thatsemester.

**d. 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 are 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.

**g. 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.

**h. Program qualifying criteria:** For qualifying the Program every student is required to earn prescribed credits (i.e. 171). 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.

**i. Revision of Regulations, Curriculum and Syllabi:** The University may revise, amend, change or update the Regulations, Curriculum, Syllabus and Scheme of examinations through the Board of Studies and the Academic Council as and when required.

**j. Conditions for Award of a Degree:**

a. Should complete the requirements of the Degree in maximum duration specified for the program. Semester withdrawals due to medical reasons are not counted in six years. 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 six years and minimum period of four years.

b. Successfully completing the Internship studies.

c. 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.

**Acceptance of MOOC courses**

Faculty of 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.

**Instructions for MOOC courses**

1. 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.
2. The copy of the list of courses taken by the students for any course has to be submitted to the Controller of the Examination.
3. MOOC course should be done from SWAYAM platform as per the guidelines of UGC.
4. 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.
5. The fees (if any) for the registration and / or assessment of the MOOC course must be borne by the student only.
6. 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.
7. 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.
8. 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.
9. MOOC course coordinators shall be appointed for each of the course taken by the student.

# First Year





GNA UNIVERSITY
Inspiring Innovation.....

**Core Course BTP102: SEMICONDUCTOR PHYSICS**
**Credits: 04**

L T P
3 1 0

**Course Description:** The course aims to equip the students with the with the ability to familiarize the basics of Semiconductor Physics and Lasers so that they can use these in Engineering as per their requirement.

**Course Outcomes (CO):**

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

**CO1:** Explain the fundamental principles and properties of electronic materials and semiconductors

**CO2:** Analyze the design, fabrication, and characterization techniques of Engineered semiconductor materials.

**CO3:** Describe the importance of Lasers and wave equation in nature and appreciate the mathematical formulation of the same.

**Co4:** Develop the basic tools with which they can study and test the newly developed devices and other semiconductor applications.

**Course Contents:**

**UNIT I**

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons

**UNIT II**

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.

**UNIT III**

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint densityof states, Densityof states for photons, Transition rates (Fermi's goldenrule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model

**UNIT IV**

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity.

**Suggested Reference Books**

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.(1995)
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.,(2007).
3. S. M. Sze: Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya: Semiconductor Optoelectronic Devices, Prentice Hall of India (1997)





**Core Course BTM102: MATHEMATICS-I**

**Credits: 04**

L T P
3 1 0

**Pre-Requisites:** NA

**Course Description:** The course aims to equip the students with the ability to familiarize the prospective engineers with techniques in basic calculus and linear algebra and equip them with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

**Course Outcomes (CO):**

The course will enable the student to:

**CO1:** Apply fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

**CO2:** Solve problems related to matrices and linear algebra including linear transformations, eigen values, diagonalization.

**CO3:** Characterize a set of vectors and linear systems using the concept of linear independence.

**CO4:** Identify and construct linear transformations of a matrix

**Co5:** Solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous, or Bernoulli cases.

**Course Contents:**

**UNIT I**

**Calculus:** Evolute and Involute; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle 's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

**UNIT II**

**Matrices:** Solution of linear systems of equations, linear Independence, rank of a matrix, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination; Eigen values, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigen bases. Diagonalization.

**UNIT III**

Vector spaces: Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank nullity theorem, composition of linear maps, Matrix associated with a linear map.

**UNIT IV**

**First order ordinary differential equations:** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

**Ordinary differential equations of higher orders:** Second order linear differential equations with variable coefficients, method of variation of parameters.

**Text Books:**

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

**Suggested Readings:**

5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
8. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.





## BEE101: BASIC ELECTRICAL & ELECTRONICS ENGINEERING

L T P
3 1 0

**Credits: 04**

**Course Description:** The course aims to equip the students with the basic concepts of electricity, electrical components and their applications. Also explain the working principle, construction, applications of various electrical machines.
The course includes the basic fundamentals of electronic components, devices and transducers, principles of digital electronics and concepts of basic electricity and electrical circuits which includes SCR, Transformer, magnetic circuits etc.

**Course Outcomes (CO):**

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

**CO1:** Describe strong basics of Electrical Engineering and practical implementation of Electrical fundamentals.

**CO2:** Develop and solve models of magnetic circuits.

**CO3:** Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state.

**Co4:** Analyze and solve electric and magnetic circuits, Identify functions of digital multimeter, cathode ray oscilloscope and various devices in the measurement of physical variables.

**Course Content**

**UNIT I**

Fundamentals of dc circuits: Introduction of CRO and multimeter, fundamentals of electricity (current, voltage, inductor, capacitor, resistor), ohm's law, Kirchhoff's' current and voltage law, series and parallel resistances and their circuit analysis. Elementary calculations for energy consumption and power factor improvement.

**UNIT II**

Fundamentals of ac circuits: AC circuits (generation, AC values, waveforms), Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. AC circuits (resistive, capacitive, inductive circuits), Impedance, admittance, polar form and rectangular form in AC circuits.

**UNIT III**

Principles of Magnetic circuits and transformers: Magnetism and transformers (Electromagnetic Induction, Mutual Induction), Working of Transformers (operation, principle turns ratio and applications), Losses in transformers, Rating and emf equation of transformers. Laws and terminologies in magnetic circuits.

**UNIT IV**

Electrical Installations & Power Converters: Components of LT Switchgear: Fuse, MCB, ELCB, MCCB, Types of Wires and Cables, Earthing and grounding. Batteries & UPS and its types. Introduction to SCR, DIAC, TRIAC and its VI characteristics.

**UNIT V**

Basics of Electronics: Introduction to Semi-Conductor materials (PN junction diodes, biasing and construction of PN Diode, Zener diode and its applications), Bipolar Junction Transistors (Construction, Working, configurations of Transistor and Applications).

**UNIT VI**

Digital Electronics: Introduction, number system and conversion, basic logic gates and their

truth tables, Flip-Flop's, Half and full adder, Half and full subtractor, Multiplexer and De multiplexer encoder, Decoder.

**Recommended Books/ Suggested Readings:**

1. B.L THAREJA , Fundamentals of Electrical engineering and electronics, S.CHAND 1st 2013.
2. EARL GATES , Introduction to electronics, DELMAR CENGAGE LEARNING, 6th edition 2013.
3. J.B GUPTA , Basic electrical and electronics engineering, S.K Kataria and sons edition 2013.
4. Basic Electrical and Electronics and Computer Engineering by R Muthusubramanian, S Salivahanan,K A Muraleedharan, Tata McgrawHill.
5. Basic electrical and electronics engineering DP KOTHARI 4TH EDITION 2013 MC Graw Hill.





## COM101: ENGLISH COMMUNICATION

**Credits: 02**

L T P
2 0 0

**Pre-Requisites:** NA

**Course Description:**

1. To make students capable of using English language in context.
2. To enhance effective reading and writing skills.

**Course Outcomes:**

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

UNIT I

Reading Skills: Comprehension Strategies- Skimming, Scanning&Inferencing, Summarising of Newspaper Articles, Paraphrasing of Complex Sentences

UNIT II

English Grammar and Usage: Parts of Speech, Common Errors in writing, Tenses, Change of Voice, Transformation of Sentences

**UNIT III**

Basic Writing Practices: Paragraph writing, Picture Composition, University based Notices, Notes Making after listening to a Motivational Speech, Formal Letter based on University concerns, MS Word (font style, size, format, spacing)

**UNIT IV**

Vocabulary Enrichment: Word Coinage, Synonym, Antonym, Homophones, Idioms and Phrasal verbs

**Reference Book:**

Functional English Grammar by Graham Lock, 1995

**Suggested Readings:**

Practical English Usage. Michael Swan OUP. 1995
On Writing Well. William Zinsser. Harper Resource Book. 2001
Communication Skills. Sanjay Kumar and PushpLata.Oxford University Press. 2006 Exercises in Spoken English. CIEFL, Hyderabad. Oxford University Press
Internet Links:
https://www.englishgrammar101.com/
http://learnenglish.britishcouncil.org/en/english-grammar
http://www.englishgrammarsecrets.com/
http://www.myenglishpages.com/
http://www.english-for-students.com/Homonyms-B.html

## BTP122: SEMICONDUCTOR PHYSICS LABORATORY

L T P
2 0 0

**Credits: 01**

**Pre-Requisites:** NA

**Course Description:**

The course aims to equip the students with the with the ability to familiarize the basics of Semiconductor Physics and Lasers so that they can use these in Engineering as per their requirement.

**Course Outcomes (CO):**

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

**CO1:** Draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

**CO2:** Understand the characteristics and the behavior of various materials in a practical manner and gain knowledge about various communication mediums and its usage

**Choice of 10-12 experiments from the following:**

**List of Experiments:**

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To find the quality factor of a damped harmonic oscillator.
3. To study one dimensional collision using two hanging spheres of different materials.
4. To determine the Moment of Inertia of a Flywheel.
5. To find out the frequency of AC mains using electric–vibrator.
6. To determine g by Bar Pendulum.
7. To determine g by Kater's Pendulum
8. To study the magnetic field of a circular coil carrying current.
9. To study B–H curve using CRO.
10. To find out dielectric constant of a dielectric substance.
11. To study the laser beam characteristics like; wave length using diffraction grating aperture
12. To determine numerical aperture of an optical fibre.
13. To determine attenuation & propagation losses in optical fibres.
14. To find the refractive index of a material using spectrometer.
15. To determine the grain size of a material using optical microscope.

**Physics virtual lab:**

1. To study Zener diode voltage as regulator and measure its line and load regulation.
2. To study the B-H Curve .
3. To draw the static current-voltage (I-V) characteristics of a junction diode
4. To determine the resistivity of semiconductors by Four Probe Method.
5. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.
6. dTo determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.

## BEE121: BASIC ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY

L T P
0 0 2

**Credits: 01**

**Pre-Requisites:** NA

**Course Description:**

This subject deals with basic circuit solution methods, introduction to electrical machines, electronic equipment's and basics of domestic electrical installations. This course includes the basic concepts of electrical engineering

**Course Outcomes (CO):**

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

**CO1:** Handle basic electrical equipment .

**CO2:** Understand domestic wiring procedures practically.

**CO3:** Assemble electronic systems.

**Co4:** Describe all the fundamental concepts involving electrical engineering

**List of Experiments**

1. To verify ohm's law and its limitations
2. To calculate the resistances and verify ohm's law for the wires of different material
3. To calculate the resistances of colored resistors
4. To verify Kirchhoff's current and voltage law
5. To study the various functions of CRO and calculate the amplitude and frequency of a sine wave using CRO.
6. To measure power and power factor in a single phase ac circuit.
7. To find out voltage – current relationship in a R-L-C series and parallel circuit and determine the resonance frequency of the circuit
8. To measure the resistance and inductance of a coil by ammeter- voltmeter method.
9. To obtain the characteristics of a pn junction diode.
10. To verify the application of zener diode as a voltage regulator
11. To verify the input and output characteristics of CE, CB and CC npn transistor.
12. To verify the functioning of a transistor as an amplifier
13. To verify the truth table of the various logic gates
14. To study the BCD to decimal encoder kit.

**BCS101: PROGRAMMING FOR PROBLEM SOLVING** L T P
**Credits: 03** 2 0 0

**Pre-Requisites:** NA

**Course Description:**

The course aims to equip the students to make students familiar with the use of computers, learn to convert algorithms into programs using C language and how to use programming languages and the logic for writing computer programs.

This course includes components of a computer system, Algorithm and fundamentals of programming, Iteration and loops, functions, sorting, array, Structure and Pointers and File handling.

**Course Outcomes (CO):**

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

**CO1:** Formulate simple algorithms for arithmetic and logical problems.

**CO2:** Implement conditional branching, iteration and recursion.

**CO3:** Use arrays, pointers and structures to formulate algorithms and programs.

**CO4:** Apply programming to solve matrix addition and multiplication problems and sorting problems.

**Course Content:**

**UNIT I**

Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker.

Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code.

Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C, Fundamental data types, Variables and memory locations, Storage classes.

**UNIT II**

(Loops & Functions)

Iteration and loops: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

**UNIT III**

Arrays: Arrays (1-D, 2-D), Character arrays and Strings

Basic Algorithms: Searching, Basic Sorting Algorithms, Finding roots of equations, idea of time complexity

**UNIT IV**

Function and Recursion: Functions (including using built in libraries), Recursion with example programs such as Quick sort, Ackerman function etc.

**UNIT V**

Structure and Pointers: Pointers, Structures (including self referential structures e.g., linked list, notional introduction)

File handling: Introduction to file handling and its various modes

**Text Books:**

1. Exploring Microsoft Office 2010 by Robert T. Grauer, Mary Anne S. Poatsy, Michelle Hulett, Cynthia Krebs, Keith Mulberry, Prentice Hall.
2. Computer Fundamentals by P.K. Sinha, BPB Pub, 4th Ed.
3. Let Us C by Yashwant Kanitkar

**Suggested Readings:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

## COM121: ENGLISH COMMUNICATION LABORATORY

L T P
0 0 2

**Credits: 01**

**Pre-Requisites:** NA

**Course Description:**

1. To make students capable of using English language in context.
2. To gain active listening and responding skills.

**Course Outcomes (CO):**

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

CO1: The students will be able to develop better understanding of Standard English accent.

CO2: The students will be able to develop fluency in English language.

**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

**Reference Book:**

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

**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.






## BCS121: PROGRAMING FOR PROBLEM SOLVING LABORATORY

L T P
0 0 2

**Credits: 01**

**Pre-Requisites:** NA

**Course Description:**

The Lab course aims to acquaint students with the usage of computers, demonstrate to them how to transform algorithms into programs using C language, and train them how to utilize programming languages and logic to write computer programs.

This course includes document creation in MS-Word, fundamentals of programming, Iteration and loops, functions, sorting, array, Recursion, Structure and Pointers and File handling.

**Course Outcomes (CO):**

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

**CO1:** Create documents using MS-Office

**CO2:** Formulate the algorithms for simple problems

**CO3:** Translate given algorithms to a working and correct program

**CO4:** Correct syntax errors as reported by the compilers

**CO5:** Identify and correct logical errors encountered at run time

**Course Content:**

**List of experiments:** Students should be made to practice the various concepts learned in class room by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following –age. Michael Swan. OUP. 1995.

1. Create documents using MS-Office exploring its various features.
2. Problem solving using computers: Familiarization with programming environment
3. Variable types and type conversions: Simple computational problems using arithmetic expressions
4. Branching and logical expressions: Problems involving if-then-else structures
5. Loops, while and for loops: Iterative problems e.g., sum of series
6. 1D Arrays: searching, sorting: 1D Array manipulation
7. 2D arrays and Strings, memory structure: Matrix problems, String operations
8. Functions call by value: Simple functions
9. Numerical methods: Root finding, numerical differentiation, numerical integration
10. Recursion, structure of recursive calls: Recursive functions
11. Pointers, structures and dynamic memory allocation: Pointers and structures
12. File handling: File operations

## COM121: ENGLISH COMMUNICATION LABORATORY

L T P
0 0 2

**Credits: 01**

**Pre-Requisites:** NA

**Course Description:**

1. To make students capable of using English language in context.
2. To gain active listening and responding skills.

**Course Outcomes (CO):**

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

CO1: The students will be able to develop better understanding of Standard English accent.

CO2: The students will be able to develop fluency in English language.

**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

**Reference Book:**

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

**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.






## BCS121: PROGRAMING FOR PROBLEM SOLVING LABORATORY

L T P
0 0 2

**Credits: 01**

**Pre-Requisites:** NA

**Course Description:**

The Lab course aims to acquaint students with the usage of computers, demonstrate to them how to transform algorithms into programs using C language, and train them how to utilize programming languages and logic to write computer programs.

This course includes document creation in MS-Word, fundamentals of programming, Iteration and loops, functions, sorting, array, Recursion, Structure and Pointers and File handling.

**Course Outcomes (CO):**

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

**CO1:** Create documents using MS-Office

**CO2:** Formulate the algorithms for simple problems

**CO3:** Translate given algorithms to a working and correct program

**CO4:** Correct syntax errors as reported by the compilers

**CO5:** Identify and correct logical errors encountered at run time

**Course Content:**

**List of experiments:** Students should be made to practice the various concepts learned in class room by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following –age. Michael Swan. OUP. 1995.

1. Create documents using MS-Office exploring its various features.
2. Problem solving using computers: Familiarization with programming environment
3. Variable types and type conversions: Simple computational problems using arithmetic expressions
4. Branching and logical expressions: Problems involving if-then-else structures
5. Loops, while and for loops: Iterative problems e.g., sum of series
6. 1D Arrays: searching, sorting: 1D Array manipulation
7. 2D arrays and Strings, memory structure: Matrix problems, String operations
8. Functions call by value: Simple functions
9. Numerical methods: Root finding, numerical differentiation, numerical integration
10. Recursion, structure of recursive calls: Recursive functions
11. Pointers, structures and dynamic memory allocation: Pointers and structures
12. File handling: File operations

## ENS001: ENVIRONMENTAL SCIENCE

L T P
0 0 2

**Credits: 02**

**Pre-Requisites:** NA

**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:** Learned about environment, its role and importance for living beings.

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

**CO3:** Understand about the natural resources and their uses.

**CO4:** Recognize 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.

**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 II

- 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.
- Biodiversity and Conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hotspots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: habitat loss, poaching ofwildlife, 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 III

**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.
- 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 IV

**Human Communities and the Environment**

Human population and growth: Impacts on environment, human health, and welfares.

Carbon footprint.(G7)

Resettlement and rehabilitation of project affected persons, case studies.

Disaster management: floods, earthquakes, cyclones, and landslides.

Environmental movements: Chipko, Silent valley, Bishnois 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 environmentaleffects ofdams (pp. 29-64). ZedBooks.
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 o f Ecology.Philadelphia:Saunders.
10. Pepper, I.L., Gerba, C.P. &Brusseau, M.L. 2011. Environmental and Pollution Science. AcademicPress.
11. Rao, M.N. & Datta, A.K. 1987. Wastewater Treatment. 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 andConservation.
**S. Chand Publishing, New Delhi.**
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices fromthe Tropics. John Wiley &Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the IndianSubcontinent.
18. Warren, C.E. 1971. Biology and Water Pollution Control. WB Saunders.
4. Wilson, E.O. 2006. The Creation: An appeal to save life on earth. New York:Norton.
19. World Commission on environment and Development. 1987. Our Common Future. Oxford UniversityPress
20 www.nacwc.nic.in
21 www.opcw.org





**BTC101: ENGINEERING CHEMISTRY**

**Credits: 04**

L T P
3 1 0

**Pre-Requisites:** NA

**Course Description:** The course aims to equip the students with introduction to crystal field theory and spectroscopic properties, to understand the conditions of chemical equilibrium, periodic properties of elements, molecular shapes, and importance of stereochemistry in organic reactions and explore the synthesis of organic drug molecules.

The course includes quantum chemistry, co-ordination chemistry, solid states, and various spectroscopic techniques, states of matter, thermodynamic and periodic properties, stereochemistry and synthesis of drug molecules.

**Course Outcomes (CO):**

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

**CO1:** Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and crystal field theory to explain aspects of structural, magnetic and spectroscopic properties.

**CO2:** Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

**CO3:** Rationalize bulk properties and processes using thermodynamic considerations.

**Co4:** Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity and also list major chemical reactions that are used in the synthesis of molecules.

**Course Content**

**UNIT I**

Atomic structure & Chemical Bonding: Schrodinger equation. Particle in a box solution and their applications for conjugated molecules. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbital theory-general introduction and the energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory- general introduction and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

**UNIT II**

Spectroscopic techniques and applications: Principles of spectroscopy and selection rules – Electronic spectroscopy. Fluorescence and its applications in medicine. IR & microwave (Vibrational and rotational spectroscopy of simple diatomic molecules) Applications. Nuclear magnetic resonance and magnetic resonance imaging proton NMR, surface characterization techniques (FTIR & XRD).

**UNIT III**

Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

**UNIT IV**

Polymers: General introduction, classification of polymers, Mechanism of addition and condensation polymerization, Idea of number average and weight average molecular masses of polymers, Properties and uses of polystyrene, polyester, polyamide, epoxy, phenol-

formaldehyde and silicon resins.

Stereochemistry: Representations of three-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality in organic molecules, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

Organic reactions and synthesis of a drug molecule: Introduction to simple reactions substitution, addition, elimination, oxidation, reduction and cyclizations. Synthesis of a commonly used drug molecules (Aspirin, Metronidazole, Ciprofloxacin).

**Recommended Books / Suggested Readings:**

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
http://bcs.whfreeman.com/vollhardtschore5e/default.asp





**BTM202: MATHEMATICS-II (DIFFERENTAL CALCULUS)** L T P 3 1 0

**Credits: 4**

**Pre-Requisites:** BTM 102

**Course Description:** The course aims to equip the students with the ability to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables & equip them to deal with advanced level of mathematics and applications that would be essential for their disciplines.

