Your Dreams Our Goal

# POORNIMA UNIVERSITY

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)

## FACULTY OF COMPUTER SCIENCE AND ENGINEERING

## DEPARTMENT OF COMPUTER APPLICATION

# SCHEME & SYLLABUS

# (2025-2028)

# PROGRAM: BCA

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**Disclaimer:** The scheme, syllabus and other materials published in this booklet may be changed or modified as per the requirement after approval of competent authority. The decision taken by the management of Poornima University will be final and abiding to all.

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# POORNIMA UNIVERSITY

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)

## Vision

Our vision is to create knowledge-based society with scientific temper, team spirit and dignity of labour to face global competitive challenges.

## Mission

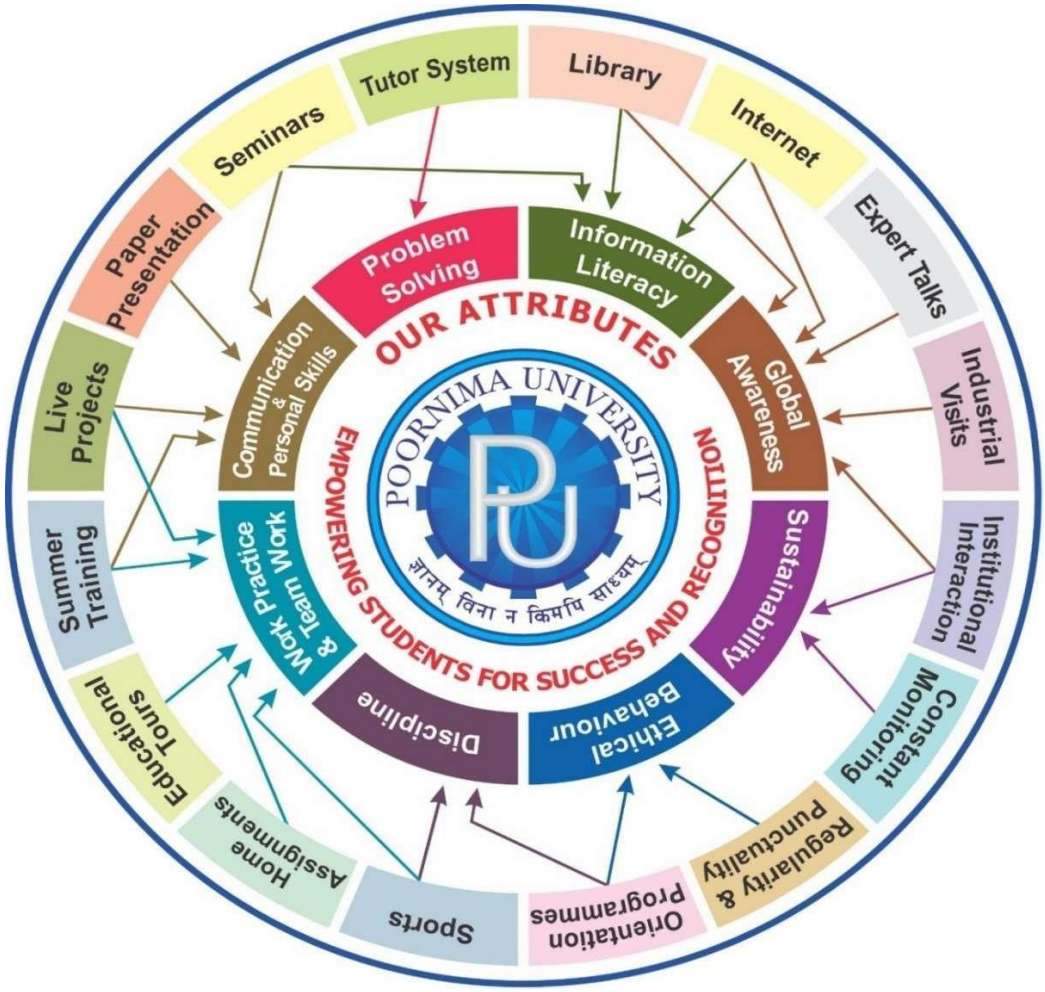
Our mission is to evolve and develop skill-based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

## Quality Policy

To provide quality education through faculty development, updating of facilities and continual improvement for meeting norms laid down by the government, keeping the stakeholders satisfied. Poornima University has forged industrial alliances with Top MNC's worldwide which assures high educational standards, up to- date and forward- thinking curricula, and professional relevance. At Poornima University you will have a distinct advantage through exposure to the corporate standard environment through industry sponsored infrastructure and expert faculty. The University involves global industry leaders in many ways.