**Course Outcomes (CO):**

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

**Co1:** Use mathematical tools needed in evaluating multiple integrals and their usage.

**CO2:** Apply effective mathematical tools for the solutions of differential equations in engineering problems.

**CO3:** Apply concepts of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

**Co4:** Identify with functions of several variables that are essential in most branches of engineering.

**Course Content**

**UNIT I**

**Multivariable Calculus (Differentiation):** Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence

**UNIT II**

**Multivariable Calculus (Integration):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes; Triple integrals (Cartesian), orthogonal curvilinear coordinates; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes (without Proofs)

**UNIT III**

**Complex Variable – Differentiation:** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

**UNIT IV**

**Complex Variable – Integration:** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine

**Text Books:**

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

**Suggested Readings:**

1. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.





## BCS302: OBJECT ORIENTED PROGRAMMING USING C++

L T P
3 0 0

**Credits: 3**

**Course Description:** This course will enable students the fundamentals of Object-Oriented Programming (OOP) and C++. Large programs are most likely the most complicated programs developed by humans. Because of their complexity, programs are prone to error, and software failures may be costly and even fatal. Object-oriented programming provides a novel and effective technique to deal with this complexity, serving as the foundation for all other courses based on the Object-Oriented idea.
The course includes basic concepts of OOPs, functions, Structures and Unions, Inheritance and File handling.

**Course Outcomes (CO):**

Upon successful completion of the course, the students should be able to:
**CO1:** Discuss the principles of Object-Oriented Programming.
**CO2:** Identify classes, objects, members of a class and the relationships among them needed to solve a specific problem.
**CO3:** Demonstrate the concept of data encapsulation, inheritance, polymorphism and friend functions.
**CO4:** Analyze the handling formatted I/O and unformatted.

**Course Content**

**UNIT I**

Introduction: Beginning with C++, its applications, advantages etc, Difference between C and C++, Creating C++ source file, Editing, Compiling, Linking, Debugging, Difference between Procedure Oriented Programming approach and Object-Oriented Programming approach. C++ Fundamentals: Tokens, Keywords, Data Types, Expressions, Operators, Reference variables, and Manipulators. Control Structures: Decision control statements (if, if-else, if-else-if), Looping statements (while, do-while, for), break, continue, switch statements.

**UNIT II**

Functions: Different types of functions, Argument passing techniques-Pass by value, Pass by address, Pass by Reference; Inline functions, Function overloading, Default arguments, Recursion. Arrays and Strings: Defining arrays, Initialization, passing one-dimensional array to function, multi-dimensional arrays, Defining and initializing string variables.

**UNIT III**

Structures and Unions: Declaration and definition, initialization, array of structures, Difference between structure and union. Pointers: Declaration and initialization, array of pointers, pointer to pointer, operations on pointers. Classes and Objects: Class specification, Class objects, defining member functions, declaration of objects to class, accessing class members with objects, access specifiers (private, public, protected), array of objects, Constructors and Destructors, Operator overloading.

**UNIT IV**

Inheritance: Public, private and protected inheritance, Friend function, Single inheritance, multi- level inheritance, Multiple inheritance and its ambiguity, Hierarchical inheritance, Hybrid inheritance, Virtual base class, Abstract class, Composition. Polymorphism: Compile-time andRun-time polymorphism, Virtual Functions, Pure virtual functions, this pointer.

Exception Handling and File Handling: try-catch block, multiple catch blocks, catching all exceptions, rethrowing exceptions, File handling functions

**Recommended Books / Suggested Readings::**

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, TataMc-Graw Hill.
2. The C++ Programming Language, BjarnaStroustrup, Third Edition, Addison-Wesley Publishing Company.
3. Object Oriented Programming in C++ by Robert Lafore
4. Let Us C++, YashwantKanitk





## BME102: ENGINEERING DRAWING AND GRAPHICS

L T P
1 0 4

**Credits: 3**

**Pre-Requisites:** BME122

**Course Description:**

The course aims to equip the students to make students familiar with the principles of this manufacturing process to produce the product. Engineering drawing is a powerful engineering language. It is the pillar that supports the engineering and technological framework. Furthermore, it serves as a connection between ideas and their execution.

This course includes cad & reverse engineering, liquid based and solid based additive manufacturing systems and medical and bio-additive manufacturing.

**Course Outcomes (CO):**

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

**CO1:** Demonstrate comprehensive knowledge of the broad range of AM processes, devices, capabilities and materials that are available.

**Co2:** Understand the various software tools, processes and techniques that enable advanced/additive manufacturing and personal fabrication.

**Co3:** Recognize how to create physical objects that satisfy product development/prototyping requirements, using advanced/additive manufacturing devices and processes.

**CO4:** Articulate the various tradeoffs that must be made in selecting advanced/additive manufacturing processes, devices and materials to suit particular product requirements.

**CO5:** Design and fabricate an actual multi-component object using advanced/additive manufacturing devices and processes.

**Co6:** Analyze the latest trends and business opportunities in AM, distributed manufacturing and mass customization

**Course Content**

**UNIT I**

**Introduction**: Overview – History - Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling – Applications.

**CAD & Reverse Engineering:** Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology.

**UNIT II**

**Liquid Based and Solid Based Additive Manufacturing Systems:** Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process.

**UNIT III**

**Powder Based Additive Manufacturing Systems:** Selective Laser Sintering ,Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron BeamMelting.

**UNIT IV**

**Medical and Bio-Additive Manufacturing:** Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE).

**Text Books:**

1. Chua C.K., Leong K.F., and Lim C.S., —Rapid prototyping: Principles and applications‖, Third edition, World Scientific Publishers, 2010.

**Suggested Readings:**

1. Gebhardt A., —Rapid prototyping‖, Hanser Gardener Publications, 2003.
2. Liou L.W. and Liou F.W., —Rapid Prototyping and Engineering applications: A tool box for prototype development‖, CRC Press, 2007.
3. FDM Guide Book

**List of Experiments:**

1. Practical Demonstration of vacuum casting in MK Technology.
2. Practical Implementation and comparison of various Rapid Prototyping Technologies.
3. Practical Demonstration of FDM Printing.
4. To import CAD STL file of the part to be printed in Catalyst Software and set part orientation, units and scale.
5. To add the print model to pack and analyze model and support material requirement and time consumption for the printer.
6. To prepare the Work Table and set up the Material Cartridges in Dimension SST 1200ES for proper loading and unloading.
7. To send the print file to FDM Machine and produce the RP Model.
8. To perform machine maintenance and verify the stable condition of machine nozzles





## COM201: BUSINESS COMMUNICATION

L T P
2 0 0

**Credits: 2**

**Pre-Requisites:**NA

**Course Description:**

1. To make students develop business writing etiquette in terms of formats.
2. To develop their reading skills and enhance their vocabulary

**Course Outcomes (CO):**

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

**CO1:** The students will be able to develop effective reading and writing skills.

**CO2:** The students will learn vocabulary and technical jargons as used in business communication.

**Course Content**

**UNIT I**

**Communication& Interpersonal Skills:** Process of Communication, Types of communication, Modes of Communication, Barriers to Communication, Delivering Effective PPT

**UNIT II**

**Technical Writing:** Memorandum, Notices, Blog Writing, Report Making, Minutes of Meeting, E- Mail, Press Note, Resume& Cover Letter, Formal Letter- Complaint Letter, Inquiry Letter, Confirmation Letter, Resignation Letter, Permission Letter,

**UNIT III**

**Vocabulary Building:** Misspell words; Techno based Acronyms, Word formation- prefix, suffix, Foreign Words, Phrases

**UNIT IV**

**Functional Grammar:** Conditional Sentences, Degrees of Comparison, Punctuation, Question Tags

**Reference Book:**

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.

## BTC 121: ENGINEERING CHEMISTRY LABORATORY

L T P
0 0 2

**Credits: 01**

**Pre-Requisites:** NA

**Course Description:** The course aims to equip the students with experimental/practical knowledge of illustrating the principles of chemistry relevant to the study of science and engineering.

The course includes separation techniques, determination of ions in water, rate constants for chemical reactions, cell constants, conductometry, potentiometry, chemical analysis, saponification and chemical oscillations.

**Course Outcomes (CO):**

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

**CO1:** Estimate rate constants of reactions from concentration of reactants/products as a function of time

**CO2:** Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc

**CO3:** Synthesize a small drug molecule/polymer and analyze a salt sample

**Co4:** Analyses the inorganic salts and chromatography for separation of compounds.

**List of Experiments:**

Choice of 10-12 experiments from the following:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to demonstrate isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.





## BME123: WORKSHOP/MANUFACTURING PRACTICES

L T P
0 0 4

**Credits: 2**

**Pre-Requisites:** NA

**Course Description:**

The course aims to equip the students with experimental/practical knowledge of various tools and their application in carpentry, fitting and sheet metal.

This course includes various cutting, filling and joining and workshop practices

**Course Outcomes (CO):**

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

**CO1:** Use one – way, two-way switches, parallel and series connections in house wiring.

**CO2:** Practices various joints of welding.

**CO3:** Make use of various fitting tool.

**Co4:** Perform Cold & Hot forging.

**Course Content**

**UNIT I**

**Smithy Shop:** Introduction; Forging tools and equipment, Hot working process; Cold working process. Forging operations in Smithy shop. Safety measures to be observed in the smithy shop. Introduction to various heat treatment processes e.g annealing, hardening, tempering, normalizing etc.

**JOBS**

1. To Make A Circular Ring by Cold Forming.
2. To Make A Chisel from Round Bar by Hot Forging.
3. To Forge A Cubical Shape from Round

**UNIT II**

**Fitting Shop:** Introduction to fitting shop tools, common materials used in fitting shop, Identification of materials. (e.g. Steel, Brass, Copper, Aluminium etc.).Identification of various sections of steel such as Flat, Angle, Tee, Channel, Bar Girder, Square, Z-Section, etc. Description and demonstration of various types of work benches. holding devices and files. Safety Precautions while using tools. Description and demonstration of simple operation of hack-sawing, demonstration and description of various types of blades and their specifications, uses and method of fitting the blade. Introduction to various types of threads (internal, external)- single start, multi-start, left hand and right hand threads. Description and demonstration of various types of drills, taps and dies Selection of dies for threading, selectionof drills and taps for tapping operations.

**JOBS**

- Prepare a template of given size by hack sawing and filing.
- Prepare a job having internal and external threads.

**UNIT III**

**Electric Shop:** Introduction; various electrical materials, Tools & Various electrical instruments used in electric shop, Concept of wiring. Introduction to the construction of a Lead- acid battery and its working. Installation of a battery and to connect two or more batteries in series and in parallel, Charging of a battery and testing it with the help of hydrometer and Cell Tester. Importance of three-phase wiring and its effectiveness. Estimating and costing of power

connection, Safety Measures during electrical works

**JOBS**

1. To Make Series and Parallel Connections.
2. Domestic Wiring – Connecting Lamp and Fan
3. Stair Case Wiring (2way).
4. Charging and Testing of Battery.

**UNIT IV**

**Welding Shop:** Introduction; Types of welding; introduction to welding equipment e.g. a.c. welding set, d.c. rectifier, Electrode holder, electrodes and their specifications, welding screens and other welding related equipment and accessories. Types of welding joints, Concept of Gas welding; Arc welding; MIG welding; TIG welding; Spot welding, Seam welding, Different welding position, Soldering and Brazing. Safety measures during welding operations.

**JOBS**

1. Practice Arc Welding.
2. Prepare Lap Joint with Arc Welding.
3. Prepare Butt Joint.
4. Prepare T Joint.

**RECOMMENDED BOOKS**


1. Workshop Technology Part 1-3 by Chapman W A J , Viva Books Pvt. Ltd, New Delhi
2. Work Shop Technology byRaghuwanshi R S, Dhanpat Rai and Sons, New Delhi
3. Production Technology by Jain R K, Khanna Publishers, New Delhi






**COM221: BUSINESS COMMUNICATION LABORATORY**

L T P
0 0 2

**Credits: 2**

**Pre-Requisites:**NA

**Course Description:**

1. To sharpen listening and speaking skills for workplace.
2. To teach effective conversational skills required in professional environment

**Course Outcomes (CO):**

1. The students will be able to develop effective reading and writing skills.
2. The students will learn vocabulary and tecAfter completion of this course students will be enable to -

**CO1:** The students will be able to develop thorough knowledge of professional communication

**CO2:** The students will be able to make and deliver effective presentations

**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**M**

**UNIT III**

**Phonological Skills:** Pronunciation, syllables and word stress.

**UNIT IV**

**Speaking Skills:**Cambridge English Empower Elementary Student's Book by Cambridge University Press

**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.

## BCS 322: OBJECT ORIENTED PROGRAMMING LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:**
The course aims to equip the students with the basic programming and error correction. The course helps students to solve real life problems.
This course includes OOPs Concepts, Loops, Array, function, recursion, pointers, structures and develop a mini project.

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**Co1:** Identify and correct logical errors encountered at run time.
**CO2:** Design real world applications by developing programming skills.
**CO3:** Demonstrate the use of various OOPs concepts with the help of programs.
**CO4:** Develop programs with reusability.

**List of Experiments**
**1. Problem solving using computers:** Familiarization with programming environment
**2. Variable types and type conversions:** Simple computational problems using arithmetic expressions
**3. Branching and logical expressions:** Problems involving if-then-else structures
**4. Loops, while and for loops:** Iterative problems e.g., sum of series
**5. 1D Arrays: searching, sorting:** 1D Array manipulation
**6. 2D arrays and Strings, memory structure:** Matrix problems, String operations
**7. Functions call by value:** Simple functions
**8. Recursion, structure of recursive calls:** Recursive functions
**9. Pointers, structures and dynamic memory allocation:** Pointers and structures
**10. Object Oriented Concepts:** Polymorphism, abstraction, inheritance, encapsulation File handling: File operations
11. Create a small project using C++ like Tic-tac-toe, Quiz Game, Hangman





## UHV001: UNIVERSAL HUMAN VALUES

L T P
3 0 0

**Credits: 3**

**Course Description:**
The course aims to equip the students with understanding about the role and importance of human values and ethics in personal, social and professional life.

The course introduces the student to enable students to understand and appreciate ethical concerns relevant to modern lives, to help students develop sensitivity and awareness; leading to Commitment and courage to act on their own belief.

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**CO1:** Analyze the significance of value inputs provided in formal education along with skills and develop a broader perspective about life and education.
**CO2:** Formulate their aspirations and concerns at different levels of living, and the way to fulfill them in a sustainable manner.
**CO3:** Evaluate their current state of understanding and living, and model a healthy lifestyle.
**Co4:** Examine the issues of home sickness, interactions with seniors on the campus, peer pressure with better understanding and feel grateful towards parents, teachers and others.
**CO5:** Develop more confidence and commitment for value-based living in family, society and nature.

**Course Content**

**UNIT I**

**Introduction to value education:** understanding the need, basic guidelines, Concept of Human Values: Meaning and Importance of Values, basic human aspiration, Method to fulfill the basic aspiration- SVDD, SSDD, SSSS, Understanding and living in harmony at various levels.

**UNIT II**

**Right Understanding (Knowing)-** Knower, Known & the Process The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).

**UNIT III**

**Understanding Harmony in the Family:** Relationships, harmony, Emotions and Feelings, understanding harmony in the Family-The basic unit of human interaction, Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between Intention and Competence and other salient values in relationship.
Understanding Harmony in the Society: Comprehensive human goal, Universal human order, Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (SarvabhaumVyawastha)- from family to world family.

**UNIT IV**

**Understanding Harmony in the Society:** Comprehensive human goal, Universal human order, Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (SarvabhaumVyawastha)- from family to world family.

UNIT V

**Understanding Human Being:** Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self.

**Understanding harmony in Nature:** Understanding the harmony in the Nature, Orders in nature, Interconnectedness and mutual fulfillment among the four orders of nature. Ethical living: - Ethical human conduct, Professional Ethics.

**Suggested Readings:**

1. R R Gaur, R Sangal,G P Bagaria, 2009, A Foundation Course in Value Education
2. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books
3. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA.

# Second Year





GNA UNIVERSITY
Inspiring Innovation.....

**BCS 301: DATA STRUCTURE & ALGORITHMS**

**Credits: 3**

L T P
3 0 0

**Course Description:**

The course aims to equip the students with the basic concepts of data structures and algorithms. The course includes concepts about searching and sorting techniques, the basics stacks, queues, lists, trees and graphs, and to enable the students to solve problems with the help of fundamental data structures.

**Course Outcomes (CO):**

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

**CO1:** Analyze the algorithms to determine the time and computation complexity and justify the correctness

**CO2:** Implement linear search and binary search for a given search problem

**CO3:** Determine the time and computation complexity for a given problem of Stacks, Queues and linked lists

**CO4:** Implement Graph search and traversal algorithms and determine the time and computation complexity.

**Course Content**

**UNIT I**

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

**UNIT II**

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

**UNIT III**

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

**UNIT IV**

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms andcomplexity analysis

**Recommended Books / Suggested Readings:**

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.
2. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
3. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education





**BCS 209: BASICS OF PYTHON**

**Credits: 3**

L T P
3 0 0

**Course Description:**

The course aims to equip the students with the basic concepts of Python programming language. The Python programming language which is one of the most popular programming languages worldwide.

The course includes basic concepts of Python, functions, Data Collections and Language Component, Object and Classes, I/O and Error Handling in Python and Applications.

**Course Outcomes (CO):**

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

**CO1:** Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

**CO2:** Demonstrate proficiency in Exceptions, and File Systems.

**CO3:** Interpret the concepts of Object-Oriented Programming as used in Python.

**CO4:** Illustrate uses of conditional and iterative statements in Python programs.

**Course Content**

**UNIT I**

Introduction to Python Language, Strengths and Weaknesses, Installing IDLE, Dynamic Types, Naming Conventions, String Values, String Operations, String Slices, String Operators, Numeric Data Types, Conversions, Built In Functions

**UNIT II**

Data Collections and Language Component: Introduction, Control Flow and Syntax, Indenting, The if Statement, Relational Operators, Logical Operators, Boolean Operators, Bit Wise Operators, The while Loop, break and continue, The for Loop, Lists, Tuples, Sets, Dictionaries, Sorting Dictionaries, Copying Collections

**UNIT III**

Object and Classes: Classes in Python, Principles of Object Orientation, Creating Classes, Instance Method, File Organization, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes

**UNIT IV**

Functions and Modules: Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope, Functions - "First Class Citizens", Passing Functions to a Function,Mapping Functions in a Dictionary, Lambda, Modules, Standard Modules – sys, Standard Modules – math, Standard Modules – time, The dir Function

**UNIT V**

I/O and Error Handling in Python: Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data from a File, Additional File Methods, Using Pipes as Data Streams, Handling IO Exceptions, Working with Directories, Metadata, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions

**UNIT VI**

Applications of Python(Data Science/ Cyber/ Cloud): Importance of learning data analysis in python, Building Predictive Models, Python Data Structures, Python Libraries. Python programming and packages, Installation of Jupyter/PycharmNotebook and Google colab Control Statement, Object oriented programming in Python, Installation of different packages Brief introduction of Packages of Python for different applications. Django: Introduction, Apps, Models and Views and URL Structure

**Reference Book:**

1. Dive into Python, Mike
2. Learning Python, 4th Edition by Mark Lutz
3. Programming Python, 4th Edition by Mark Lutz





## BEE302: DIGITAL CIRCUITS AND LOGICAL DESIGN

L T P
3 0 0

**Credits: 3**

**Course Description:**

The course aims to equip the students with the formal procedures for the analysis and design of combinational and sequential circuits.

**The course includes** introduction to basic postulates of Boolean algebra and shows the correlation between Boolean expressions, introduce the methods for simplifying Boolean expressions and also introduce the concept of memories and programmable logic devices.

**Course Outcomes (CO):**

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

**CO1:** Apply the knowledge of digital number systems, Boolean algebra, and logic gates for logic function minimization.

**CO2:** Analyze different methods used for simplification of Boolean expressions.

**CO3:** Design and implement Combinational and Sequential circuits.

**CO4:** Describe different types of memories and their applications.

**Course Content**

**UNIT I**

**Number Systems and Boolean Algebra:** Number systems, Binary addition and Subtraction, Subtraction using 1's & 2's complements and using 9's &10'scomplements, Binary codes, Error detecting and Correcting codes, Theorems of Boolean algebra, Canonical forms, Logic gates.

**UNIT II**

**Combinational Circuits:** Representation of logic functions, Simplification using Karnaugh map, Tabulation method, Implementation of combinational logic using standard logic gates, Multiplexers and DE multiplexers, Encoders and Decoders, Code Converters, Adders, Subtractors, Parity Checker and Magnitude Comparator

**UNIT III**

**Sequential Circuits:** Flip flops SR, JK, D and T flip flops Level triggering and edge triggering, Excitation tables Counters -Asynchronous and synchronous type modulo counters, design with state equation state diagram, Shift registers, type of registers, circuit diagrams.