# Knowledge Wheel

At Poornima, the academic atmosphere is a rare blend of modern technical as well as soft skills and traditional systems of learning processes.



## About Program and Program Outcomes (PO):

**Title of the Program:** Bachelor of Computer Applications (BCA)

**Nature of the Program:** BCA is a three-year full-time Programme

## Program Outcomes (POs):

Graduates will be able to:

**PO1: Computational information:** Appreciate and apply mathematical organization, computing and domain information for the conceptualization of computing models from clear harms.

**PO2: Difficulty Analysis:** Talent to classify, significantly evaluate and prepare complex computing problems using fundamentals of computer knowledge and request domains.

**PO3: Drawing / Improvement of Solutions:** Facility to transform composite production scenarios and present-day issues into problems, explore, recognize and propose included solutions using rising technologies.

**PO4: Accomplish Investigations of Compound Computing Troubles:** Ability to invent and ways experiments interpret data and present well up to date conclusions.

**PO5: Current Implement Procedure:** Skill to select recent computing tools, skills and techniques compulsory for original software solutions

**PO6: Proficient Principles:** Facility to apply and give expert principles and cyber systems in a universal monetary situation.

**PO7: Ultimate Education:** Identify the need for and enlarge the ability to appoint in permanent education as a Computing qualified.

**PO8: Individual and team work:** Ability to job as a part or manager in various teams in multidisciplinary situations.

**PO9: Communication:** being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO10: 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.

## Program Specific Outcomes (PSOs):

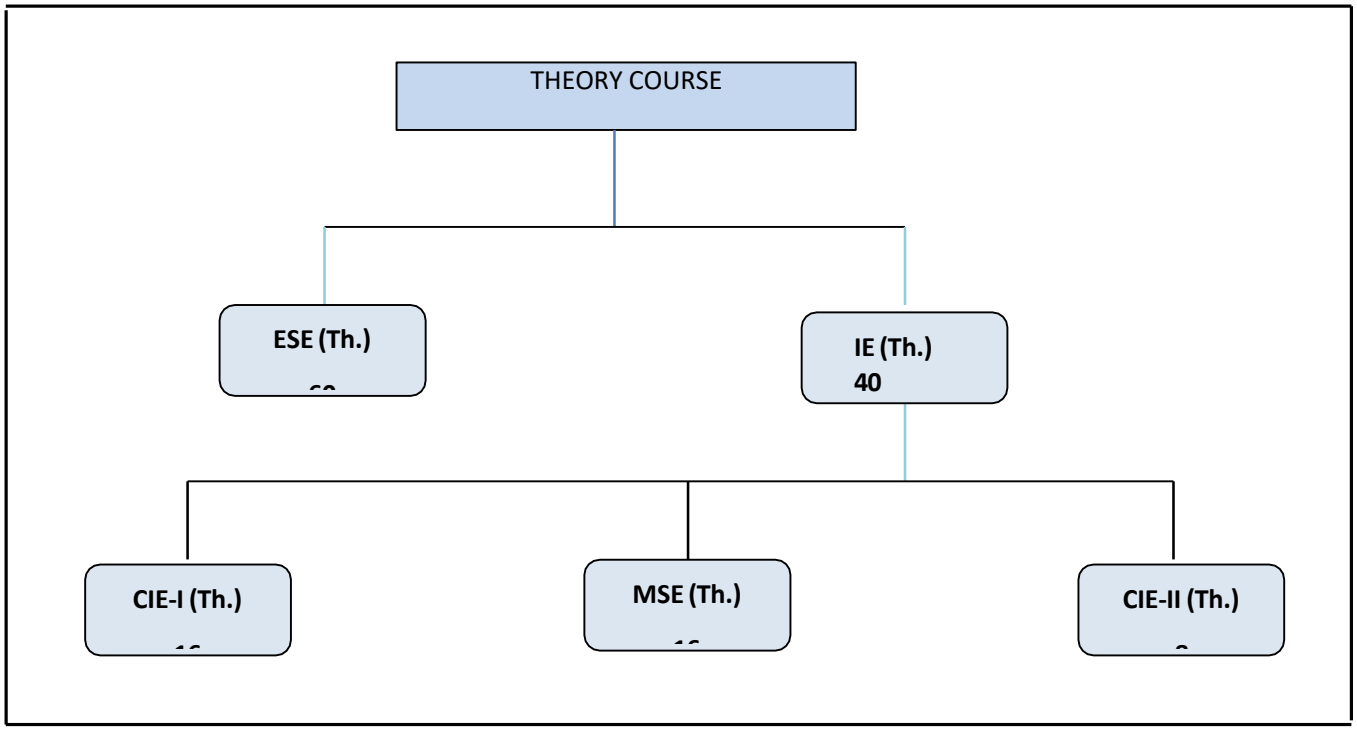
**PSO1:** The graduates are proficient in fundamental principles and methods of Computer Science and are able to design, create & evaluate algorithms appropriate to specific problems.