**UNIT IV**

**Digital Logic Families:** Introduction to bipolar Logic families: RTL, DCTL, DTL, TTL, ECL and MOS Logic families: NMOS, PMOS, CMOS, Details of TTL logic family -Totempole, open collector outputs, TTL subfamilies, Comparison of different logic families.

**UNIT V**

D/A and A/D Converters: Weighted resistor type D/A Converter, Binary ladder D/A converter, Steady state accuracy test, D/A accuracy and resolution, Parallel A/D Converter, counter type A/Dconverter, Successive approximation A/D converter, Single and Dual slope A/D converter, A/D accuracy and resolution.

**Recommended Books / Suggested Readings:**

1. Wakerly J F, Digital Design: Principles and Practices, Prentice-Hall, 2nd Ed., 20022.

2. D. D. Givone, Digital Principles and Design, Tata Mc-Graw Hill, New Delhi, 2003.
3. S. Brown and Z. Vranesic, Fundamentals of Digital Logic with Verilog Design, Tata Mc-Graw Hill, 2008.





## BTM 302: MATHEMATICS – III (PROBABILITY AND STATISTICS)

L T P
3 0 0

**Credits: 4**

**Pre-Requisites:** NA

**Course Description:**

The course aims to equip the students with the ability to familiarize the students with statistical techniques and to equip them with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

**Course Outcomes (CO):**

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

**CO1:** Understand the ideas of probability and random variables and various discrete and continuous probability distributions and their properties.

**Co2:** Implement the basic ideas of statistics including measures of central tendency, correlation and regression.

**CO3:** Identify the statistical methods of studying data samples.

**Co4:** Apply the basic ideas of statistics including Curve fitting by method of least squares and testing of significance.

**Course Content**

**UNIT I**

**Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, Expectation of Discrete Random Variables, Moments, Variance of a sum

**UNIT II**

**Continuous Probability Distributions:** Continuous random variables and their properties, distribution functions.

**Probability distributions:** Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions

**Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Bayes' rule.

**UNIT III**

**Basic Statistics: Measures of Central tendency:** Moments, skewness and Kurtosis - Correlation and regression – Rank correlation

**UNIT IV**

**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

**Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes

**Text Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968

**Suggested Readings:**

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
3. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.





**DOS001: FOUNDATION COURSE IN HUMANITIES**

**(Development of Societies/Philosophy)**

L T P
3 0 0

**Credits: 3**

**Course Description:**

This course will introduce you to some ofthe main areas of contemporary philosophy. This course will be an introductory overview of several different areas of philosophy.

**Course Content**

**UNIT I**

**Social Development:**

1. Concepts behind the origin of Family, Clan and Society
2. Different Social Systems
3. Relation between Human being and Society
4. Comparative studies on different models of Social Structures and their evolution

**UNIT II**

**Political Development:**

1. Ideas of Political Systems as learnt from History
2. Different models of Governing system and their comparative study

**UNIT III**

**Economic Development:**

1. Birth of Capitalism, Socialism, Marxism
2. Concept of development in pre-British, British and post British period-Barter, Jajmani
3. Idea of development in current context.
4. E. F. Schumacher's idea of development, Buddhist economics. Gandhian idea of development. Swaraj and Decentralization.

## BCS321: DATA STRUCTURE & ALGORITHMS LABORATORY

**Credits: 1**

L T P
0 0 2

**Course Description:**
The course aims to equip the students with the basic concepts of data structures and algorithms.
The course includes the implementation of various searching and sorting technique along with space and time complexity

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**CO1:** Analyze the working of various data structures
**CO2:** Implement linear search and binary search for a given search problem
**CO3:** Implement solutions for the problem of Stacks, Queues and linked lists
**CO4:** Write programs for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity
**CO5:** Implement Graph search and traversal algorithms with the help of programs

**List of Experiments**
**1. Linear Search**
**2. Binary Search**
**3. Stacks**
**4. Queues:** Simple, Circular, Priority
**5. Linked Lists:** Singly linked list, Doubly Linked List, Circular Linked List
**6. Trees:** Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree
**7. Sorting and Hashing:** Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort
**8. Graph:** Graph search and traversal





## BCS 222: PYTHON LABORATORY

**Credits: 1**

L T P
0 0 2

**Course Description:** The Python programming language which is one of the most popular programming languages worldwide. The course shows you how to use the free open-source Python to write basic programs and Python, functions, variables, If Else statements, For loops, While loops, iterative and recursive programs and algorithms such as the Insertion Sort algorithm.

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**CO1:** Apply the principles python programming.
**CO2:** Write clear and effective python code.
**CO3:** Create applications using python programming.
**CO4:** Develop and use Web Services using python.

**List of Experiments**
1. Write python program to print Hello World
2. Write python program to Hello World using string variable
3. Write python program to store data in list and then try to print them.
4. Write python program to do basic trim and slice on string.
5. Write python program to print list of numbers using range and for loop
6. Write python program to store strings in list and then print them.
7. Write python program to let user enter some data in string and then verify data and print welcome to user.
8. Write python program in which a function is defined and calling that function prints Hello World
9. Write python program in which a function (with single string parameter) is defined and calling that function prints the string parameters given to function.
10. Write python program in which a class is define, then create object of that class and call simple print function define in class.

**BTCY301: FUNDAMENTALS OF CYBER AND NETWORK SECURITY** L T P 3 0 0

**Credits: 1**

**Course Description:**

This course provides the foundation for understanding the key issues associated with protecting information assets. The purpose of the course is to provide the student with an overview of the field of information security and assurance

**Course Outcomes (CO):**

This course will develop students 'knowledge in/on...

CO1: Analyze the broad set of technical, social & political aspects of Cyber Security.

CO2: Appreciate the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure.

Co3: Describe the importance of ethical hacking tool.

CO4: Implement the ethical hacking process.

**Contents:**

**UNIT I**

INTRODUCTION TO CYBER SECURITY - Importance and challenges in Cyber Security - Cyberspace- Cyber threats - Cyber warfare - CIA Triad - Cyber Terrorism – Cyber Securityof Critical Infrastructure -Cyber security –Organizational Implications.

**UNIT II**

HACKERS AND CYBERCRIMES: Types of Hackers- Hackers and Crackers, Profile, Malicious Software: Viruses, Worms, System Corruption, Attack Agents, Information Theft, Keyloggers, Phishing, Spyware Payload Stealthing, Backdoors, Rootkits, Distributed Denial of Service Attacks, Bots and Botnets.

**UNIT III**

ETHICAL HACKING AND SOCIAL ENGINEERING: Ethical Hacking Concepts and Scopes - Threats and Attack Vectors - Information Assurance – Threat Modeling-Enterprise Information Security Architecture-Vulnerability Assessment and Penetration, Testing-Types of Social Engineering-Insider Attack- Preventing Insider Threats-SocialEngineering Targets and Defense Strategies.

**UNIT IV**

NETWORK SECURITY: IP Security Overview, IP Security Policy, IPV4, IPV6, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange (IKE), DHCP, NAT, DNS, FQDN, IoT.

**UNIT V**

CRYPTOGRAPHY: Basic of cryptography, including conventional and public-key cryptography, hash functions, authentication, and digital signatures. Key Management and Distribution: SymmetricKey Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure, certificate Authority (CA), SSH and SSL

**Text Books:**

1. Donaldson,S.,Siegel,S.,Williams,C.K.,Aslam,A.,"EnterpriseCybersecurity –How to Build a Successful Cyber defense Program against Advanced Threats", Apress, 1st Edition, 2015.
2. Nina Godbole, Sumit Belapure, "CyberSecurity", Willey, 2011.
3. Roger Grimes,"Hacking the Hacker", Wiley, Ist Edition,2017.
4. Cyber Law By Bare Act, Govt of India, IT Act 2000

**BCS501: COMPUTER NETWORKS** L T P
**Credits: 3** 3 0 0

**Course Description:**
The course aims to equip the students with understanding of modern network architectures from a design and performance perspective.
The course introduces the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs), to provide an opportunity to do network programming, to provide a WLAN measurement idea.

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**CO1:** Discuss the features of computer networks, protocols and network design models.
**CO2:** Select appropriate congestion control techniques and Quality of Service requirements for a network.
**Co3:** Illustrate the functions and protocols of network layer, transport layer and application layer in inter-networking.
**CO4:** Analyze the services and features of various protocol layers in data networks.

**Course Content:**

**UNIT I**

**Data communication Components:** Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

**UNIT II**

**Data Link Layer and Medium Access Sub Layer:** Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

**UNIT III**

**Network Layer:** Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

**UNIT IV**

**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

**UNIT V**

**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

**Suggested Books:**
1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India
3. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition
4. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India
5. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America

## BCS521: COMPUTER NETWORKS LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Objectives:**

1. To develop an understanding of modern network architectures from design and performance perspective
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs)
3. To do network programming
4. To provide a WLAN measurement idea

**Course Outcomes (CO):**

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

**CO1:** Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.

**CO2:** Design for a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) based on the market available component.

**CO3:** Develop network programming for a given problem related to TCP/IP protocol.

**CO4:** Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open-source available software and tools.

**List of Experiments:**

1. Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
2. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc
3. Preparing straight and cross cables.
4. Configuration of TCP/IP Protocols in Windows.
5. Connect two computers with each other and ping in packet Tracer.
6. Connect with other computers in LAN (Configure the IP address and How to Connect with Other Pcs).
7. Distinguish between Hub and Switch using packet Tracer.
8. Configure network Topologies using packet tracer software.
9. Configure a hybrid network (wired and wireless) in packet tracer.
10. Configure a network using Routers, Switches, Access Points to show the functionality of LAN with
12. Configure a Network and verify ARP protocol.
13. Network Commands (ping, trace route, DNS tools, Telnet, IP config, FTP clients).
14. Configure Network using DHCP protocol.
15. Configure an ICMP protocol on Packet Tracer.
16. Configure Network using various Routing protocol like., RIP.
17. Subnet planning and its implementation.
18. Implementation of various LAN protocols and configurations





## BEE322: DIGITAL CIRCUITS AND LOGICAL DESIGN LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:** The course aims to equip the students with practical experience in design, realization and verification of Dorgan's Theorem, SOP, POS forms.

The course includes Full/Parallel Adders, Subtractors and Magnitude Comparator, Multiplexer using logic gates, Demultiplexers and Decoders, Flip-Flops, Shift registers and Counters.

**Course Outcomes (CO):**

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

**Co1:** Demonstrate the truth table of various expressions and combinational circuits using logic gates.

**CO2:** Design, test and evaluate various combinational circuits such as adders, subtractors, comparators, multiplexers and de-multiplexers

**CO3:** Construct flips-flops, counters and shift registers.

**Co4:** Develop a digital logic and apply it to solve real life problems.

**List of Experiments:**

FACULTY OF ENGINEERING, DESIGN AND AUTOMATION

B. TECH COMPUTER SCIENCE AND ENGINEERING (CLOUD COMPUTING)2022-2023

1. Design and verification of the truth tables of Half and Full adder circuits
2. Design and verification of the truth tables of Half and Full subtractor
3. Design and implementation of 4-bit binary Adder/ Subtractor and BCD adder using IC7483
4. Design and implementation of code converters using logic gates

a. BCD to excess-3 code

b. Binary to gray code

5. Verification of the truth table of the Multiplexer using IC 74150
6. Verification of the truth table of the De-Multiplexer using IC 74154
7. Design and test of an SR flip-flop using NOR/NAND gates
8. Verify the truth table of a D flip-flop (7474) and JK flip -flop (7476)
9. Verification of the results of 3-bit synchronous up/down counter
10. Verification of 4-bit ripple counter and Mod -10 / Mod-12 Ripple counters
11. Operate the universal shift register 74194
12. Operate a 7 segment LED display through a counter using a low frequency clock.

**BCS401: OPERATING SYSTEMS** L T P
**Credits: 3** 3 0 0

**Course Description:** The course aims to equip the students with the fundamentals of Operating Systems.
The course includes the mechanisms of OS to handle processes and threads and their communication, mechanisms involved in memory management in contemporary OS, knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**CO1:** Distinguish concepts related to processes, threads, process scheduling, race conditions and critical sections.
**CO2:** Develop techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time for a given specification of memory organization
**CO3:** Design and implement file management system
**CO4:** Illustrate the concepts of process management and process scheduling mechanisms employed in Operating Systems.
**CO5:** Develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

**Course Content:**

**UNIT I**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

**UNIT II**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits ofthreads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

**UNIT III**

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

**UNIT IV**

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

**UNIT V**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set , Dirty page/Dirty bit
– Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

**UNIT VI**

**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms
**File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance
**Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Recommended Books / Suggested Readings:
1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India
3. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
4. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
5. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
6. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

## BTDA301: PYTHON FOR DATA SCIENCE

**Credits: 3**

L T P
3 0 0

**Course Description:** This course teaches students to master the concepts of Python programming. The data acquired by the organization requires insights in order to make decisions, make forecasts, and discover hidden patterns within the data. Python is an ideal language to utilize for data science activities since it has all of the necessary tools and libraries. This course includes overview of Python, with a focus on major Python data structures and libraries such as Pandas, NumPy, and Matplotlib for performing various data science functions such as data preparation, cleaning, exploratory analysis, and visualization.

**Course Outcomes (CO):**

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

**CO1:** Identify the need for data science and solve basic problems using Python built-in data types and their methods.

**CO2:** Design an application with user-defined modules and packages using OOP concept

**CO3:** Apply various Python data structures to effectively manage various types of data.

**CO4:** Use various data visualization tools for effective interpretations and insights of data.

**CO5:** Design applications applying various operations for data cleansing and transformation.

**Course Content:**

**UNIT I**

Introduction to Data Science:

Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types

**UNIT II**

File, Exception Handling and Oops:

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods - Python Exception Handling. OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

**UNIT III**

Introduction To NumPy:

NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing- Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-SortingUnique and Other Set Logic.

**UNIT IV**

Data Manipulation with Pandas:

Introduction to pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping EntriesIndexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format

**UNIT V**

Data cleaning, preparation and visualization:

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

**Reference Books:**

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.
3. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017

## BCS303: COMPUTER ORGANIZATION & ARCHITECTURE

L T P
3 0 0

**Credits: 3**

**Course Description:** The course aims to equip the students with the basic principles of computer architecture. The course includes concepts of Instruction Level Architecture, the art in memory system design and the knowledge of micro programming.

**Course Outcomes (CO):**

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

**CO1:** Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

**CO2:** Write assembly language program for specified microprocessor for computing 16-bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication)

**CO3:** Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.

**CO4:** Design a memory module, given a CPU organization and instruction, and analyze its operation by interfacing with the CPU

**CO5:** Assess performance of a given CPU organization, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology

**Course Content:**

**UNIT I**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs. Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look- ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

**UNIT II**

Introduction to 8085architectures: Introduction to Microprocessors, microcontroller; 8085 Microprocessor Architecture, pin description, Bus concept and organization; concept of multiplexing and de-multiplexing of buses; concept of static and dynamic RAM, type of ROM, memory map.8085 Microprocessor interfacing: 8255 Programmable Peripheral Interface, 8254 programmable interval timer, interfacing of Input/output device, 8279 Key board/Display interface.

**UNIT III**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

**UNIT IV**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

**UNIT V**

Semiconductor Memories: Memory organization, Classification, and characteristics of memories, Sequential memories, ROMs, R/W memories, Content Addressable memories, Charged-Coupled Device memory, PLA, PAL and Gate Array.

**Recommended Books / Suggested Readings:**

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.
3. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
4. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education
5. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education

**BTM402: DISCRETE MATHEMATICS** L T P
**Credits: 4** 3 1 0

**Course Description:** The course aims to equip the students with the ability to construct and understand mathematical proofs. The course includes set theory, relation, function, combinatorics, graph theory, trees.

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**Co1:** Implement the working with mathematical notation and common concepts in discrete mathematics.
**Co2:** Understand the basic concepts in set theory, logic, combinatorics, and graph theory.
**CO3:** Identify the challenges for theoretical Computer Science and its contribution to other sciences.

**Course Content:**

**UNIT I**

**Sets, relations and functions:** Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.
**Relation:** Definition, types of relation, composition of relations, Inverses
**Function:** Definition and types of function, composition of functions, Inverses.

**UNIT II**

**Propositional logics:** Introduction to first order logic and first order theory,Syntax and Semantics, proof systems, satisfability, validity, soundness, completeness, deduction theorem etc.
**Partially ordered sets:** Complete partial ordering, chain, and lattice, complete, distributive, modular and complemented lattices. Boolean lattices.

**UNIT III**

Algebraic Structures: Algebraic structures with one binary operation – semi-group; monoid and group; cosets; Lagrange theorem; normal subgroup; homomorphic sub-group congruence relation and quotient structures, error correcting code; algebraic structures with two binary operations; ring; integral domain and field; Boolean algebra and Boolean ring (Definition and simple examples)

**UNIT IV**

Introduction to Counting: Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.
Introduction to Graphs: Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees- All definitions and simple example.

Recommended Books / Suggested Readings:
1. Liu C.L., Elements of Discrete Mathematics, McGraw Hill Int. edn.
2. Kolman B & Busby C.R., Discrete Mathematical Structure for Computer Science, Prentice Hall of India Ltd.
3. Seymour Lipschutz, M. Lipson, "Discrete Mathematics" Tata Mc Graw Hill, 2005. 4. Deo N., Graph Theory, Prentice Hall of India.
4. Trembley J.P. & Manohar R., Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill.

**BCS402: JAVA PROGRAMMING**

**Credits: 3**

L T P
3 0 0

**Course Description:** The course aims to equip the students with fundamentals of object-oriented programming in Java. The course includes as variables, conditional and iterative execution, methods in JAVA, fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.

**Course Outcomes (CO):**

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

**CO1:** Demonstrate the behavior of programs involving the basic programming constructs like control structures, constructors, string handling and garbage collection.

**CO2**: Use object-oriented programming concepts such as classes, objects, constructors, data hiding, inheritance and polymorphism to solve a given problem.

**CO3:** Implement the inheritance (multilevel, hierarchical and multiple) by using extend and implement keywords.

**CO4:** Illustrate how robust programs can be written in Java.

**CO5:** Write Graphical User Interface based application programs by utilising event handling features and Swing in Java.

**Course Content:**

**UNIT I**

**Introduction:** The Evolution of Java, Object-Oriented Programming Concepts and Java, Two paradigms, Differences between C++ and Java, The Primary Characteristics of Java, The Architecture, Java class libraries, Java Virtual Machine, Data types, Tokens, Literals, Variable and scope, Symbolic Constants, Data type, Type casting, Operators, Wrapper classes, Installation of Java and IDE(Netbeans/Eclipse)

**Control Statements:** Introduction, Control Statements, Sequence Control Statement, Decision Control Statement, Case Control Statement, Iteration Control Statement, Jump in Loops, Labeled Loops.

**UNIT II**

**Arrays:** Introduction, Array, Need Of Array, Types Of Array, One Dimensional Array, Multidimensional Array, Memory representation of Arrays.

**Strings:** Introduction, String Methods, String Buffer.

**Classes:** Introduction, Defining A Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Call By Value And Call By Reference, Recursion, Access Control, Constructors, Method Overloading, Constructor Overloading, Garbage Collection, Finalize( ) Method, This Keyword, Static Members, Nesting Of Methods.

**UNIT III**

**Inheritance:** Inheritance, Types of Inheritance, Using Super, Constructor -Order Of Execution In Inheritance, Overriding Methods, Final Keyword, Abstract Methods and Classes, Visibility Control Interface

**Packages and Interfaces:** Defining, Creating and Accessing a Package, Understanding CLASS PATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces

Exception handling: Exception handling fundamentals, Exception types, Uncaught Exceptions Usingtry and catch, multiple catch clauses, nested try statements throw, finally Java built in exception creating your own exception sub classes, using exceptions

**UNIT IV**

Multithreaded Programming: The Java thread model, the main thread, creating thread, creating multiple thread, using isalive(), yield(), sleep() and join(). Thread priorities, synchronization, inter thread communications, daemon threads, suspending, resuming and stopping threads.

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

**UNIT V**

Applets: Applets basics, Applets HTML tags and attributes, Inter-applet communication

AWT & Swing: Introduction, Components AWT, Introduction to Swing, limitations of AWT, MVC architecture, components, containers, exploring swing-JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons, JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

**Recommended Books / Suggested Readings:**

1. Java 2: The Complete Reference by Tata McGraw Hill
2. Head First Java by Kathy Sierra
3. Core Java-I (Addison Wesley) by Horstmann
4. Thinking in Java by Bruce Eckel
5. Java: How to program by Deitel & Deitel Modern Operating Systems - Andrew S. Tenenbaum, Pearson Education Asia / PHI

## BCS502: DATABASE MANAGEMENT SYSTEMS

L T P
3 0 0

**Credits: 3**

**Course Description:** The course aims to equip the students with understanding of different issues involved in the design and implementation of a database system. The course introduces the student to study the physical and logical database designs, database modeling, relational, hierarchical, and network models ,to understand and use data manipulation language to query, update, and manage a database, to develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing, to design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

**Course Outcomes (CO):**

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

**CO1:** Write relational algebra expressions for that query and optimize the developed expressions.

**CO2:** Design the databases using ER method and normalization.

**CO3:** Construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.

**CO4:** Execute using Query optimization algorithms for a given query optimize

**CO5:** Determine the transaction atomicity, consistency, isolation, and durability in a transaction-processing system.

**CO6:** Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

**Course Content:**

**UNIT I**

**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations.

**UNIT II**

**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

**UNIT III**

**Storage strategies:** Indices, B-trees, hashing.

**UNIT IV**

**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

**UNIT V**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

**UNIT VI**

Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining, No SQL

**Recommended Books / Suggested Readings:**

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press
3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education
4. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

## BCS421: OPERATING SYSTEMS LABORATORY

**Credits: 1**

L T P
0 0 2

**Course Description:** The course aims to equip the students with shell programming and the use of filters in the UNIX environment
The course includes programming in C using system calls, file system related system calls, implementation of CPU Scheduling Algorithms, page replacement algorithms and Deadlock avoidance.

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**CO1:** Implement deadlock avoidance, and Detection Algorithms
**CO2:** Compare the performance of various CPU Scheduling Algorithm
**CO3:** Critically analyze the performance of the various page replacement algorithms

**List of Experiments:**

- Simulate the following cpu scheduling algorithms: a) FCFS b) SJF c) Round Robin d)Priority
- Simulate the file allocation strategies: a) Sequential b) Indexed c) Linked
- Simulate MVT and MFT
- Simulate all File Organization techniques A) Single level directory b)Two level c)Hierarchical d)DAG
- Simulate Bankers Algorithm for Deadlock Avoidance
- Simulate Bankers algorithm for Deadlock Prevention
- Simulate all page replacement Algorithms a)FIFO b) LRU c) LFU
- Simulate Paging Technique of memory management.
- Write a C program to stimulate the following contiguous memory allocation techniques a) Worst-fit b) Best fit c) First fit to simulate the following contiguo us memory
- Write a C program to stimulate the disk scheduling algorithms. a) FCFS b) SCAN c) C-SCAN
- Write a C program to simulate optimal page replacement algorithms
- Write a C program to simulate the concept of Dining-Philosophers problem.





## BCS 522: DATABASE MANAGEMENT SYSTEMS LABORATARY

**Credits: 1**

L T P
0 0 2

**Course Description:** The course aims to equip the students with an understanding of different issues involved in the design and implementation of a database system.

The course introduces the student to study the physical and logical database designs, database modeling, relational, hierarchical, and network models, to understand and use data manipulation language to query, update, and manage a database, to design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:

**CO1:** Write relational algebra expressions for that query and optimize the developed expressions for a given query.
**CO2:** Construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.
**CO3:** Optimize its execution using Query optimization algorithms for a given query.
**CO4:** Execute triggers, cursors, and stored procedures in PL/SQL.

**List of Experiments:**
1. Introduction to SQL and installation of SQL Server / Oracle /DB2
2. Data Types, Creating Tables, Retrieval of Rows using Select Statement, Conditional Retrieval of Rows, Alter and Drop Statements
3. Working with Null Values, matching a Pattern from a Table, Ordering the Result of a Query, Aggregate Functions, Grouping the Result of a Query, Update and Delete Statements
4. Set Operators, Nested Queries, Joins, and Sequences
5. Views, Indexes, Database Security and Privileges: Grant and Revoke Commands, Commit and Rollback Commands
6.PL/SQL Architecture, Assignments and Expressions, Writing PL/SQL Code, Referencing Non-SQL parameters
7. Stored Procedures and Exception Handling. Triggers and Cursor Management in PL/SQL

## BCS422: JAVA PROGRAMMING LABORATORY

**Credits: 1**

L T P
0 0 2

**Course Overview:** A Java Programming lab manual is intended to provide a basic knowledge of java programming for students. To develop software development skills in java programming and Students will have the proficiency to develop projects in java programming. The course helps the students to solve the interdisciplinary applications through java programming.

**Course Outcomes:**

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

**CO1:** Write Java programs using the object oriented concepts - classes, objects, constructors, data hiding, inheritance and polymorphism.

**CO2:** Utilise datatypes, operators, control statements, built in packages & interfaces, Input/ Output Streams and Files in Java to develop programs.

CO3: Design, code and debug various programs in Java Programming Language.

CO4: Write Graphical User Interface based application programs by utilizing event handling features and Swing in Java

**List of Experiments:**

1. Write a Java program that prints all real solutions to the quadratic equation ax2 +bx + c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2 -4ac is negative, display a message stating that there are no real solutions.
2. The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non recursive functions to print the nth value in the Fibonacci sequence.
3. Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer. (use Scanner class to read input)
4. Write a Java program to multiply two given matrices.
5. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util)
6. Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome.
7. Write a Java program for sorting list of names. Read input from command line.
8. Write a Java program to make frequency count of words in a given text.
9. Write a Java programthat implements Quick sort algorithm for sorting a list of names in ascending order
10. Write a Java program to create a Student class with following fields i. Hall ticket number ii. Student Name iii. Department Create 'n' number of Student objects where 'n' value is passed as input to constructor.
11. Write a Java program to demonstrate String comparison using == and equals method.
12. Write a java program to create an abstract class named Shape that contains an empty method named number Of Sides ( ).Provide three classes named Trapezoid, Triangle and Hexagon suchthat each one of the classes extends the class Shape. Each one of the classes contains only the method number Of Sides ( ) that shows the number of sides in the given geometrical figures.
13. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using JTable component.
14. Write a Java program to read copy content of one file to other by handling all file related exceptions.
15. Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
16. Write a Java program that reads a file and displays the file on the screen, with a line number before each line.
17. Write a Java program that displays the number of characters, lines and words in a text file.
18. Write a Java program that creates three threads. First thread displays "Good Morning" everyone second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.
19. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
20. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result.
21. Write a Java program for handling mouse events.
22. Write a Java program for handling key events using Adapter classes
23. Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts.
24. Write a Java program that allows the user to draw lines, rectangles and ovals.
25. Develop simple calculator using Swings.
26. Develop a game e.g. Ball game, Cannon game, Pinball game, tic tac toe, hangman etc.
27. Mini Project

## BTDA311: PYTHON FOR DATA SCIENCE LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:** The course aims to equip the students with fundamentals of Python Programming in Data Science.
This course includes python basics, and different packages and libraries of python used in Data Science.

**Course Outcomes (CO):**

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

**CO1:** Design an application with user-defined modules and packages using OOP concept
**CO2:** Employ efficient storage and data operations using NumPy arrays.
**CO3:** Apply powerful data manipulations using Pandas.
**CO4:** Examine the process for importing and exporting the data.

**List of Experiments:**

1. Implement basic Python programs for reading input from console. Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: Strings, List, Tuples, Dictionary, Set Solve problems using decision and looping statements. Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem. Handle numerical operations using math and random number functions. Create user-defined functions with different types of function arguments.

2. Create packages and import modules from packages. Perform File manipulations- open, close, read, write, append and copy from one file to another. Handle Exceptions using Python Built-in Exceptions. Solve problems using Class declaration and Object creation. 5. Implement OOP concepts like Data hiding and Data Abstraction.

3. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting. Computation on NumPy arrays using Universal Functions and Mathematical methods. Import a CSV file and perform various Statistical and Comparison operations on rows/columns. Load an image file and do crop and flip operation using NumPy Indexing.

4. Create Pandas Series and Data Frame from various inputs. Import any CSV file to Pandas Data Frame and perform the following: (a) Visualize the first and last 10 records (b) Get the shape, index and column details (c) Select/Delete the records(rows)/columns based on conditions. (d) Perform ranking and sorting operations. (e) Do required statistical operations on the given columns. (f) Find the count and uniqueness of the given categorical values. (g) Rename single/multiple columns

5. Import any CSV file to Pandas Data Frame and perform the following: (a) Handle missing data by detecting and dropping/ filling missing values. (b) Transform data using apply () and map() method.
© Detect and filter outliers. (d) Perform Vectorized String operations on Pandas Series. (e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.



## BCS333: COMPUTER ORGANIZATION & ARCHITECTURE LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:**
The course aims to introduce Machine Architecture with coverage of digital logic, machine level data and instruction representation, ALU design, and organization of the processor data path and control. It also examines performance analysis, memory system hierarchy, pipelining, and communication.

**Course Outcomes (CO):**

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

**CO 1:** Implement adder circuits using basic gates.
**CO 2:** Describe the converter circuits using basic gates.
**CO 3:** Design the working of Multiplexer by using IC 74153
**CO 4:** Discuss the various circuits for ALU, data path and control units.

**List of Experiments:**

1. Computer Anatomy- Memory, Ports, Motherboard and add-on cards.
2. Dismantling and assembling PC.
3. Introduction to 8085 kit.
4. Addition of two 8 bit numbers, sum 8 bit.
5. Subtraction of two 8 bit numbers.
6. Find 1's complement of 8-bit number.
7. Find 2's complement of 8-bit number.
8. Shift an 8-bit no. by one bit.
9. Find Largest of two 8 bit numbers.
10. Find Largest among an array of ten numbers (8 bit).
11. Sum of series of 8 bit numbers.
12. Addition and subtraction of two 16 bit numbers, sum 16 bit.
13. Implement of Booth's algorithm for arithmetic operations.
14. Find 1's and 2's complement of 16-bit number.
15. Implement simple programs using I/O based interface.

# Third Year





GNA UNIVERSITY
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**BCS602: SOFTWARE ENGINEERING** LTP 300

**Credits: 3**

**Course Description:** The course aims to equip the students with different basic principles of software engineering and their application on software projects.
This course includes software development life cycle, development models and agile software development, requirement analysis & design, software project management and software quality assurance as well as testing approaches.

**Course Outcomes (CO):**
Upon successful completion of the course, the students should be able to:
**CO1:** Differentiate Traditional and Agile Software Development approaches.
**CO2:** Prepare SRS (Software Requirement Specification) document and Software Design for a given problem.
**CO3:** Use of software project management concepts while planning, estimation, scheduling, tracking and change management of a project with different applications.
**CO4:** Apply various software testing techniques.
**CO5:** Recognize how to ensure the quality of software product, different quality standards and software quality metrics.

**Course Content**

**UNIT I**

Software Engineering: The software problem, Evolution of Software Engineering, Principles of software engineering, Software Development vs. Software Engineering.
Software Process: Software Process, Selection of appropriate process model, Software Process Models- Waterfall, Spiral, Prototyping, Agile Methodology- such as Scrum and XP.

**UNIT II**

Advanced Requirement Analysis & Design: Analysis Principles, SRS, Requirement Elicitation Techniques- FAST and QFD, Design Principles, Design Concepts, Data Design, Architectural Design- Architectural Styles, Procedural Design

**UNIT III**

Software Project Management: The Management Spectrum, Software Project Planning and its characteristics, Types of metrics, Effort Estimation- FP, LOC, FP vs. LOC, Schedule & Cost

Estimation Models- Activity Networks- PERT/CPM, COCOMO-I, COCOMO-II, Risk Assessment- Probability Matrix, Risk Management

**UNIT IV**

Software Testing: Testing Fundamentals- Error/Fault/Failure, Testing Principles, Test Cases, Testing Techniques-White Box & Black Box, Unit Testing, Integration Testing, System Testing, Verification and Validation Testing, Acceptance Testing

**UNIT V**

Software Quality Management: S/W Quality, Importance of S/W Quality, Quality Metrics, Quality Standards- ISO 9126, Change Control, Change Control Process.

Advanced S/W Engineering: CASE Tools, Reverse Engineering, Re-engineering, Web Engineering

**Recommended Books / Suggested Readings:**

1. R.S. Pressman, Software Engineering: A Practitioner's Approach (6th ed.), McGraw- Hill, 2006

2. P. Jalote, An Integrated Approach to Software Engineering (3rd ed.), Narosa Publishing House, 2005

3. Ian Sommerville, Software engineering, Pearson education.





**BCS503: FORMAL LANGUAGE & AUTOMATA THEORY** LTP 300

**Credits: 3**

**Course Description:** The course aims to equip the students with understanding of equivalence of languages accepted by Push down Automata and languages generated by context free grammars

The course introduces the student to develop a formal notation for strings, languages and machines, to design finite automata to accept a set of strings of a language, to prove that a given language is regular and apply the closure properties of languages, to design context free grammars to generate strings from a context free language and convert them into normal forms

**Course Outcomes (CO):**

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

**CO1:** Write a formal notation for strings, languages and machines.

**CO2:** Design finite automata to accept a set of strings of a language.

**CO3:** Determine whether the given language is regular or not for a given language.

**Co4:** Execute the Query optimization algorithms for a given language.

**CO5:** Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars.

**CO6:** Write the hierarchy of formal languages, grammars and machines.

**Course Content**

**UNIT I**

**Introduction:** Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

**UNIT II**

**Regular languages and finite automata:** Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.

**UNIT III**

**Context-free languages and pushdown automata:** Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

**UNIT IV**

**Context-sensitive languages:** Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable

(recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs asenumerators.

**UNIT V**

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

**Recommended Books / Suggested Readings:**

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing
4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.





**BCS504: WEB TECHNOLOGIES**

**Credits: 3**

L T P
3 0 0

**Course Description:** The course aims to make student aware with the basic of web development.

The need for Internet-based apps is growing by the day in this digital age. To immerse learners in the Internet-driven environment and prepare them to design diverse web-based applications. The course includes knowledge of HTML, CSS, XML, AJAX & real time query processing.

**Course Outcomes (CO):**

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

**CO1:** List the various HTML tags and use them to develop the user-friendly web pages.

**CO2:** Create interactive web pages to improve the user experience using client-side scripting with JavaScript.

**CO3:** Apply advanced asynchronous web communication mechanisms like AJAX and jQuery for building highly interactive webpages.

**CO4:** Use server-side scripting with PHP to generate the web pages dynamically using the database connectivity.

**Course Content**

**UNIT I**

**HTML:** Introduction to HTML, formatting text, Lists, adding graphics to HTML page, creating tables, linking documents, frames, DHTML and Style sheets, working with images, maps and forms.

**Introduction to CSS:** Introduction to CSS, Block and Inline Elements, Inline Styles, using internal CSS, using external CSS, How CSS rules cascade, inheritance, why use external style sheets?

**UNIT II**

**Javascript: Introduction, programming constructs:** variables, operators, statements and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, handling events and working with objects, creating and processing forms, using hidden fields and cookies, introduction to Cookies, working with links and images, Introduction to jQuery, jQuery effects, jQuery get, set contents and Atrributes.

**UNIT III**

**XML:** XML syntax rules, XML elements, XML attributes, creating an XML document, using element, declaration and examination, using XML in an HTML document, XML DTD displaying XML with CSS.

**UNIT IV**

**AJAX:** Introduction, HTTP request, XMHttpRequest, AJAX Server Script, AJAX Database.

UNIT V

**PHP and Overview of Node.js and React JS:** Introduction, syntax, statements, operators, Loop string functions, sessions, E-mail, Variables arrays in php with attributes Date & Time, Image uploading file handling in php, PHP and MySQL, PHP and AJAX, introduction to node. js with mongo DB. React JS

Recommended Books / Suggested Readings:


1. HTML in 24 hours by SAMS publications
2. Programming PHP By Kevin Tatroe, Peter MacIntyre, RasmusLerdorf
3. Learning XML By Erik T. Ray
4. Head First Ajax By Rebecca Riordan
5. Head First JavaScript By Michael Morrison Fundamentals of Computer Algorithms, Ellis Horowitz, SatrajSahni and Rajasekharam, Galgotia publications Pvt. Ltd
6. Beginning HTML, XHTML, CSS, and JavaScript By Jon Duckett
7. Php: The Complete Reference By Steven Holzner
8. Professional AJAX by Nicholas C Zakas






**BCS604: COMPUTER GRAPHICS**

**Credits: 3**

L T P
3 0 0

**Course Description:** : The course aims to equip the students with mastering the principles of the art and science of computer graphics

The course introduces the student to become proficient in the design and programming of interactive computer graphics systems and to understand in detail, the operation of a graphics pipeline and each of its components.

**Course Outcomes (CO):**

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

**CO1:** Identify and recognize the basic terminologies and concepts of Computer Graphics.

**CO2:** Understanding Elementary 3D graphics.

**CO3:** Evaluate various Algorithms of 2D Transformations on different type of objects.

**CO4:** Illustrate concepts of windowing and clipping and filling polygons.

**CO5:** Compare different color models, lighting, shading models for creating computer graphics applications.

**Course Content**

UNIT I

**Introduction:** Computer Graphics and its applications, Elements of a Graphics, Graphics Systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Input devices.

UNIT II

Graphics Primitives: Points, lines, circles and ellipses as primitives, scan conversion algorithms for primitives, fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes, area-fill attributes, character attributers.

UNIT III

Two-dimensional Geometric Transformations: Basic Transformations-Translation, Rotation and Scaling, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing transformations.

UNIT IV

Clipping: viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping (cohen-sutherland, liang- bersky, NLN), polygon clipping, text clippng.

UNIT V

Elementary 3D Graphics: Plane projections and its types, Vanishing points, Specification of a 3D view. Visibility: Image and object precision, Hidden edge/surface removal or visible edge/surface determination techniques; z buffer algorithms, Depth sort algorithm, Scan line algorithm and Floating horizon technique. Advance Topics: Introduction of Rendering, Ray

tracing, Antialiasing, Fractals, Gourard and Phong shading, Color Models: Properties of Light, Intuitive Color Concepts, RGB Color Model, CMY Color Model, HLS and HSV Color Models, Conversion between RGB and CMY color Models, Conversion between HSV and RGB color models, Color Selection and Applications.

**Recommended Books / Suggested Readings:**

1. Donald Hearn and M.Pauline Baker, "Computer Graphics", Second Edition, PHI/Pearson Education

2. Zhigandxiang, Roy Plastock, Schaum's outlines, "Computer Graphics Second Edition", Tata Mc- Grawhill edition

3. C, Foley, VanDam, Feiner and Hughes, "Computer Graphics Principles & Practice", Second Edition, Pearson





**Elective:**

**1. BUSINESS INTELLIGENCE AND ANALYTICS**

**2. MACHINE LEARNING**

**3. CLOUD ANALYTICS**

**BTDA501: BUSINESS INTELLIGENCE AND ANALYTICS** L T P 3 0 0

**Credits: 3**

**Course Description:** The course deals with data management solutions implemented in companies and enterprises to collect historical and present data, while using statistics and software to analyze raw information, and deliver insights for making better future decisions.

**Course Outcomes (CO):**

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

CO1: Elaborate the essentials of BI & data analytics and the corresponding terminologies CO2: Analyze the steps involved in the BI - Analytics process

CO3: Illustrate competently on the topic of analytics

CO4: Understand & Implement the K-Means Clustering with Iris Dataset

CO5: Demonstrate the real time scenario (Case study) by using BI & Analytics techniques

**Course Content**

**UNIT I**

**INTRODUCTION TO Business Intelligence:** Introduction - History and Evolution: Effective and Timely decisions, Data Information and Knowledge, Architectural Representation, Role of mathematical Models, Real Time Business Intelligent System

**UNIT II**

**BI – DATA MINING & WAREHOUSING:** Data Mining - Introduction to Data Mining, Architecture of Data Mining and How Data mining works (Process), Functionalities & Classifications of Data Mining, Representation of Input Data, Analysis Methodologies. Data Warehousing - Introduction to Data Warehousing, Data Mart, Online Analytical Processing (OLAP) – Tools, Data Modelling, Difference between OLAP and OLTP, Schema – Star and Snowflake Schemas, ETL Process – Role of ETL

**UNIT III**

**BI – DATA PREPARTTION:** Data Validation - Introduction to Data Validation, Data Transformation – Standardization and Feature Extraction, Data Reduction – Sampling, Selection, PCA, Data Discretization.

**UNIT IV**

**BI – DATA ANALYTICS PROCESS:** ANALYTICS PROCESS - Introduction to analytics process, Types of Analytical Techniques in BI – Descriptive, Predictive, Perspective, Social Media Analytics, Behavioral, Iris Datasets

**UNIT V**

**IMPLEMENTATION OF BI – ANALYTICS PROCESS: Operational Intelligence:** Technological – Business Activity Monitoring, Complex Event Processing, Business Process Management, Metadata, Root Cause Analysis.