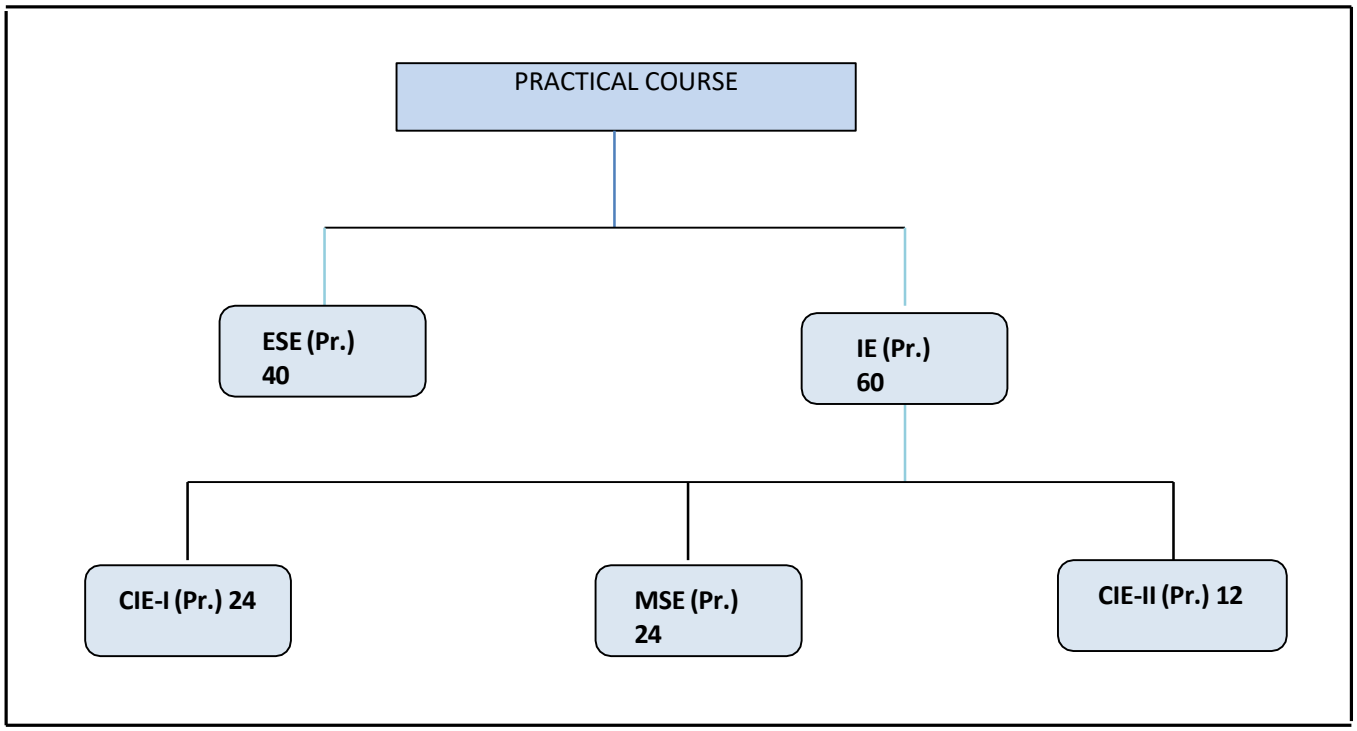
**PSO2:** The graduates possess in-depth knowledge of various components of hardware and system software.