**Recommended Books / Suggested Readings:**

1. Cindi Howson, "Successful Business Intelligence", Second Edition, McGraw-Hill Education, 2013.





**BCS744: MACHINE LEARNING**

**Credits: 3**

L T P
3 0 0

**Course Description:** The course aims to equip the students with fundamentals of machine learning. The course includes as types of learning, Clustering Techniques and Deep Learning.

**Course Outcomes (CO):** Upon successful completion of the course, the students should be able to:

**CO1:** Describe the Machine Learning concepts and basic parameter estimation methods.

**CO2:** Demonstrate supervised learning concepts (regression, linear classification).

**CO3:** Illustrate the concepts of Multilayer neural network and Support Vector Machine.

**CO4:** Apply and analyze the various algorithms of supervised and unsupervised learning.

**Course Content**

**UNIT I**

Machine learning paradigms: supervised, semi-supervised, unsupervised, reinforcement learning. Regression: Linear regression with one variable, Linear regression with multiple variables, solution using gradient descent algorithm and matrix method, basic idea of overfitting in regression, Linear Methods for Classification- Logistic regression.

**UNIT II**

Kernel Methods and Support Vector Machines: the Two-Class Problem, Dual Representation, Soft Margin Classification; Origins of Kernel methods, Kernel Mapping, The Kernel Trick; Constructing Kernels, Support Vector Machines: Formulation and Computation; Radial Basis Function Networks; Positive Semi-Definite Kernels, Linear Kernel, Polynomial Kernel.

**UNIT III**

Clustering and Learning Basic Clustering Techniques: Standard k-Means (Lloyd) Algorithm, Generalized Clustering, over partitioning, Merging, Modifications to the k-Means Algorithm, k-Means Wrappers, Rough k Means, Fuzzy k-Means, k-Harmonic Means Algorithm, Hybrid Clustering Algorithms.

**UNIT IV**

Deep Learning Neural network: Perceptron, multilayer network, backpropagation, Introduction to deep neural network: Convolutional Neural Networks, its architecture, convolution layers, pooling layers, fully connected layers, activation functions.

**Recommended Books / Suggested Readings:**

1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008.
2. Christopher Bishop. Pattern Recognition and Machine Learning. 2e.
3. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
4. Introduction to Machine Learning Edition 2, by EthemAlpaydin

**BTDA502: IMAGE ANALYTICS**

L T P
3 0 0

**Credits: 3**

**Course Description:** The course Image analysis involves processing an image into fundamental components to extract meaningful information. Image analysis can include tasks such as finding shapes, detecting edges, removing noise, counting objects, and calculating statistics for texture analysis or image quality.

**Course Outcomes (CO):**

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

**CO1:** Discuss the fundamentals of digital image processing and apply the various techniques for intensity transformations functions. Implement Color image Smoothing and Sharpening.

**CO2:** Illustrate Morphological operation and Apply Some Basic Morphological Algorithms.

**CO3:** Apply image segmentation techniques such as Optimum Global Thresholding using Otsu's Method, Active Contours: Snakes and Level Sets for various real-time applications.

**CO4:** Analysis various Feature Extraction methods and implement for various real-time applications. CO5: Apply and Analysis various Image Pattern Classification methods such as Minimum-Distance Classification, Optimum (Bayes) Statistical Classification, and Deep Convolutional Neural Network.

**Course Content:**

**UNIT I**

**DIGITAL IMAGE FUNDAMENTALS**

Introduction – Fundamental steps in Image Processing Systems – Image Acquisition – Sampling and Quantization – Pixel Relationships – Mathematical Tools Used in Digital Image Processing. Some Basic Intensity Transformation Functions: Image Negatives, Log Transformations, Power-Law Transformations - Histogram Processing. Color Fundamentals - Fundamentals of Spatial Filtering - Smoothing Spatial Filters - Sharpening Spatial Filters.

**UNIT II**

**MORPHOLOGICAL IMAGE PROCESSING**

Morphological Image Processing: Fundamentals - Erosion and Dilation - Opening and Closing – Hit or Miss Transform - Some Basic Morphological Algorithms – Morphological Reconstruction – Grayscale Morphology

**Unit III**

**IMAGE SEGMENTATION**

Introduction - Point, Line, and Edge Detection – Thresholding: Foundation, Basic Global thresholding, Optimum Global Thresholding using Otsu's Method, Multiple Thresholds, Variable Thresholding – Segmentation by Region Growing and by Region Splitting and Merging – Image Segmentation: Active Contours: Snakes and Level Sets

**UNIT IV**

**FEATURE EXTRACTION**

Background - Representation – Boundary Preprocessing – Boundary Feature Descriptors: Some Basic Boundary Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments - Regional Feature Descriptors: Some Basic Descriptors, Topological and Texture Descriptors, Moment Invariants – Principal Components as Feature Descriptors – Whole-image Features Object – Scale-Invariant Feature Transform (SIFT).

**UNIT V**

**IMAGE PATTERN CLASSIFICATION**

Background -Patterns and Pattern Classes – Pattern Classification by Prototype Matching: Minimum Distance Classifier, Using Correlation for 2-D prototype matching, Matching SIFT Features, Matching Structural Prototypes - Optimum (Bayes) Statistical Classifiers - Neural Networks and Deep Learning: Background - The Perceptron - Multilayer Feedforward Neural Networks - Deep Convolutional Neural Networks

**References Books:**

1. Kenneth R. Castleman,Digital Image Processing Pearson, 2006.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", Person Educaiton, 2003

## BCS622: SOFTWARE ENGINEERING LABORATORY

L T P
3 0 0

**Credits: 1**

**Course Description:** The course aims to equip the students with -of-the-art knowledge on Software Engineering and UML in an interactive manner.

The course includes case studies to demonstrate the practical applications of different concepts and provide a scope to the students where they can solve small, real life problems.

**Course Outcomes (CO):**

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

**CO1:** Discuss and Analyses how to develop software requirements specifications for a given problem.

**CO2:** Describe basic concept of UML, design, implementation of test cases.

**CO3:** Develop various structure and behavior UML diagrams.

**Co4:** Build DFD models for different application development.

**List of Experiments:**

1. Identifying the Requirements from Problem Statements
2. Estimation of Project Metrics
3. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
4. E-R Modeling from the Problem Statements
5. Identifying Domain Classes from the Problem Statements
6. State chart and Activity Modeling
7. Modeling UML Class Diagrams and Sequence diagrams
8. Modeling Data Flow Diagrams
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites

## BCS 525: WEB TECHNOLOGIES LABORTARY

L T P
3 0 0

**Credits: 1**

**Course Description:** The course aims to equip the students with understanding and learn to implementation of HTML and to make student understand the basics of scripting using Java Script

The course enables the student to learn about XML, AJAX & real time query processing

**Course Outcomes (CO):**

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

**CO1:** Infer the structure of HTML elements in a webpage.

**CO2:** Build Webpages using HTML and CSS

**CO3:** Utilize JavaScript to add functionality to webpages

**CO4:** Implement different Ajax & JQuery functionalities in Web development.

**List of experiments:**

Students should be made to perform experiments learnt on the concepts of Computer Graphics covering the following list. They may perform more practical's as required to understand the subject.

1. Create web page in HTML to display the usage of formatting tags and lists
2. Create web page in HTML to display the usage of tables and frames
3. Show how to use graphics and links using HTML & CSS
4. Show the usage of image map and linking
5. Create alert, prompt and dialog box using JavaScript
6. Create a form using HTML and CSS. With the help of Javascript add all types of form validations to it
7. Display the usage of Cookies using Javascript
8. Create an XML document
9. Create a form using AJAX
10. Create a formusing HTML, CSS, XML, AJAX and php and store & retrieve its data using MySQL
11. Create your own module in node.js and Program of jQuery selectors.

## BTDA511: BUSINESS INTELLIGENCE AND ANALYTICS LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:** The course aims to equip the students with the practical aspects of multi-tier application development using the .NET framework. The goalof this course is to introduce the students to the basics of distributed application development.

**Course Outcomes:**

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

**CO1:** Develop ASP.NET Web Services, secure web services, and .NET remoting applications

**CO2:** Utilize the .NET framework to build distributed enterprise applications

**CO3:** Describe the development and deployment cycles of enterprise applications.

**CO4:** Develop web application in ASP.NET technology.

**List of experiments:**

1. Write a program for Arithmetic Calculator using Windows Application.
2. Implement Windows Form based application using controls like menus, dialog and tool tip, dropdown, radio and selection button etc.
3. Implement Master Form with Windows application
4. Write a program for events and Delegates.
5. Implement concepts of Inheritance, visual inheritance and Interface in windows application
6. Use Data Controls like Data List, Grid View, Detail View, Repeater and List Bound Control
7. Implement web application using ASP.NET with web controls.
8. Create a Web application that illustrates the use of themes and master pages with Site-Map
9. Create a Web Application in ASP.NET using various CSS.
10. Create the simple to demonstrate the AJAX concept using AJAX toolkit.
11. Write a program to check whether empty query string is entered in Asp .net



## BTCC513: MACHINE LEARNING LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:** This course helps to learn the application of machine learning algorithms in real life examples. It guides the usage of tools that are needed to implement programs capable of learning from data. It introduces Python framework Scikit-Learn that makes a great entry point to learn Machine Learning.

**Course Outcomes (CO):**

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

**CO1:** Design Python programs for various machine learning algorithms.

**CO2:** Implement algorithms for prediction tasks

**CO3:** Analyze the performance of classification algorithms

**CO4:** Demonstrate suitable machine learning algorithms for clustering tasks

**CO5:** Apply appropriate datasets to the Machine Learning algorithms

**List of experiments:**

1. Basics of python and Introduction to Anaconda-Spyder Interface
2. Prepare data for machine learning
3. Demonstrate linear Regression for a prediction task
4. Apply Multiple Linear Regression and evaluate its performance
5. Build a Binary Classifier using Decision Tree Algorithm
6. Use the Tensor Flow library to build and train neural nets
7. Apply k-means algorithm for clustering task
8. Using Agglomerative algorithm generate dendrogram from the given dataset
9. Perform feature selection using Backward Elimination Algorithm
10. Demonstrate Dimensionality Reduction using PCA Algorithm
11. Experiment LDA Algorithm for supervised classification
12. Apply Factor Analysis technique for feature extraction
13. Analyze Performance of classifier using k-fold cross validation technique

## BTDA512: IMAGE ANALYTICS LABORATORY

**Credits: 1**

L T P
0 0 2

**Course Description:** This teaching contributes to develop a correct approach to the image analysis and quantification.It also enables students to deepen their knowledge and abilities in the use of the computer, in the manipulation of the images and in the extraction of quantitative data.

**Course Outcomes:**

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

**CO1:** Use image analysis software, image manipulation programs, and image quantification

**CO2:** Describe the characteristics of the digital image, the principles of morphometry and statistical interpretation.

**CO3:** Demonstrate image analytics in solving practical problems of commercial and scientific interests.

**CO4:** Explore the practical aspects of intelligent perception and understanding of images.

**List of experiments:**

Use Python/ MATLAB

1. Apply various intensity transformations functions.
2. Computing and plotting image histograms and use standard image processing toolbox Spatial filters.
3. Implement color image Smoothing and Sharpening
4. Implement Morphological operations.
5. Implement Morphological Reconstruction.
6. Implement Grayscale Morphology.
7. Implement Optimum Global Thresholding using Otsu's Method.
8. Implement Image segmentation by Region Growing, Splitting and Merging
9. Implement Image Segmentation by Active Contours using anyone method Snakes and Level Sets
10. Implement Boundary Feature Descriptors
11. Implement Topological and Texture Descriptors
12. Implement Scale-Invariant Feature Transform (SIFT)
13. Implement Minimum-Distance Classification Algorithm.
14. Implement Optimum (Bayes) Statistical Classification Algorithm.
15. Implement Deep Convolutional Neural Network.





## BCS624: COMPUTER GRAPHICS LABORATRY

**Credits: 1**

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0 0 2

**Course Description:** The course aims to equip the students with understanding and learn to master the principles of the art and science of computer graphics.

The course enables the student to become proficient in the design and programming of interactive and multimedia systems and to understand in detail, the operation of a graphics pipeline and each of its components

**Course Outcomes (CO):**

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

**CO1:** Apply the various predefined functions for drawing various geometric shapes.

**CO2:** Implement various graphics algorithms for drawing and filling of geometric objects.

**Co3:** Analyze various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.

**CO4:** Compare strengths and weakness of various graphics algorithms.

**List of experiments:**

Students should be made to perform experiments learnt on the concepts of Computer Graphics covering the following list. They may perform more practical's as required to understand the subject.

1. Write a program to plot a point (pixel) on the screen
2. Write a program to draw a straight line using DDA Algorithm
3. Write a program to draw a straight line using Bresenham's Algorithm
4. Write a program to implement mid-point circle generating Algorithm
5. Write a program to implement ellipse generating Algorithm
6. Write a program to translate an object with translation parameters in X and Y directions
7. Write a program to scale an object with scaling factors along X and Y directions
8. Write a program to rotate an object with a certain angle about origin
9. Write a program to perform the rotation of an object with certain angle about an arbitrary point
10. Write a program to perform composite transformations of an object
11. Write a program to perform the reflection of an object about major
12. Write a program to clip line segments against windows using Cohen Sutherland Algorithm
13. Write a program to perform the polygon clipping against windows using Sutherland Hodgeman technique

## INTRODUCTION TO HADOOP

L T P
3 0 0

**Credits: 3**

**Course Description:** The course technologies used to store, manage, and analyze big data in a Hadoop ecosystem.

**Course Outcomes (CO):**

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

**CO1:** Describe the big data technologies used to process and querying the bigdata in Hadoop, MapReduce, PIG.

**CO2:** Use of appropriate components for processing, scheduling and knowledge extraction from large volumes in distributed Hadoop Ecosystem.

**CO3:** Develop a Map Reduce application for optimizing the jobs.

**CO4:** Implement Big Data Activities using Hive.

**Course Content**

**UNIT I**

Introducing Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges, History and overview of Hadoop, Use Case of Hadoop, Hadoop Distributors, Processing Data with Hadoop, Interacting with Hadoop Ecosystem

**UNIT II**

Hadoop Distributed File System (HDFS): The Design of HDFS, HDFS Concepts, Basic Filesystem Operations, Hadoop Filesystems. The Java Interface- Reading Data from a Hadoop URL, Reading Data Using the Filesystem API, Writing Data. Data Flow- Anatomy of a File Read, Anatomy of a File Write, Limitations

**UNIT III**

Map Reduce Framework: Exploring the features of Map Reduce, Working of MapReduce, Exploring Map and Reduce Functions, Techniques to optimize MapReduce jobs, Uses of MapReduce. Controlling MapReduce Execution with Input Format, Reading Data with custom Record Reader, -Reader, Writer, Combiner, Partitioners, MapReduce Phases, Developing simple MapReduce Application.

**UNIT IV**

Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, working with operators in Pig, Working with functions in Pig. Introducing Hive: Getting started with Hive, Hive Services, Data types in Hive, Built-in functions in Hive, Hive DDL.

**Recommended Books / Suggested Readings:**

1. Michael Minelli, Michele Chambers, Ambiga Dhiraj, —Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiley CIO Series, 1st Edition, 2013.

2. Rajiv Sabherwal, Irma Becerra- Fernandez, —Business Intelligence –Practice, Technologies and Management, John Wiley, 1st Edition, 2011.





## BCS601: COMPILER DESIGN

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3 0 0

**Credits: 3**

**Course Description:** The course aims to equip the students with different stages in the process of compilation.

The course includes different methods of lexical analysis, top-down and bottom-up parsers, identify synthesized and inherited attributes, develop syntax directed translation schemes, develop algorithms to generate code for a target machine.

**Course Outcomes (CO):**

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

**CO1:** Discuss how the design of a compiler requires most of the knowledge acquired during their study.

**CO2:** Design top-down and bottom-up parsers for a given parser specification

**CO3:** Apply the ideas, the techniques, and the knowledge acquired for the purpose of other language processor design.

**CO4:** Develop algorithms to generate code for a target machine

**Course Content**

**UNIT I**

**Introduction:** Phases of compilation and overview.

**Lexical Analysis (scanner):** Regular languages, finite automata, regular expressions, from regular expressions to finite automata, scanner generator (lex, flex).

**UNIT II**

**Syntax Analysis (Parser):** Context-free languages and grammars, push-down automata, LL(1) gram- mars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottomup parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

**UNIT III**

**Semantic Analysis:** Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. Symbol Table: Its structure, symbol, attributes and management.

**UNIT IV**

**Runtime Environment:** Procedure activation, parameter passing, value return, memory allocation, and scope.

**Intermediate Code Generation:** Translation of different language features, different types of intermediate forms.

**UNIT V**

Code Improvement (optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc. Architecture dependent codeimprovement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code

generation

Advanced topics: Type systems, data abstraction, compilation of Object-Oriented features and non-imperative programming languages.

**Recommended Books / Suggested Readings:**

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, "Compilers-Principles, Techniques & Tools", Pearson Education

2. Robin Hunter, "Essence of Compilers", Pearson Education

3. Steven S. Muchnick, Advanced Compiler Design & Implementation, Morgan Kaufmann Publishers





**BCS603: DESIGN AND ANALYSIS OF ALGORITHMS**

**Credits: 3**

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3 0 0

**Course Description:** The course aims to equip the students with analyzing the asymptotic performance of algorithms.

The course includes to write rigorous correctness proofs for algorithms, demonstrate a familiarity with major algorithms and data structures, apply important algorithmic design paradigms and methods of analysis and to synthesize efficient algorithms in common engineering design situations

**Course Outcomes (CO):**

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

**Co1:** Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms

**CO2:** Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms

**CO3:** Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation

**CO4:** Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming

**CO5:** Develop the dynamic programming algorithms, and analyze it to determine its computational complexity

**CO6:** Model engineering problem for a given model using graph and write the corresponding algorithm to solve the problems

**Course Content**

**UNIT I**

**Introduction:** Characteristics of algorithm.

**Analysis of algorithm:** Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

**UNIT II**

**Fundamental Algorithmic Strategies:** Brute-Force, Greedy,Dynamic Programming, Branchand- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

**UNIT III**

**Graph and Tree Algorithms:** Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree,

Topological sorting, Network Flow Algorithm.

**UNIT IV**

**Tractable and Intractable Problems:** Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

**UNIT V**

**Advanced Topics:** Approximation algorithms, Randomized algorithms, Class of problems beyond NP
– P SPACE

**Recommended Books / Suggested Readings:**


1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill
2. Fundamentals of Algorithms – E. Horowitz et al
3. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson
4. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley
5. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA






**BTDA601: DATA VISUALIZATION AND HANDLING**

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3 0 0

**Credits: 3**

**Course Description:**

The course aims to equip the students with visualizing and handling data using R programming.

**Course Outcomes (CO):**

1. Interpret basics of Data Visualization
2. Implement visualization of distributions
3. Write programs on visualization of time series, proportions & associations
4. Apply visualization on Trends and uncertainty
5. Explain principles of proportions

**Course Content**

**UNIT I**

INTRODUCTION TO VISUALIZATION: Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values ,Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x–y relationships, Geospatial Data

**Unit II**

VISUALIZING DISTRIBUTIONS: Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing MultipleDistributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, QuantileQuantile Plots, Visualizing Many Distributions at Once- Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

**Unit III**

VISUALIZING ASSOCIATIONS & TIME SERIES: Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variable

**Unit IV**

VISUALIZING UNCERTIANITY: Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plot

PRINCIPLE OF PROPORTIONAL INK: The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information ,Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

**Text Books**

Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization,O'Reilly ,2016

Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems,Apress, 2018



**ELECTIVE- II**

**1. STATISTICAL INFERENCE FOR DATA SCIENCE**

**2. BLOCKCHAIN TECHNOLOGY**

**3.INFORMATION SECURITY**

**4. STREAM PROCESSING AND ANALYTICS**

## BTDA602: STATISTICAL INFERENCE FOR DATA SCIENCE

**Credits: 3**

**Course Description:** In this course, Students will learn how to define and construct good estimators, method of moments estimation, maximum likelihood estimation, and methods of constructing confidence intervals that will extend to more general settings.

**Course Outcomes (CO):**

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

**CO1:** Perform exploratory analysis on the datasets

**CO2:** Describe the various distribution and sampling

**CO3:** Perform Hypothesis Testing on datasets

**CO4:** Apply statistical inference for Regression

**CO5:** Apply statistical inference for Classification

**Course Content**

**UNIT I**

EXPLORATORY ANALYSIS: Elements of Structured, Estimates of Location - Mean, Median, Mode, Outliers, Estimates of Variability- Standard Deviation, Z-Score, Frequency Table and Histograms, Correlation

**Unit II**

DATA SAMPLING AND DISTRIBUTION: Normalization, Sampling Data-Simple Random sampling, Stratified, Cluster Sampling, Sampling Error/Bias. Bootstrapping, Central Limit Theorem, Confidence intervals, Normal distribution, Binomial distribution, Poisson distribution

**Unit III**

REGRESSION AND PREDICTION: Simple Linear Regression, Multiple Linear Regression, Confidence and Prediction Intervals, Categorical Variables, Multicollinearity, Polynomial Regression

CLASSIFICATION: Naive Bayes, Discriminant Analysis, Logistic Regression, Evaluating Classification Models, Strategies for Imbalanced Data

HYPOTHESIS: A/B Testing, Hypothesis Tests- null, one-way, two-way, P-value, Type 1 & 2 errors,

t-tests, multiple testing, degrees of freedom, ANOVA, Chi-Square Tests, Power and Sample Size

**Recommended Books / Suggested Readings:**

1. Dodge, Yadolah, ed. Statistical data analysis and inference. Elsevier, 2014.
2. Ismay, Chester, and Albert Y. Kim. Statistical Inference via Data Science: A Modern Dive into R and the Tidyverse. CRC Press, 2019.





## BTCC602: BLOCKCHAIN TECHNOLOGY

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3 0 0

**Credits: 3**

**Course Description:** Decentralized blockchain-based systems, such as Bitcoin and Ethereum, are successful beyond all expectations. Although still in their infancy, they promise to revolutionize how we think of financial, information, and other infrastructures. This course covers the technical aspects of public distributed ledgers, blockchain systems, cryptocurrencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and build secure distributed applications.

**Course Outcomes (CO):**

1. Explain design principles of Bitcoin and Ethereum.
2. Explain Nakamoto consensus.
3. Explain the Simplified Payment Verification protocol.
4. List and describe differences between proof-of-work and proof-of-stake consensus.
5. Interact with a blockchain system by sending and reading transactions.
6. Design, build, and deploya distributed application.
7. Evaluate security, privacy, and efficiency of a given blockchain system.

**Course Content**

### UNIT I

**Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

### UNIT II

**Blockchain:** Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

### UNIT III

**Distributed Consensus:** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

### UNIT IV

**Cryptocurrency:** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

### UNIT V

**Cryptocurrency Regulation:** Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

**Suggested Books:**

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts





**BTCC603: INFORMATION SECURITY**

**Credits: 3**

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3 0 0

**Course Description:**

Information security is of critical importance in this generation of digital communication using telephone lines and computer networks. The objective of this laboratory is to provide students research opportunity on data transmission security and data recovery. Simultaneously, complexities associated with threat to security on data transmission are also studied.

**Course Outcomes (CO):**

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

**CO1:** Describe the importance of information security awareness for data protection and attacks in system security.

**CO2:** Identify information system requirements for both of them such as client and server.

**CO3:** Apply knowledge of security threats to computer systems, and perform countermeasures to secure a computer.

**CO4:** Apply various tools and techniques to secure mobile devices, email, and web browser.

**Course Content**

**UNIT I**

**Attacks on Computers and Computer Security:** Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography: Concepts and Techniques: Introduction, 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**

**Symmetric key Ciphers:** Block Cipher principles &Algorithms(DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4,Location and placement of encryption function, Key distribution Asymmetric key Ciphers: Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman, ECC), Key Distribution.

**UNIT III**

**Message Authentication Algorithms and Hash Functions:** Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm Authentication Applications: Kerberos, X.509 Authentication Service, Public — Key Infrastructure, Biometric Authentication

**UNIT IV**

**E-Mail Security:** Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security

architecture, Authentication Header, Encapsulating security payload, Combining security associations, key management

**UNIT V**

**Web Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions,
Cross site Scripting Vulnerability, Virtual Elections.

**Suggested Books:**

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, Ist Edition.
2. Cryptography and Network Security :Forouzan Mukhopadhyay, Mc Graw Hill, 2"d Edition
3. Information Security, Principles and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Sceurity: WM.Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGELearning
6. Network Security and Cryptography: Bernard Menezes, CENGAGELearning





**BTDA603: STREAM PROCESSING AND ANALYTICS** L T P 3 0 0

**Credits: 3**

**Course Description:** This course covers how to build streaming data pipelines on Google Cloud. Pub/Sub is described for handling incoming streaming data. The course also covers how to apply aggregations and transformations to streaming data using Dataflow, and how to store processed records to Big Query or Cloud Bigtable for analysis. Learners will get hands-on experience building streaming data pipeline components on Google Cloud using Qwik Labs.

**Course Outcomes (CO):**

Upon completion of this course, students will be able to:

**CO1:** Explain the need for stream processing
**CO2:** Comprehend the architectures of stream processing
**CO3:** Describe Distributed Processing and Resilience Model
**CO4:** Design effective streaming solutions using Spark Streaming

**Course Content**

**UNIT — I**

INTRODUCTION TO STREAM PROCESSING MODEL: Fundamentals of Stream Processing: What Is Stream Processing? Examples of Stream Processing- Scaling Up Data Processing-DistributedStream Processing- Introducing Apache Spark. Stream-Processing Model: Sources and Sinks- Immutable Streams Defined from One AnotherTransformations and Aggregations-Window Aggregations - Stateless and Stateful Processing- The Effect of Time.

**UNIT — II**

STREAMING ARCHITECTURES: Components of a Data Platform- Architectural Models- The Use of a Batch-Processing Component in a Streaming Application- Referential Streaming Architectures- Streaming Versus Batch Algorithms. Apache Spark as a Stream-Processing Engine: Spark's Memory Usage- Understanding Latency- ThroughputOriented Processing-Fast Implementation of Data Analysis.

**UNIT — III**

DISTRIBUTED PROCESSING AND RESILIENCE MODEL: Spark's Distributed Processing Model: Running Apache Spark with a Cluster Manager- Spark's Own Cluster Manager - Resilience and Fault Tolerance in a Distributed System- Data Delivery Semantics- Microbatching and One-Element-at-a-Time - Bringing Microbatch and One-Record-at a- Time Closer Together-Dynamic Batch Interval- Structured Streaming Processing Model. Spark's Resilience Model: Resilient Distributed Datasets in Spark - Spark Components - Spark's Fault-Tolerance Guarantees.

**UNIT — IV**

STRUCTURED STREAMING: Introducing Structured Streaming- The Structured Streaming Programming Model – Structured Streaming in Action – Structured Streaming Sources – Structured Streaming Sinks - Event Time– Based Stream Processing.

**UNIT — V**

Linux Hacking : Linux Vulnerabilities, Scanning Tools, Scanning Tools, Linux Security Tools, Advanced Intrusion Detection System, Linux Security Auditing Tool; Evading Firewalls, Intrusion Detection Systems, Intrusion Detection Tools, Penetration Testing – Penetration Test vs Vulnerability Test, Reliance on Checklists and Templates, Phases of Penetration Testing, Risk Analysis, Active Reconnaissance.

**Suggested Books:**

1. Henrique C. M. Andrade, Buğra Gedik and Deepak S. Turaga, "Fundamentals of Stream Processing: Application Design, Systems, and Analytics", Cambridge University Press, 2014.
2. Bryon Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, 1st edition, 2014.
3. Anindita Basak, Krishna Venkataraman, Ryan Murphy, Manpreet Singh, "Stream Analytics with Microsoft Azure", Packt Publishing, December 2017.



**ELECTIVE-III**

**1.DATAWARE HOUSING AND MINING**

**2.SAS PROGRAMMING**

**3.SIMULATION AND MODELING**

**4.IOT CLOUD AND DATA ANALYTICS**

**BTCC604: DATAWARE HOUSING AND MINING**

**Credits: 3**

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3 0 0

**Course Description:** This course gives an introduction to methods and theory for development of data warehouses and data analysis using data mining. Data quality and methods and techniques for preprocessing of data. Modeling and design of data warehouses. Algorithms for classification, clustering and association rule analysis.

**Course Outcomes (CO):**

Students will be able to:

1. Describe the functionality of data warehousing component and working of online analytical processing
2. Analyse data pre-processing and generate frequent patterns from a given data set.
3. Identify standard classification algorithms and assess the quality of classification models.
4. Demonstrate basic clustering models and perform outlier analysis
5. Apply data mining on real time applications and infer the outcomes.
6. Choose the appropriate tools for performing Data mining for a given data set and infer the findings.

**Course Content**

**UNIT I**

**DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING:** Basic of Data Warehouse - Data Warehouse Modeling: Data Cube and OLAP - Data Warehouse Implementation - Data Generalization by Attribute-Oriented Induction - Data Cube Computation - Data Cube Computation Methods - Processing Advanced Kinds of Queries by Exploring Cube Technology - Multidimensional Data Analysis in Cube Space

**UNIT II**

**INTRODUCTION, DATA PREPROESSING AND MINING FREQUENT PATTERNS AND ASSOCIATON:** Introduction to data mining – kinds of data – Kinds of patterns to be mined – Technologies – applications – issues in mining – Data objects and attribute types – statistical distribution of data – data visualization – Measuring Data similarity and dissimilarity – Need for preprocessing – Data cleaning – Data Integration – Data reduction - Data Transformation and Data Discretization - Frequent Item sets, Closed Item sets, and Association Rules - Frequent Itemset Mining Methods.

## UNIT III

**CLASSIFICATION:** Basics – Decision tree Induction – Baye's Classification - Rule-Based Classification - Model Evaluation and Selection - Techniques to Improve Classification Accuracy - Bayesian Belief Networks - Classification by Backpropagation - Support Vector Machines - Classification Using Frequent Patterns - Lazy Learners (or Learning from Your Neighbors) - Other Classification Methods.

## UNIT IV

CLUSTERING: Basics - Partitioning Methods - Hierarchical Method - Density-Based Methods - Grid- Based Methods - Evaluation of Clustering - Clustering with Constraints - Outliers and Outlier Analysis

- Outlier Detection Methods - Statistical Approaches - Proximity-Based Approaches - Clustering- Based Approaches.

## UNIT V

DATA MINING TRENDS AND RESEARCH FRONTIERS: Mining Complex Data Types - Other Methodologies - Data Mining Applications - Data Mining and Society – Data Mining Trends – Real world applications – Data Mining Tool study.

**Suggested Books:**

1. Alex Berson and Stephen J. Smith. "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill, 2016.
2. Pieter Adrians, Dolf Zantinge. "Data Mining", Addison Wesley, 2000.





## BTDA604: SAS PROGRAMMING

L T P
3 0 0

**Credits: 3**

**Pre requisites:** None

**Course Description:**

This course is for users who want to learn how to write SAS programs to access, explore, prepare, and analyze data. It is the entry point to learning SAS programming for data science, machine learning, and artificial intelligence

**Course Objectives (CO):**

Upon successful completion of this course students should be able to:

**CO1:** Use various components of an INPUT statement to process raw data files in SAS.

**CO2:**Remember how to Create and Manipulate the temporary and permanent data sets contents from the data set values.

**CO3:** Perform data processing using conditional processing & iterative processing and looping.

**CO4:** Use SAS functions to manipulate character data, numeric data, arrays and SAS date values

**CO5:**Apply the SAS Output Delivery System to prepare detailed reports and Generate summary.

**Course Content**

## UNIT I

**INTRODUCTION TO SAS & DATA STEP PROCESSING:** What is SAS – Writing Your First SAS Program - Reading Raw Data from External Files – Introduction - Reading Data Values Separated by Blanks - Specifying Missing Values with List Input - Reading Data Values Separated by Commas from CSV files -Using an alternative Method to Specify an External File - Reading Data Values Separated by Delimiters Other Than Blanks or Commas - Specifying INFILE Options with the DATALINES Statement - Reading Raw Data from Fixed Columns—Method 1: Column Input - Reading Raw Data from Fixed Columns—Method 2: Formatted Input - Using a FORMAT Statement in a DATA Step versus in a Procedure - Using Informats with List Input.

## UNIT II

**SAS DATA SETS, LABELS AND FORMATS:** Creating Permanent SAS Data Sets - SAS Libraries—The LIBNAME Statement - Why Create Permanent SAS Data Sets? -Examining the Descriptor Portion of a SAS Data Set Using PROC CONTENTS - Listing All the SAS Data Sets in a SAS Library Using PROC CONTENTS - Viewing the Data Portion of a SAS Data Set Using PROC PRINT - Using a SAS Data Set as Input to a DATA Step -Creating Labels and Formats - Reading and Writing Data from anExcel Spreadsheet.

UNIT III

**PERFORMING CONDITIONAL PROCESSING & ITERATIVE PROCESSING: LOOPING:**

Introduction - Performing Conditional Processing - If-else, if-else with do statement, Select When - Performing Iterative Processing: Looping – Do-loop Statement - Managing SAS Dataset using set statement - Working with Dates -How SAS Stores Dates - Reading Date Values from Text Data - Demonstrating a Date Constant - Computing the Current Date - Extracting the Day of the Week, Day of the Month, Month, and Year from a SAS Date.

UNIT IV

SAS FUNCTIONS: Working with Character Functions - Numeric Functions - Combining data set-one to one reading, concatenation and merge - Array-single and multi-dimensional array

UNIT V

PRESENTING AND SUMMARIZING THE DATA: Descriptive statistics-Proc means and proc freq - Proc report-column, define, headline, head skip, compute, order and group - Proc tabulate, Proc - Proc printto, proc import and proc export - Introducing the Output Delivery System

**Suggested Books:**

1. Geoff Der , Brian S. Everitt, " Geoff Der , Brian S. Everitt, " A Handbook of Statistical Analyses using SAS ", 5th Edition, October 2012, SAS Institute.

2. Geoff Der , Brian S. Everitt, " A Handbook of Statistical Analyses using SAS ", 2nd Edition, Library of Congress Cataloging-in-Publication Data,2002





**BTCY606: SIMULATION AND MODELLING**

**Credits: 3**

L T P
3 0 0

**Course Description:** Fundamentals and techniques for designing and using simulation, modeling, and optimization algorithms with applications in system performance modeling, business infrastructure modeling, and distributed and parallel computing. An introduction to advanced complex systems models.

**Course Outcomes (CO):**

Upon successful completion of this course students should be able to:

**CO1:** Understand computer simulation technologies and techniques, provides the foundations for the student to understand computer simulation needs.

**CO2:** Implement and test a variety of simulation and data analysis libraries and programs.

**CO3:** Build simulation software environments, and not just building simulations using pre-existing packages.

**Co4:** Describe concepts of modelling layers of society's critical infrastructure networks.

**Course Content**

UNIT I

**Introduction to Simulation:** System and System Environment, Components of System, Discrete and Continuous System, System Simulation, Model of a System, Types of Model, Use of Differential and Partial differential equations in Modelling, Advantages, Disadvantages and Limitations of Simulation, Application Areas, Phases in Simulation Study

**Simulation of Continuous and Discrete System:** Continuous System Models, Analog Computer, Analog Methods, Hybrid Simulation, Digital-Analog Simulators, Feedback Systems Discrete Event Simulation, Representation of time, Simulation Clock and Time Management, Models of Arrival Processes - Poisson Processes, Non-stationary Poisson Processes, Batch Arrivals; Gathering statistics, Probability and Monte Carlo Simulation

UNIT II

**Queuing System:** Characteristics and Structure of Basic Queuing System, Models of Queuing System, Queuingnotation, Single server and Multiple server Queueing Systems, Measurement of Queueing System Performance, Elementary idea about networks of Queuing with particular emphasis to computersystem, Applications of queuing system

Markov Chains: Features, Process Examples, Applications

**Random Numbers:** Random Numbers and its properties, Pseudo Random Numbers, Methods of generation of RandomNumber, Tests for Randomness - Uniformity and independence, Random Variate Generation

### UNIT III

**Verification and Validation:** Design of Simulation Models, Verification of Simulation Models, Calibration and Validation of themodels, Three-Step Approach for Validation of Simulation Models, Accreditation of Models.

**Analysis of Simulation Output:** Confidence Intervals and Hypothesis Testing, Estimation Methods, Simulation run statistics,Replication of runs, Elimination of initial bias

Simulation of Computer Systems: Simulation Tools, Simulation Languages: GPSS, Case Studies of different types of SimulationModels and Construction of sample mathematical models

**Recommended Books / Suggested Readings:**

1. Laszlo, Computational Geometry, PHI
2. M.de Berg, Computational Geometry-algorithms &applications,Springer India





## BTDA605: IOT CLOUD AND DATA ANALYTICS

L T P
0 0 2

**Credits: 3**

**Course Description:** This course takes students through the architecture of an IoT network, covering sensors, devices and analysis. It includes instruction on concepts such as device communication, streaming data processing, and scalability. The instructors use simulated devices to show the cloud side of internet of things projects

**Course Outcomes (CO):**

CO1: Demonstrate the working of IoT
CO2: Identify the need of cloud computing for IOT.
CO3: Apply Machine Learning Algorithms for IoT data
CO4: Predict and visualize output using Data Analytic tools
CO5: Identify the Vulnerability in connected networks

**Course Content:**

### Unit I

Introduction to Amazon EMR: Introduction to Amazon EMR. Common EMR Applications, Deployment Options, Implementation

### Unit II

IoT and CLOUD: Cloud computing – Cloud service models – Cloud Deployment models – Need of cloud computing for IoT-Fog computing Vs Cloud Computing for IoT-IoT Cloud Platforms – Microsoft Azure IoT-Amazon Web Services IoT-IBM WATSON IoT-Google's cloud IoT.

### Unit III

IOT AND MACHINE LEARNING: Principles and foundation of Artificial intelligence and IoT – Machine Learning Paradigms for IoT – Supervised learning for IoT-Linear Regression-Logistic regression-SVM – Decision Tree -Naive's bayes,Deep Learning for IoT-Neural Network.

### Unit IV

DATA ANALYTICS FOR IoT: Defining IoT Analytics - IoT Analytics challenges – IoT analytics for the cloud-Microsoft Azure overview– Designing data processing for analytics – Designing visual analysis for IoT data-Data science for IoT-Feature engineering with IoT data.

### Unit V

IoT SECURITY: Overview of IoT Security- security Threats in IoT- APIs in IoT-Authentication in IoT-Strategies for securing IoT-Public Key Cryptography.

**Reference Books:**

1. Rajkumar Buyya, Amir Vahid Dastjerdi," Internet of Things: Principles and Paradigms", Elsevier,2016.
2. R. Chandrasekaran," Essentials of Cloud computing", 2nd Edition, Chapman and Hall/CRC, 2015.
3. Amita Kapoor, "Hands on Artificial intelligence for IoT", 1 st Edition, Packt Publishing, 2019.
4. David Etter," IoT Security: Practical Guide Book", CreateSpace Independent Publishing Platform,
2016.





## BCS621: COMPILER DESIGN LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:** The course aims to equip the students with basic compiler functioning. The course includes different methods of lexical analysis, design top-down and bottom-up parsers, develop syntax directed translation schemes and develop algorithms to generate code for a target machine

**Course Outcomes (CLO):**

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

**CO1:** Develop lexical analyser for a given grammar specification

**CO2:** Design top-down and bottom-up parsers for a given parser specification

**CO3:** Develop syntax directed translation schemes

**CO4:** Apply algorithms to generate code for a target machine

**List of Experiments:**

1. C Program to Design Lexical Analyzer
2. Understanding the LEX/FLEX tool. Implementation of Lexical Analyzer using LEX/FLEX Tool.
3. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Predictive Parser in C language.
4. Understanding the YACC tool.
5. Generate YACC specification for a few syntactic categories.

a. Program to recognize a valid arithmetic expression that uses operator +, –, * and /.

b. Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.

c. Implementation of Calculator using LEX/FLEX and YACC

6. Convert the BNF rules into YACC form and write code to generate Abstract Syntax Tree.
7. Implement type checking.
8. Implement control flow analysis and Data flow Analysis.
9. Implement any one storage allocation strategies (Heap, Stack, Static)
10. Construction of DAG
11. Implement the back end of the compiler which takes the three-address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler. The target assembly instructions can be simple move, add, sub, jump. Also simple addressing modes are used.
12. A Program to Generate Machine Code.
13. Implementation of Simple Code Optimization Techniques.
14. Design of a mini compiler for simple programs.

## BCS623: DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:** The course aims to equip the students with the implementation of various algorithms.

The course includes solving problems using divide and conquer strategy, backtracking strategy and greedy and dynamic programming techniques.

**Course Outcomes (CO):**

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

**CO1:** Design algorithms using divide and conquer, greedy and dynamic programming.

**CO2:** Use the design techniques such as dynamic programming, greedy algorithm for more complex problems.

**CO3:** Analyze the performance of merge sort algorithms using divide and conquer technique.

**CO4:** Apply the dynamic programming technique to solve real world problems such as knapsack and TSP.

**List of Experiments:**

1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using OpenMP, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. Obtain the Topological ordering of vertices in a given digraph.
4. Compute the transitive closure of a given directed graph using Warshall's algorithm.
5. Implement 0/1 Knapsack problem using Dynamic Programming.
6. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
7. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
8. Print all the nodes reachable from a given starting node in a digraph using BFS method.
9. Check whether a given graph is connected or not using DFS method.
10. Find a subset of a given set S = {sl, s2, ,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S={1, 2, 5, 6, 8} and d = 9 there are two solutions{1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
11. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
12. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
13. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using OpenMP and determine the speed-up achieved.
14. Implement N Queen's problem using Back Tracking.