**PSO3:** Identify and apply domain specific tools to solve real world problem of society in field of Cloud Technology, Artificial Intelligence, Data Science, Game Technology and Information Security.

**PSO4:** Ability to apply their skills in the field of database design and web & mobile application development.

## Examination System: Marks Distribution of Theory Course:




**A. Marks Distribution of Practical Course:**

**PRACTICAL COURSE**

**Th**.: Theory, Pr**.**: Practical, **ESE:** End Semester Examination, **MSE:** Mid Semester Examination,

**CIE:** Continuous Internal Evaluation.

## CO Wise Marks Distribution:

| | Maximum Marks | CO to be Covered | CO to be Covered | Maximum Marks |
|---|---|---|---|---|
| **CIE-I** | 16 ( 8 + 8) | 1 & 2 | 1 & 2 | 24 (12 + 12) |
| **MSE** | 16 ( 8 + 8) | 3 & 4 | 3 & 4 | 24 (12 + 12) |
| **CIE-II (Activity/ Assignment )** | 8 (8) | 5 | 5 | 12 (12) |
| **ESE** | 60 | - | - | 40 |
| **TOTAL** | 100 | - | - | 100 |

## Minimum Passing Percentage in All Exams:

| S. No. | Program Name | Minimum Passing Percentage in | | |
|---|---|---|---|---|
| | | IE Component | ESE Component | Total Component |
| 1 | Course Work for PhD Registration | - | - | 50% |
| 2 | B. Arch., FIRE Dept. ( BBA, B. Com., MBA) | - | 45% | 50% |
| 3 | MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH | - | 40% | 40% |
| 4 | B. Tech., B. Des., BVA, BCA, B.Sc., BBA, B.Com., B.A. & any other program | - | 35% | 35% |

## GPA Calculation

$$SGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$SGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

$C_i$ is the number of credits of subject i,

$G_i$ is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course in the semester

## CGPA Calculation

$$CGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$CGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

$C_i$ is the number of credits of subject i,

$G_i$ is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course of all the semesters up to which CGPA is computed

# Grading Table:

**Table-A**

Applicable for B.Arch., FIRE Courses (BBA, B.Com, MBA), & PhD. Course Work

| Academic Performance | Grade | Grade Point | Marks Range (in %) |
|---|---|---|---|
| Outstanding | O | 10 | 90≤ x ≤100 |
| Excellent | A+ | 9 | 80≤ x <90 |
| Very Good | A | 8 | 70≤ x <80 |
| Good | B+ | 7 | 60≤ x <70 |
| Above Average | B | 6 | 50≤ x <60 |
| Fail | F | 0 | x <50 |

**Table-B**

Applicable for All Courses except Table-A

| Academic Performance | Grade | Grade Point | Marks Range (in %) |
|---|---|---|---|
| Outstanding | O | 10 | 90≤ x ≤100 |
| Excellent | A+ | 9 | 80≤ x <90 |
| Very Good | A | 8 | 70≤ x <80 |
| Good | B+ | 7 | 60≤ x <70 |
| Above Average | B | 6 | 50≤ x <60 |
| Average | C | 5 | 40≤ x <50 |
| Pass* | P | 4 | 35≤ x <40 |
| Fail | F | 0 | x <35 |

*** Not applicable for master programs**

## CGPA to percentage conversion rule:

**Equivalent % of Marks in the Program = *CGPA* *10**

## Award of Class

| CGPA | Percentage | Equivalent Division |
|---|---|---|
| 7.50 ≤ CGPA | 75% or more | First Division with Distinction |
| 6.00 ≤ CGPA < 7.50 | 60% ≤ x <75% | First Division |
| 5.00 ≤ CGPA < 6.00 | 50% ≤ x <60% | Second Division |
| 4.00 ≤ CGPA < 5.00 | 40% ≤ x < 50% | Pass Class |

# Guidelines for Massive Open Online Courses (MOOCs)

## (Session 2025-28)

Poornima University, in its never-ending endeavor to equip students with best-of-class learning and knowledge, has undertaken to include MOOC courses as part of its credit scheme from session 2023-24 onwards. The objective behind this is to enable students to study courses designed by the best teachers in the country and to scale their knowledge base with the rest of learners from the nation. The MOOCs which are included under this scheme is can be chosen from SWAYAM-NPTEL.

## Introduction of MOOCs: SWAYAM-NPTEL

### About SWAYAM-NPTEL

NPTEL (National Programme on Technology Enhanced Learning), is a joint venture of the IITs and IISc, funded by the Ministry of Education (MoE) Government of India, and was launched in 2003. Initially started as a project to take quality education to all corners of the country, NPTEL now offers close to 600+ courses for certification every semester in about 22 disciplines.

### Some highlights:

Largest online repository in the world of courses in engineering, basic sciences and selected humanities and management subjects

YouTube channel for NPTEL – most subscribed educational channel, 1.3 billion views and 40+ lakhs subscribers

More than 56000 hours of video content, transcribed and subtitled

Most accessed library of peer-reviewed educational content in the world

Translation of more than 12000 hrs of English transcripts in regional Indian languages

### NPTEL Online Certification:

The objective of enabling students obtain certificates for courses is to make students employable in the industry or pursue a suitable higher education programme. Through an online portal, 4, 8, or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. Enrolment to and learning from these courses is free. Following these online courses, an in- person, proctored certification exam is conducted and a certificate is provided through the participating institutions and industry, as applicable.

Some statistics regarding the open online courses since March 2014 till Dec 2021
Completed courses: 3496;

Enrollments across courses: 1.58 CRORE +
Number of exam registrations: 15.1 LAKH +

All the statistics pertaining to completed courses are available at https://beta.nptel.ac.in/courses.

All courses are completely free to enroll and learn from. The certification exam is optional and comes at a fee of Rs 1000/course exam.

# MOOCs at Poornima University:

MOOCs envelops best in class teaching - learning processes along with meeting the requirements of various courses in terms of quality of teaching and evaluation system. To promote the MOOCs among students of Poornima University, it is decided to consider the credits earned through MOOCs.

## MOOCs as Credit Courses

**(For this document, only those MOOCs will be considered which are available only on NPTEL platforms)**

Credit and Non-credit SWAYAM-NPTEL MOOCs can be opted by anyone, anytime, anywhere and in any language. However, prior-permission of the University Authorities is mandatory if the credits are to be transferred to regular degree.

As Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards): Open Elective (for batches entered till 2022) courses were available at university level in offline mode till 2022-23 for which relevant booklets were published. From session 2023-24, Multidisciplinary Courses are introducing in lieu of open elective courses as per NEP 2020. These courses carries 02 credits. These category/types of courses (similar/different) are available as MOOC courses on SWAYAM- NPTEL platform which are being introduced from session 2023-24 onwards for all the students. The respective Deans / HODs shall provide all the information to all the students pertaining to MOOCs as per details given below:

Deans / HODs shall prepare a list of up to 10 appropriate MOOC courses (From NPTEL Only) of Minimum 02/03 credits each, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.

After approval, the respective Deans / HODs shall circulate a notice to all their respective students so that they can select any one course from the list, the credits (only 02) of which will be counted against Open Elective/ Multidisciplinary courses pertaining to that particular semester.

The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean and provide the academic support to students as per requirement.

## Important points related to MOOCs at Poornima University

Only one MOOC shall be allowed in a particular semester for the purpose of credit transfer in the beginning.

No attendance will be taken for MOOC courses.

The method of assessments of MOOC such as assignments and examination are completely associated with that particular MOOC and no internal exam (IE component) will be conducted by the department as well as by the Examination Cell.