## ELECTIVE -III LABORATORY

L T P
3 0 0

## BTDA611: DATA MINING TOOLS LABORATORY

**Credits: 1**

**Course Description:** The course aims to equip the students with the implementation of various data mining tools.

**Course Outcomes (CLO):**

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

1. Apply data mining tools for various phases of data mining.
2. Implement the classification techniques with different algorithms.
3. Demonstrate and apply clustering techniques with different algorithms.
4. Apply association rule for mining.
5. Design a single and multi-layer neural network.

**Lab Exercises:**

1. Demonstration of pre-processing on dataset car.arff
2. Demonstration of pre-processing on dataset diabetes diagnosis
3. Demonstration of classification rules process on dataset using ID3 and J48 algorithm.
4. Implement the classification rules process on car dataset using Naïve Baye's algorithm in Weka explorer. Demonstration of classification rule process on dataset using simple K-means algorithm in weka explorer. Build a Neural Network model to process Diabetic diagnosis dataset.
5. Demonstration of classification on dataset diabetic diagnosis and car using decision table algorithm in weka explorer.
6. Demonstration of association rule using dataset diabetic diagnosis using apriori algorithm in weka explorer. Demonstration of classification on dataset diabetic and car in Matlab.
7. Demonstration of clustering on dataset diabetic and car in Matlab.



## BTDA612: SAS PROGRAMMINGLABORATORY

L T P
0 0 2

**Credits: 2**

**Course Description:** The course aims to equip the students with the implementation of various algorithms.The course includes solving problems using divide and conquer strategy, backtracking strategy and greedy and dynamic programming techniques.

**Course Outcomes (CLO):**

1. Use SAS functions to manipulate character data, numeric data, arrays and SAS date values
2. Apply the SAS Output Delivery System to prepare detailed reports and Generate summary.

**List of experiments:**

1. Installation of SAS software.
2. Write a Simple Program to Read Raw Data and Produce a Report.
3. A distributor of athletic shoes is putting all its shoes on sale at 20 to 30% off the regular price. The distributor has two data files, one with information about each type of shoe and one with the discount factors. The first file contains one record for each shoe with values for style, type of exercise (running, walking, or cross-training), and regular price. The second file contains one record for each type of exercise and its discount. Find the sale price, and combines the two data files
4. Use a DATA step to create a SAS data set from an existing SAS data set.
5. Write a Simple Program to perform PROC PRINT using a SAS Data Set as Input to a DATA Step.
6. Using the SAS Output Delivery System to Convert a SAS Data Set to an Excel Spreadsheet.
7. Listing All the SAS Data Sets in a SAS Library Using PROC CONTENTS
8. Perform the various conditional processing statements.
9. Perform the various Looping operations.
10. Create SAS date values by using the functions MDY, TODAY, DATE, and TIME. Extract the month, year, and interval from a SAS date value by using the functions YEAR, QTR, MONTH, and DAY.
11. Merging Two Data Sets with Different BY Variable Names and variable Data type.

## BTCY619: SIMULATION AND MODELLING LABORATORY

L T P
3 0 0

**Credits: 1**

**Course Description:** The syllabus consists of introduction to system, modeling and simulationof different types of systems. It includes the modelling of systems, its validation, verification and analysis of simulation output. It comprises the concept of queuing theory, random number generation as well as study of some simulation languages.

**Course Outcomes (CO):**

**CO1:** Describe the concept of simulation and modelling of real time systems.

**CO2:** Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.

**CO3:** Develop skills to apply simulation software to construct and execute goal-driven system models.

**Co4:** Interpret the model and apply the results to resolve critical issues in a real world environment.

**Lab Exercises:**

1. Implement different methods of random number generation
2. Simulating games of dice that generate discrete random variate, using random number generation
3. Testing of random numbers (K-S and Chi Square Test)
4. Implementing applications of Monte Carlo methods
5. Implement applications of Markov's chain
6. Simulation of single queue server system
7. GPSS models - queue, storage, facility, multi-server queue, decision making problems

## BTDA613: IOT CLOUD AND DATA ANALYTICS LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:** The course aims to equip the students to design and develop IOT based applications using cloud concepts

**Course Outcomes (CLO):**

CO1: Describe what IoT is and how it works with cloud?

CO2: Recognize the factors that contributed to the emergence of IoT & Cloud.

**Lab Exercises:**

1. Study of IoT simulators.
2. Simulate data collection using IoT simulators (IOTIFY/NETSIM)
3. Study of Hardware platforms Arduino/Raspberry pi/Node MCU
4. Implement sensor data collection using IoT gateways (Arduino/Raspberry pi/Node MCU)
5. Develop your own Application that stores IoT data in open source IoT cloud platform analytic tools.
6. Study of Streaming IoT data in to Google cloud platform using Qwik lab environment.
7. Write a program to implement the Linear regression for a sample training data set stored as a .CSV file. 1.Compute the accuracy of the classifier, considering few test data sets. 2. Build an decision tree classifier for weather prediction dataset. Compute the accuracy of the classifier, considering few test data sets
8. Develop application for Smart Traffic that analyze the IoT data and predict the Traffic Jam.
9. Visualize the predicted output using Data Analytics tool
10. Implement pen test and identify the vulnerable device in your network using Kali Linux.
11. Implement Password Guess attack after identifying Vulnerable device using Kali Linux

**BTDA608: HADOOP LABORATORY**

**Credits: 1**

L T P
0 0 2

**Course Description:** The course aims to equip the students to design and develop applications using Hadoop and Pig.

**Course Outcomes (CLO):**

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

- Demonstrate the HDFS commands
- Implement HADOOP with Map-Reduce
- Use Apache Pig for analytics framework
- Demonstrate HIVE QL
- Compute the Page-Rank using Pig 6. Implement Map-Reduce programs for data analysis

**Lab Exercises:**

- Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves). Hadoop file management: Adding files and directories, retrieving files, Deleting files
- Move files between your regular Linux file-system and HDFS you can use the put and get commands.
- Run the word-count job with the command below, where "/user/biadmin/input/" is where the input files are, and "output" is the directory where the output of the job will be stored.
- Write a script to implement the following: o Exploring Data with Apache Pig o Splitting a Dataset o Joining Datasets with Apache Pig
- Write a script to implement the following on the given dataset: o Sorting o Grouping the Data with Apache Pig
- Write a script to Demonstration: Computing Page Rank using Pig
- Database manipulation using Hive: To create, alter, drop databases and views
- Define an external Hive table and review the results, Implement Partition and Skew in Hive
- Functions and indexes in Hive, Use Hive to Drop Functions and indexes
- Produce the histogram by summing the word counts grouped by word length.

# Fourth Year



**BCS701: ARTIFICIAL INTELLIGENCE**
**Credits: 3**

L T P
3 0 0

**Course Description:** The course aims to equip the students with various Artificial Intelligence Techniques and knowledge representation methods.
The course includes knowledge acquisition, manipulation, various AI algorithms, Expert system and Natural Language Processing.

**Course Outcomes (CLO):**
Upon successful completion of the course, the students should be able to:
**CO1:** Understand the basic concepts and techniques of Artificial Intelligence.
**CO2:** Apply AI algorithms for solving practical problems.
**CO3:** Describe human intelligence and AI.
**CO4:** Select appropriately from a range of techniques when implementing intelligent systems.

**Course Content**

**UNIT I**

**Introduction and Applications:** History of AI from Alan Turing and developments in AI, AI techniques, Criteria for success. Problem Solving Concepts and Methods

**UNIT II**

Problem Characteristics, Breadth -first Search and Depth-First Search methods, Heuristic Search Techniques - Hill Climbing, Best first Search, A*, Problem reduction, Ao*, Constraint satisfaction and means-ends analysis techniques

**UNIT III**

Information and Knowledge, Knowledge Acquisition and Manipulation, Issues in knowledge representation, Knowledge Representation Methods, Propositional Logic and First Order Predicate Logic, Resolution Principle, Horn's Clauses, Semantic networks, Partitioned Semantic Nets, Frames, Scripts and Conceptual Dependencies, Game playing: Minimax Search Procedure, Adding Alpha-Beta Cutoffs

**UNIT IV**

Definition and Applications, Characteristics of Expert Systems, Architecture of a typical expert system, Expert system Shells, Building an Expert System, Knowledge Acquisition, Case studies of Expert Systems like MYCIN. Specific Application of AI

**UNIT V**

Complexity of the problem, Syntactic processing, Semantic Analysis, Pragmatic processing, Introduction to Perception and Action.
Machine Learning: Clustering and Learning Basic Clustering Techniques, Standard k-Means (Lloyd) Algorithm, Generalized Clustering, Over partitioning, Merging, Modifications to the k-Means Algorithm, k-Means Wrappers, Rough kMeans, Fuzzy k-Means, k-Harmonic Means Algorithm,

Hybrid Clustering Algorithms; Estimation using Incomplete Data, Two classes, Multiple classes, Least squares for classification, Fisher's linear discriminant, Relation to least squares, Fisher's discriminant for multiple classes

**Recommended Books / Suggested Readings:**

1. Rich Elaine and Knight Kevin,1991: Artificial Intelligence, second edition; Tata-McGraw Hill Company, New Delhi
2. Russel, Sturat & Norviig, Peter, 2007: Artificial Intelligence; a modern Approach published by Person Education (Singapore)Pvt. Ltd.
3. George F Luger; William A. Stubblefield, 2009: Artificial Intelligence; Structures and Strategies for Complex problem solving, Second edition
4. Bala guruswami, 1994: Artifical Intelligence & Technology
5. Bharti&Chaitany, 2005: Natural Language Processing, PHI. 8. Patterson, Dan W., 1995.: Introduction to Artificial Intelligence and Expert Systems, Prentice-Hall of India Pvt.Ltd., New Delhi.





**BCS942: COMPUTER VISION**

**Credits: 3**

L T P
3 0 0

**Course Description:** The course aims to equip the students with fundamental problems of computer vision.

The course includes computer vision fundamentals, model fitting, Model reconstruction and Object recognition and shape representation

**Course Outcomes (CO):**

**CO1:** Understand the fundamental concepts in computer vision

**CO2:** Develop and evaluate solutions to problems in computer vision.

**CO3:** Demonstrate awareness of the current key research issues in computer vision.

**Co4:** Analyze and design a range of algorithms for image processing and computer vision.

**Course Content**

**UNIT I**

**Introduction:** overview of computer vision, related areas, and applications; overview of software tools; overview of course objectives.; introduction to OpenCV. Image formation and representation: imaging geometry, radiometry, digitization, cameras and projections, rigid and affine transformations. Filtering: convolution, smoothing, differencing, and scale space. Feature detection: edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors.

**UNIT II**

**Model fitting:** Hough transform, line fitting, ellipse and conic sections fitting, algebraic and Euclidean distance measures. Camera calibration: camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models. Epipolar geometry: introduction to projective geometry; epipolar constraints; the essential and fundamental matrices; estimation of the essential/fundamental matrix.

**UNIT III**

Model reconstruction: reconstruction by triangulation; Euclidean reconstruction; affine and projective reconstruction. Motion analysis: the motion field of rigid objects; motion parallax; optical flow, the image brightness constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust estimation; motion segmentation through Emotion tracking: statistical filtering; iterated estimation; observability and linear systems; the Kalman filter; the extended Kalman filter

**UNIT IV**

Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces, data-based techniques. Final presentation: students present selected topics and develop software implementation of related techniques based on the review of relevant literature. The work should be summarized in a concluding report which should include simulation results. A list of possible topics will be advertised prior to the project selection due date.

**Reference Books:**

1. Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011.
2. Computer Vision: A Modern Approach, D. Forsyth and J. Ponce, Prentice Hall, 2nd ed., 2011.
3. Introductory techniques for 3D computer vision, E. Trucco and A. Verri, Prentice Hall, 1998.





**BTCC701: DEVOPS**

**Credits: 3**

L T P
3 0 0

**Course Description:** An introduction to DevOps – the cultural and professional movement that stresses communication, collaboration, integration and automation in order to improve the flow of work between software developers and IT operations professionals. Improved workflows will result in an improved ability to design, develop, deploy and operate software and services faster. Students will build up a DevOps CI/CD toolchain, understand how code is automatically built, tested and deployed, using popular open-source tools including git, Jenkins and Docker.

**Course Outcomes (CO):**

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

**CO1:** Explain the drivers accountable for the surfacing of DevOps

**CO2:** Define and discuss the key concepts and principles of DevOps

**CO3:** Explain the Service Delivery process

**CO4:** List the most common and popular DevOps tools

**Co5:** Discuss the critical success factors for DevOps implementation

**Course Content**

**UNIT I**

**DevOps** : Introduction to DevOps - the pillars of the movement, Various Devops Tools, Introduction to CI/CD, Continuous Integration, Continuous Deployment/Delivery.

**UNIT II**

**GIT :** Git Basics, Installing GIT, Working with the BASH, Using the GUI, Git Repos, Creating repositories, Staged and upstaged resources, Working with the GIT commit lifecycle, Understanding when to commit, Git Updates and Tracking, Branching, Working with the Master branch and the HEAD, Working with the commit history, Checking out branches, Building and maintaining new branches, Merging branches, Exploring branch management strategy, Cloning and Remotes, Cloning repositories, Working with remotes, Using GIThub, Pulling and pushing repositories.

**UNIT III**

**Docker:** What is containerization, Introduction to Docker, Docker Architecture, Creating your First Container, Checking Connectivity between Containers, Docker Images, Stopping and Removing Containers, Creating Custom Docker Images, Pushing Images to Docker Hub, Using Persistent Storage With Docker, Understanding Docker Networking, Working with Docker file, Using Docker Compose

**UNIT-IV**

Jenkins: What is Jenkins, Jenkins Configuration, Using Jenkins to build projects, Linking Jenkins

to git repositories, Using Jenkins to set off Docker containerization, Deploying Docker containers

Reference Books:

1. Using Docker: Developing and Deploying Software with Containers by Adrian Mouat O'Reilly Media, 2016
2. The DevOps 2.1 Toolkit: Docker Swarm by Viktor Farcic Lean Publishing, 2017
3. Docker Bootcamp by Russ McKendrick Packt Publishing, 2017
4. Git: Mastering Version Control by Ferdinando Santacroce Packt Publishing, 2016
5. PROFESSIONAL Git by Brent Laster Wiley, 2017
6. Docker in Action, Second Edition by Jeff Nickoloff and Stephen Kuenzli Manning Publications
7. Continuous Delivery with Docker and Jenkins: Create Secure Applications by Building Complete CI/CD Pipelines, 2nd Edition
8. Book by Rafal Leszko, Packet Publishing
9. https://www.udemy.com/courses/search/?q=devops
10. https://www.udemy.com/courses/search/?q=git
11. https://www.udemy.com/courses/search/?q=jenkins
12. https://www.udemy.com/courses/search/?q=docker





**ELECTIVE-IV**

**1.BIG DATA ANALYTICS**

**2.TIME SERIES ANALYSIS AND FORCASTING**

**3.DISTRIBUTED DATABASES**

## BCS949: BIG DATA ANALYTICS

**Credits: 3**

L T P
3 0 0

**Course Description:**

The course aims to equip the students with understanding Data analytics life cycle.
The course introduces the student to the major concepts involved in Hadoop and Hive

**Course Outcomes (CLO):**

- Apply HDFS file structure and Mapreduce frameworks, and use them to solve complex problems, which require massive computation power.
- Use relational data in a Hadoop environment, using Hive and Hbase tools of the Hadoop Ecosystem.
- Working with The Hive Shell.
- Define the Comparison with traditional databases.

**Course Content**

**UNIT I**

The design of HDFS. HDFS concepts. Command line interface to HDFS. Hadoop File systems. Interfaces. Java Interface to Hadoop. Anatomy of a file read. Anatomy of a file write. Replica placement and Coherency Model. Parallel copying with distcp, Keeping an HDFS cluster balanced..

**UNIT II**

Introduction. Analyzing data with unix tools. Analyzing data with hadoop. Java MapReduce classes (new API). Data flow, combiner functions, Running a distributed MapReduce Job. Configuration API. Setting up the development environment. Managing configuration. Writing a unit test with MRUnit. Running a job in local job runner. Running on a cluster.Launching a job. The MapReduce WebUI

**UNIT III**

Classic Mapreduce. Job submission. Job Initialization. Task Assignment. Task execution. Progress and status updates. Job Completion. Shuffle and sort on Map and reducer side. Configuration tuning. MapReduce Types. Input formats. Output formats, Sorting. Map side and Reduce side joins

**UNIT IV**

The Hive Shell. Hive services. Hive clients. The meta store. Comparison with traditional databases. HiveQl. Hbasics. Concepts. Implementation. Java and Mapreduce clients. Loading

data, web queries.

Recommended Books / Suggested Readings:

1. Tom White, Hadoop, "The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012.
2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch , "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Osborne Media; 1 edition, 2011
3. https: //www.ibm.com / developerworks / community / blogs / Susan Visser Editionntry/flash book understanding big data analytics for enterprise class hadoop and streaming data? lang en





**BCS647: TIME SERIES ANALYSIS AND FORCASTING** L T P 3 0 0

**Credits: 3**

**Course Description:**

This course provides an introduction to both standard and advanced time series analysis and forecasting methods.

**Course Outcomes (CLO):**Upon successful completion of the course, the students should be able to:

- Knowledge of basic concepts in time series analysis and forecasting
- Understanding the use of time series models for forecasting and the limitations of the methods.
- Ability to criticize and judge time series regression models.
- Distinguish the ARIMA modeling of stationary and non-stationary time series
- Compare with multivariate times series and other methods of applications

**Course Content**

**UNIT I**

Introduction to Time Series and Forecasting -Different types of data-Internal structures of time seriesModels for time series analysis-Autocorrelation and Partial autocorrelation. Examples of Time series Nature and uses of forecasting-Forecasting Process-Data for forecasting – Resources for forecasting

**UNIT II**

Graphical Displays -Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments- General Approach to Time Series Modeling and Forecasting- Evaluating and Monitoring Forecasting Model Performance.

**UNIT III**

**TIME SERIES REGRESSION MODEL** -Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression- Prediction of New Observations - Model Adequacy Checking -Variable Selection Methods in Regression - Generalized and Weighted Least Squares- Regression Models for General Time Series Data- Exponential Smoothing-First order and Second order.

**UNIT IV**

**Autoregressive Moving Average (ARMA) Models -** Stationarity and Invertibility of ARMA Models - Checking for Stationarity using Variogram- Detecting Non stationarity - Autoregressive Integrated Moving Average (ARIMA) Models - Forecasting using ARIMA - Seasonal Data - Seasonal ARIMA ModelsForecasting using Seasonal ARIMA Models

Introduction - Finding the "BEST" Model - Example: Internet Users Data- Model Selection Criteria - Impulse Response Function to Study the Differences in Models - Comparing Impulse Response Functions for Competing Models .

**UNIT V**

Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models - Neural Networks and Forecasting -Spectral Analysis - Bayesian Methods in Forecasting.

**Recommended Books / Suggested Readings:**

1. Introduction To Time Series Analysis And Forecasting, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen(2015)

2. Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek Pal Dr. Pks Prakash (2017)

3. Time Series Analysis And Forecasting By ExampleSørenBisgaardMurat Kulahci Technical University Of Denmark Copyright © 2011 By John Wiley & Sons, Inc. All Rights Reserved. https://b-ok.cc/book/1183901/9be7ed





**BCS743: DISTRIBUTED DATABASE SYSTEMS** L T P 3 0 0

**Credits: 3**

**Course Description:**

The course aims to help the students to understand the Distributed database systems. When a database is distributed, the principles of the database must be examined; the student should be made aware of topics such as architecture, how to distribute a database, database control, optimizing queries, regulating replication, handling concurrency and deadlock.

The course introduces the student's concept of Distributed DBMS Architecture, design, and distributed query optimization.

**Course Outcomes (CLO):**

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

**CO1:** Understand Distributed database systems (DDBMS), its architecture, design & security issues.

**CO2:** Identify optimization techniques for Distributed Database.

**CO3:** Apply the concepts of query processing and decomposition to different queries.

**CO4:** Compare various approaches to concurrency control in Distributed database.

**CO5:** Describe the issues related to DDBMS such as reliability, concurrency control and related algorithms.

**Course Content**

**UNIT I**

Introduction: Distributed Data Processing, Distributed Database Systems, Promises of DDBSs, Complicating factors, Problem areas.