The respective Dean / HOD must submit the detail of course i.e., code, name and credit of MOOC opted against that particular course in particular semester attached with highlighting in the related examination scheme of syllabus of that semester signed by BOS Convener / HoD and Dean of Faculty to the office of Pro-President before commencement of the classes.

The center of examination for MOOCs will be finalized by SWAYAM-NPTEL. All the responsibility related to registration for MOOCs, timely submission of assignments, examinations etc. will be borne by the students only.

NPTEL will award a certificate to all the students passing the examination.

The list of registered students in MOOC along with name of course will be submitted to the Examination Cell by the Deans / HoDs before commencement of the classes.

An ESE Exam of each said MOOC course will also be conducted by the University as per university norms.

The award of marks/grading will be computed as given below:

| Award of marks/grading | Remarks |
|---|---|
| 1. 20% weightage taken from MOOC Certificate +80% weightage taken from ESE Exam of Poornima University<br>**OR**<br>2. 100% of weightage taken from MOOC Certificate<br>Note: The Higher Marks/Grades of the above two will be considered | The Certificate of MOOC to be Submitted as per date notified by COE, Poornima University |

Any student who would not be able to clear/pass the said course, will be required to appear as a back exam candidate of the University as per PU norms. Students who have not passed the MOOC exam are required to register and participate in the next semester for either the same subject or a similar subject (Ensuring at least 60% of the syllabus matches with the back subject and also approved by respective Dean) offered through NPTEL.

The scorecard and related certificate of MOOC along with a consolidated list of students with marks of assignment and final exam will be submitted to the examination cell by the concerned Dean / HOD for further process. It is also recommended that alteration/changes/scaling in marks obtained by the students in any MOOC will not be considered.

The exam registration fee of MOOC up to Max. INR 1000/- will be reimbursed to the student only after successful completion of the course in first attempt and submission of the fee receipt, score-card and certificate of the MOOC to the concerned department within stipulated time after declaration of the results.

There will be no provision of re-evaluation of MOOC.

**NOTE: This is to be noted that the procedure for getting approval from BOS, Faculty Board, Academic Council and BoM is to be followed as per regular process.**

## Attached Items:

| | |
|---|---|
| Ability Enhancement Courses | Annexure-1 |
| Value Added Course Booklet | Annexure-2 |

**POORNIMA UNIVERSITY, JAIPUR**
**Faculty of Computer Science and Engineering**

**Name of Program: BCA (Common for all)** **Duration: 3 Years** **Total Credits: 136**

**Teaching Scheme for Batch 2025-28**

**Semester-I**

| Course Code | Name of Course | Teaching Scheme | | | Marks Distribution | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | IE | ESE | Total | |
| **A.** | | **Major (Core Courses)** | | | | | | |
| **A.1** | **Theory** | | | | | | | |
| BCACCA1101 | Programming Fundamentals of C | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA1102 | Introduction to Web Technology | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA1103 | Introduction of Operating System | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA1104 | Fundamental of Computer & Digital System | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA1105 | Software Engineering | 3 | - | - | 40 | 60 | 100 | 3 |
| **A.2** | **Practical** | | | | | | | |
| BCACCA1201 | Programming Fundamentals of C Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| BCACCA1202 | Web Technology Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives** | | | | | | |
| **B.1** | **Theory** | - | - | - | - | - | - | - |
| | Professional Elective - I | 3 | | | 40 | 60 | 100 | 3 |
| **B.2** | **Practical** | | | | | | | |
| | NIL | - | - | - | - | - | - | - |
| **C** | | **Multidisciplinary Courses** | | | | | | |
| | - | - | - | - | | | | |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | |
| BEACHM1205 | Applied English Communication Skills-I | - | - | 2 | 60 | 40 | 100 | 1 |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | |
| BELCSE1201 | Skill Enhancement Course-I | - | - | 2 | 60 | 40 | 100 | 1 |
| **F** | | **Value Added Courses (VAC)** | | | | | | |
| BUVCVE1101 | Swachh Bharat | 2 | - | - | 40 | 60 | 100 | 2 |
| BUVCVD1202/ BUVCVA1201 | Exploratory Project/ Performing Arts | - | - | 2 | 60 | 40 | 100 | 1 |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | |
| | | | | | | | | |
| **Total** | | 18 | - | 12 | | | | **25** |
| **Total Teaching Hours** | | **30/30** | | | | | | |