Distributed DBMS Architecture: DBMS Standardization, Architectural Models for Distributed DBMS, Distributed DBMS Architecture

**UNIT II**

Distributed Database Design: Alternative Design Strategies, Distribution Design Issues, Fragmentation, Distribution Transparency, and Allocation.

Data Distribution Alternatives: Design Alternatives, localized data, distributed data Fragmentation, Vertical, Horizontal (primary & derived), hybrid, general guidelines, correctness rules Distribution transparency, location, fragmentation, replication

**UNIT III**

Overview of Query Processing: Query Processing Problem, Objective of Query Processing, Complexity of Relational Algebra Operations, Query Processing in Centralized System, Query Processing in Distributed System, Characterization of Query Processors, Layers of Query Processing.

**UNIT IV**

**Optimization of Distributed Queries:** Query Optimization, Centralized Query Optimization,

Join Ordering Distributed Query Optimization Algorithms.

Distributed Transaction Management & Concurrency Control: Transaction concept, ACID property, Objectives of transaction management, Types of transactions, Objectives of Distributed Concurrency Control, Concurrency Control anomalies, Methods of concurrency control, Serializability and recoverability, Distributed Serializability, Enhanced lock based and timestamp-based protocols, Multiple granularity, Multi version schemes, Optimistic Concurrency Control techniques.

**UNIT V**

**Distributed DBMS Reliability:** Reliability Concepts & Measures, Failures & Fault Tolerance in Distributed Systems, Failures in Distributed DBMS, Local Reliability Protocols, Distributed Reliability Protocols, Dealing with Site Failures, Network Partitioning.

**Recommended Books / Suggested Readings:**

1. Principles of Distributed Database Systems by M. Tamer Ozsu, Patrick Valduriez, Pearson Publication.

2. Distributed Database Management Systems- A Practical Approach by Saeed K Rahimi, Frank S Haug, Wiley Publication.

Distributed Databases Principles and Systems by Stefano Ceri, Giuseppe Pelagatti. Mcgraw Hill Publication





**ELECTIVE-V** L T P 3 0 0

**1.NATURAL LANGUAGE PROCESSING**

**2.DIGITAL IMAGE PROCESSING**

**3.PREDICTIVE MODELLING AND ANALYTICS**

## BTCC609: NATURAL LANGUAGE PROCESSING

**Credits: 3**

**Course Description:**

The course aims to equip the students with fundamental knowledge of Natural Language Processing and applying knowledge to implement real time problems in fields of natural languages.

The course includes Natural Language Processing basics, Language Modeling and Part of Speech Tagging, Words and Word Forms, and Applications and recent trends in NLP .

**Course Outcomes (CO):**

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

**CO1:** Apply knowledge of computing and mathematics appropriate to the discipline

**CO2:** Analyze a problem, identify and define the computing requirements appropriate to its solution.

**CO3:** Illustrate computational methods to understand language phenomena of word sense disambiguation.

**CO4:** Analyze and test algorithms for NLP problems & mathematical and linguistic foundations underlying approaches to the various areas in NLP.

**CO5:** Apply NLP techniques to design real world NLP applications such as text categorization, text summarization, information extraction

**Course Content**

**UNIT I**

**Introduction:** What is NLP? Why NLP is Difficult? History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, how to build an NLP pipeline? Phases of NLP, NLP APIs, NLP Libraries

**UNIT II**

Words and Word Forms: Bag of words, skip-gram, Continuous Bag-Of-Words, embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge Based and Supervised Word Sense Disambiguation.

**UNIT III**

Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD) ,Dictionary based approach ,Pragmatics.

## UNIT IV

**Applications and recent trends in NLP:** Information retrieval, Question answers system, categorization, text summarization, sentiment analysis, Named Entity Recognition, spam filter speech recognition.

**Reference Books:**


1.Daniel and Martin J. H., "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2009.

2.Speech and Language Processing: AnIntroduction to Natural Language Processing, Computational

3.Linguistics and Speech Recognition Jurafsky, David, and James H. Martin, PEARSON

4.Foundations of Statistical Natural Language Processing, Manning, Christopher D., and Hinrich Schütze, Cambridge, MA: MIT Press

5.Natural Language Understanding, James Allen. The Benjamin/Cummings Publishing Company Inc..

6.Natural Language Processing with Python – Analyzing Text with the Natural Language ToolkitSteven Bird, Ewan Klein, and Edward Loper.






## BCS751: DIGITAL IMAGE PROCESSING

L T P
3 0 0

**Credits: 3**

**Course Description:** The course aims to equip the students with the fundamental concepts and applications of Digital Image Processing.

This course includes fundamentals of digital image processing, image enhancement and image segmentation.

**Course Outcomes (CO):**

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

**Co1:** Compare different methods for image acquisition, storage and representation in digital devices and computers

**CO2:** Appreciate role of image transforms in representing, highlighting, and modifying image features

**CO3:** Interpret the mathematical principles in digital image enhancement and apply them in spatial domain and frequency domain

**CO4:** Apply various methods for segmenting image and identifying image components

**CO5:** Summarize different reshaping operations on the image and their practical applications

**Co6:** Identify image representation techniques that enable encoding and decoding images

**Course Content**

### UNIT I

**Introduction to Image processing:** Fundamental steps in image processing; Components of image processing system; Pixels; coordinate conventions; Imaging Geometry; Spatial Domain; Frequency Domain; sampling and quantization; Basic relationship between pixels; Applications of Image Processing.

### UNIT II

Image transforms and its properties – Unitary transform; Discrete Fourier Transform; Discrete Cosine Transform; Walsh Transform; Hadamard Transform;

### UNIT III

Image Enhancement in spatial domain Basic Gray Level Transformation functions – Image Negatives; Log Transformations; Power-Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching; Gray Level Slicing; Bit Plane Slicing; Histogram Processing–Equalization; Specification. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters; Ordered Statistic Filters; Sharpening: Laplacian; Unsharp Masking and High Boost Filtering.

### UNIT IV

Image Enhancement in Frequency Domain Basics of Filtering in Frequency Domain, Filters - Smoothing Frequency Domain Filters : Ideal Low Pass Filter; Gaussian Low Pass Filter; Butterworth Low Pass Filter; Sharpening Frequency Domain Filters: Ideal High Pass Filter; Gaussian High Pass Filter; Butterworth High Pass Filter; Homomorphic Filtering.

### UNIT V

Image Segmentation: Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method; Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators; Line Detection, Corner Detection.

### UNIT VI

Morphological Operations Basics of Set Theory; Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing; Hit or Miss Transformation. Representation and Description Representation - Boundary, Chain codes, Polygonal approximation approaches, Boundary segments.

**Text Books:**

A K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989. 2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (English) 3rd Edition, Pearson India, 2013.

**References:**

1. Al Bovik, The Essential Guide to Image Processing, Academic Press, 2009.

2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, 2008.

3. S Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Procesing, McGraw Hill Education, 2009





## BTDA606: PREDICTIVE MODELING AND ANALYTICS

L T P
3 0 0

**Credits: 3**

**Course Description:**

This course is designed for anyone who is interested in using data to gain insights and make better business decisions. The techniques discussed are applied in all functional areas within business organizations including accounting, finance, human resource management, marketing, operations, and strategic planning.

**Course Outcomes (CLO):**

Upon completion of this course, the students will be able to

- Understand the basics of predictive analytics and summarize Data, Categorize Models, and techniques
- Apply Decision tree, Support Vector Machine for Data Classification
- Apply Methods such as Naïve Bayes Markov Model, Linear Regression, Neural Networks to Boost Prediction Accuracy for Data Classification.
- Develop predictive models for various Real-Time Applications.
- Analyze and Visualize predictive Model's results using Data Visualization tools

**Course Content**

### UNIT I

**DATA PREPARTION:** Introduction – Predictive Analytics in the Wild – Exploring Data types and associated Techniques - Complexities of data - Applying Models: Models and simulation, Categorizing Models, Describing, summarizing data, and decisions – Identify similarities in Data: Data Clustering, converting Raw Data into a Matrix, Identify K-groups in Data.

### UNIT II

**DATA CLASSIFICATION – PART I:** Introduction – Predictive Analytics in the Wild – Exploring Data types and associated Techniques - Complexities of data - Applying Models: Models and simulation, Categorizing Models, Describing, summarizing data, and decisions – Identify similarities in Data: Data Clustering, converting Raw Data into a Matrix, Identify K-groups in Data.

### UNIT III

**DATA CLASSIFICATION – PART II:** Background – Exploring Data classification process - Using Data Classification to predict the future: Decision tree, Algorithm for generating Decision Trees, Support Vector Machine.

**UNIT IV**

DATA CLASSIFICATION – PART III: Ensemble Methods to Boost Prediction Accuracy: Naive Bayes Classification Algorithm, The Markov Model, Linear Regression, Neural Networks – Deep learning.

DATA PREDICTION: Adopt predictive analytics - Processing data: identifying, cleaning, generating, reducing dimensionality of data – Structuring Data – Build predictive model: develop and test the model.

**Recommended Books / Suggested Readings:**

1. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling to solve all your data analysis problems, Pack Publisher, 2nd Edition, 2015.
2. Aurelien,"Hands-On Machine Learning with Scikit-Learn & TensorFlow", O'Reilly Publisher, 5th Edition, 2017.
3. Max Kuhn, Kjell Johnson, " Applied Predictive Modeling" Springer, 2013.



**BCS712: ARTIFICIAL INTELLIGENCE LABORATORY**

**Credits: 1**

L T P
0 0 2

**Course Description:**

The course aims to equip the students with the basic concepts of how to use various AI techniques. This course includes various techniques and algorithms of AI used in general problem solving, optimization problems, constraint satisfaction problems, and game programming.

**Course Outcomes (CO):**

Upon completion of this course, the students will be able to

**CO1:** Explain artificial intelligence, its characteristics and its application areas.

**Co2:** Formulate real-world problems as state space problems, optimization problems or constraint satisfaction problems.

**CO3:** Select and apply appropriate algorithms and AI techniques to solve complex problems.

**CO4:** Design and develop an expert system by using appropriate tools and techniques.

**List of Experiments:**

1. Defining AI; Turing's test; Weak vs. Strong AI.
2. Applications of AI; Agent based approach
3. State space search: DFS, BFS, IDS algorithms
4. Informed search: A* algorithm
5. Optimization problems & Local search algorithms
6. Genetic algorithms
7. Constraint satisfaction problems
8. Expert systems
9. Game playing (adversarial search)
10. Introduction to machine learning

## BCS932: COMPUTER VISION LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:**

This lab equips learner with knowledge in how computers see and interpret the world as humans do; core concepts of Computer Vision and human vision capabilities; key application areas of Computer Vision and Digital Image Processing; Machine Learning and AI basics; and more.

**Course Outcomes (CO):**

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

**CO1:** Implement basic knowledge, theories and methods in image processing and computer vision.

**CO2:** Identify, formulate and solve problems in image processing and computer vision.

**CO3:** Analyze, evaluate and examine existing practical computer vision systems.

**List of Experiments:**

1. Windows and Plots
2. Program to change the Brightness of Image
3. To Flip the image around the vertical andhorizontal line
4. Display the color components of the image Red Green Blue Components of Image
5. To find the negative of an image
6. Calculate the Histogram of a given image
7. Histogram Equalization of an image.
8. Program for Image Filtering (low pass filter)1) Average filter2) Weighted Average filter3) Median filter High pass filters using1) Sobel operator2) Laplacian operator
9. Edge detection with gradient andconvolution of an Image
10. Program to find threshold of grayscale image.
11. Program to find threshold of RGB image.
12. Program to estimate and subtract thebackground of an image.
13. Program to convert color image to gray and HSV
14. Mini Project.





## BTCY701: DEVOPS LABORATORY

L T P
0 0 2

**Credits: 1**

**Course Description:**

This lab equips learners to understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet real world software development requirements.

This course includes different DevOps Tool stack in software development process.

**Course Outcomes (CO):**

**CO1:** Apply DevOps principles to meet software development requirements Creating Repositories.

**CO2:** Use the DevOps Tool stack in software development process.

**CO3:** Execute docker commands to manage images and interact with containers.

**List of Experiments:**

1. To understand Version Control System / Source Code Management, install git and create a GitHub account.
2. To Perform various GIT operations on local and Remote repositories using GIT Cheat-Sheet.
3. To understand Continuous Integration, install and configure Jenkins with Maven/Ant/Gradle to setup a build Job.
4. To Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.
5. To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
6. To Setup and Run Selenium Tests in Jenkins Using Maven.
7. To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
8. To learn Dockerfile instructions, build an image for a sample web application using Dockerfile.
9. To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet /Ansible.
10. To learn Software Configuration Management and provisioning using Puppet Blocks (Manifest,Modules, Classes, Function).

## BSOP401: MATLAB FOR ENGINEERS

**Credits: 3**

L T P
3 0 0

**Pre-Requisites:** N.A

**Course Description:**

The main description of this course is to provide a foundation in programming for engineering problem solving using the MATLAB software package. Students will develop the skills analyze and break down an engineering program and solve it algorithmically using MATLAB. Students will understand various programming constructs and how they can be used to solve a computational problem.

This course includes MATLAB fundamentals, Graphics in MATLAB and MATLAB in neural networks.

**Course Outcomes (CO):**

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

CO1: Identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

CO2: Apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

Co3: Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

**Course Contents:**

### UNIT I

MATLAB: An Overview, Brief history of MATLAB, About MATLAB, Installation of MATLAB, Help browser, Arranging the desktop, Basic functions of Matlab, Mostly used symbols in MATLAB, debugging in Matlab; Building MATLAB expressions: MATLAB datatype, command handling, MATLAB basics.

### UNIT II

MATLAB Vector and Matrix: Scalar and vector, elementary features in a vector array, matrices, eigen values and eigen vectors, matrix operations, matrix operators, creating matrix arrangement, indexing array value, other operations, mathematical operations on array, array types

### UNIT III

Graphics in MATLAB: 2D plots, parametric plots, contour lines and implicit plots, field plots, multiple graphics display function, 3D plots, multivariate data, data analysis.

### UNIT IV

MATLAB programming introduction to M-files,MATLAB editors, M files, scripts, functions, MATLAB error and correction, MATLAB debugger; Digital Image Processing with MATLAB (Image Processing).

### UNIT V

MATLAB in neural networks: About neural networks, Human and artificial neuron, Architecture ofneural networks (feed-forward, feedback, network layers), The McCuulloch-Pitts Model of Neuron, The Perceptron, Transfer function, neural network toolbox, Actual model, applications of neural network.

**Text Books:**

1. MATLAB® Programming for Engineers:Stephen J. Chapman, Thomson Corporation, 4th Edition

**BSOP403: DIGITAL MARKETING**

**Credits: 3**

L T P
3 0 0

**Pre-Requisites:** N.A

**Course Description:**

The main objective of this course is to educate students in the area of Digital Marketing. Digital Marketing and Social Media have transformed marketing and business practice across the globe. This course provides an understanding of the ever evolving digital landscape and examines the strategic role of digital marketing processes and tools in designing the overall Marketing strategyand the Digital Marketing Plan. It explores the challenges of Interactive media, the online market place, and the creative challenges of communicating and retention strategies of customers through these media, the main search engines and the future trends in digital marketing.

**Course Outcomes (CO):**

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

**CO1:** Analyse the confluence of marketing, operations, and human resources in real-time delivery.

**CO2:** Demonstrate cognitive knowledge of the skills required in conducting online research and research on online markets, as well as in identifying, assessing and selecting digital market opportunities.

**CO3:** Explain emerging trends in digital marketing and critically assess the use of digital marketing tools by applying relevant marketing theories and frameworks.

**CO4:** Investigate and evaluate issues in adapting to globalised markets that are constantly changing and increasingly networked.

**CO5:** Interpret the traditional marketing mix within the context of a changing and extended range of digital strategies and tactics.

**Course Contents:**

**UNIT I**

Introduction to Digital Marketing: The new digital world - trends that are driving shifts fromtraditional marketing practices to digital marketing practices, the modern digital consumer and new consumer's digital journey. Marketing strategies for the digital world-latest practices.

**UNIT II**

Social Media Marketing -Introduction to Blogging, Create a blog post for your project. Include headline, imagery, links and post, Content Planning and writing. Introduction to Face book, Twitter, Google +, LinkedIn, YouTube, Instagram and Pinterest; their channel advertising and campaigns

**UNIT III**

Acquiring & Engaging Users through Digital Channels: Understanding the relationship between content and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing. Marketing gamification, Online campaign management; using marketing analytic tools to segment, target and position; overview of search engine optimization (SEO).

**UNIT IV**

Designing Organization for Digital Success: Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies, how digital marketing is adding value to business, and evaluating cost effectiveness of digital strategies

**UNIT V**

Digital Innovation and Trends: The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing Understanding trends in digital marketing – Indian and global context, online communities and co-creation,

Text books:

1. MoutsyMaiti: Internet Mareting, Oxford University Press India
2. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).
3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional (October, 2013).
4. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page (3rd Edition, 2014).
5. Tracy L. Tuten& Michael R. Solomon: Social Media Marketing (Sage Publication)

**BSOP402: CONTENT MANAGEMENT SYSTEM** L T P
**Credits: 3** 3 0 0

**Pre-Requisites:** N.A

**Course Description:**

The course aims to equip the students to use the thousands of themes and plugins already out there to design own custom websites by using WordPress.

The course includes CMS and Joomla fundamentals and WordPress.

**Course Outcomes (CO):**

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

**CO1:** Appraise the role of content management technologies to organise and present web content.

**CO2:** Create and deploy websites using content management systems, including creating and editing content, creating custom templates or themes, and performing site management;

**CO3:** Examine installation and maintenance considerations for modern websites;

**CO4:** Extend the functionality of content management systems with Web programming.

**Course Contents:**

**UNIT I**

Introducing Content Management Systems: Grading and attendance policies, Purchasing and configuring a domain name and web hosting, Exploring CMS terminology, including open source, PHP, MySQL, server-side, client-side, static HTML website, how CMS web pages are generated, and so forth., Website strategy and planning, site mapping, content planning

**UNIT II**

Introduction to Joomla: Installing Joomla, Exploring the Admin Interface, Content creation using the CAM model, Content customization: images, video, audio, tags, formats, etc., Adding and displaying menus, Linking menus to articles and other features, Extending Joomla,Finding and adding Joomla extensions,Must have extensions for any Joomla site.Adding and setting up 2 "big" extensions (choose blog, calendar, image gallery, Paypal-based shopping cart, or portfolio. Other extensions on approval)

**UNIT III**

Introduction to WordPress: WordPress.org vs. WordPress.com: Installing WordPress, Exploring the admin interface, Content creation: Posts vs. pages, Content customization: images, video, audio, tags, formats, etc. Extending WordPress As with Joomla, WordPress has the ability to extend, by adding functionality to the CMS via plug-ins and widgets. Learn about working with plug-ins and widgets, including identifying a good plug-in or widget, installing, and configuring them.

**Unit -IV**

Plugins:Install WordPress Plugins -Installing plugin for SEO on WordPress website - Increasing Speed of WordPress websites -Security of WordPress websites -Contact Form for WordPress websites -Setup Contact us page for WordPress websites -Creating Post and Basics of One Page Optimization (SEO).

**Unit-V**

Page Creation:Creating Page Settings, Domain, Choosing the right domain name, Registering your domain, Choosing your hosting services -Comparing various service providers, Choosing your hosting provider, Pointing your domain to hosting provider, Setting up your Web server, Installing your WordPress to your Web server, Transferring Content to Web server

**Reference Books:**

1. CMS eBook v1.indb (mizoram.gov.in)
2. Web Content Management SYSTEMS, FEATURES, AND BEST PRACTICES. Deane Barker - PDF Free Download (adoc.pub)

**BCS543: DOT NET TECHNOLOGIES**

**Credits: 3**

L T P
3 0 0

**Course Description:** The course aims to equip the students to understand the .NET technologies for C# programming, web development and to enable them to design and construct dynamic and responsive apps for the web. Explain to students the benefits of using.NET technologies and their features. This course includes basics of C#, application development on .NET, web-based application development on .NET, and CLR and .NET framework.

**Course Outcomes (CO):**

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

**CO1:** Describe the concept of .Net Framework and C# language fundamentals.

**CO2:** Develop the console and GUI applications using .Net technology.

**CO3:** Implement various controls for Creating a web Application.

**CO4:** Use .NET framework, tools for developing applications.

**Course Contents:**

**UNIT I**

**INTRODUCTION TO C#:** Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.

**UNIT II**

**OBJECT ORIENTED ASPECTS OF C#:** Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.

**UNIT III**

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), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.

**UNIT IV**

WEB BASED APPLICATION DEVELOPMENT ON .NET: Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

**UNIT V**

CLR AND .NET FRAMEWORK: Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security.

**Recommended Books / Suggested Readings:**

1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012.
2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.
3. Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O"Reilly, 2010.