**POORNIMA UNIVERSITY, JAIPUR**
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**Teaching Scheme for Batch 2025-28**

**Semester-II**

| Course Code | Name of Course | Teaching Scheme | | | Marks Distribution | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | | ESE | Total | |
| **A.** | | **Major (Core Courses)** | | | | | | |
| **A.1** | **Theory** | | | | | | | |
| BCACSA2101 | Basic of Mathematics | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA2101 | Computer Networks | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA2102 | Python Programming | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA2103 | Software Project Management | 3 | - | - | 40 | 60 | 100 | 3 |
| **A.2** | **Practical** | | | | | | | |
| BCACCA2201 | Computer Networks Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| BCACCA2202 | Python Programming Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| BCACCA2203 | Linux and Shell Script Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives** | | | | | | |
| **B.1** | **Theory** | | | | | | | |
| | Professional Elective - II | 3 | - | - | 40 | 60 | 100 | 3 |
| **B.2** | **Practical** | | | | | | | |
| | Professional Elective Lab - II | - | - | 2 | 60 | 40 | 100 | 1 |
| **C** | | **Multidisciplinary Courses** | | | | | | |
| | MOOC Course-I | 1 | - | | | | | 2 |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | |
| BEACHM2213 | Quantitative and Verbal Aptitude Training-I | | | 2 | 60 | 40 | 100 | 1 |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | |
| BELCSE2201 | Skill Enhancement Course-II | - | - | 2 | 60 | 40 | 100 | 1 |
| **F** | | **Value Added Courses (VAC)** | | | | | | |
| BUVCVD2202/ BUVCVA2201 | Exploratory Project/ Performing Arts | - | - | 2 | 60 | 40 | 100 | 1 |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | |
| | | - | - | - | | | | |
| **Total** | | 18 | 0 | 12 | | | | **24** |
| **Total Teaching Hours** | | **30/30** | | | | | | |

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**Teaching Scheme for Batch 2025-28**

**Semester-III**

| Course Code | Name of Course | Teaching Scheme | | | Marks Distribution | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | IE | ESE | Total | |
| **A.** | | **Major (Core Courses)** | | | | | | |
| **A.1** | **Theory** | | | | | | | |
| BCACCA3101 | RDBMS | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA3102 | OOPS with Java | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA3103 | Data Structure and Algorithm | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA3104 | Computer Organization and Architecture | 3 | - | - | 40 | 60 | 100 | 3 |
| **A.2** | **Practical** | | | | | | | |
| BCACCA3201 | RDBMS Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| BCACCA3202 | OOPS with Java Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| BCACCA3203 | Data Structure and Algorithm Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives** | | | | | | |
| **B.1** | **Theory** | | | | | | | |
| | Professional Elective - III | 3 | - | - | 40 | 60 | 100 | 3 |
| **B.2** | **Practical** | | | | | | | |
| | Professional Elective - III | - | - | 2 | 60 | 40 | 100 | 1 |
| **C** | | **Multidisciplinary Courses** | | | | | | |
| | MOOC Course-II | 1 | - | - | | | 100 | 2 |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | |
| BEACHM3221 | Quantitative and Verbal Aptitude Training-II | - | - | 2 | 60 | 40 | 100 | 1 |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | |
| BULCSE3201 | Skill Enhancement Course-III | - | - | 2 | 60 | 40 | 100 | 1 |
| **F** | | **Value Added Courses (VAC)** | | | | | | |
| BUVCVA3106 | Introduction to IKS | 2 | - | - | 40 | 60 | 100 | 2 |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | |
| | - | - | - | | | | - | |
| **Total** | | 18 | | 12 | | | | **25** |
| **Total Teaching Hours** | | **30/30** | | | | | | |

**POORNIMA UNIVERSITY, JAIPUR**
**Faculty of Computer Science and Engineering**

**Name of Program: BCA(Common for all)** **Duration: 3 Years** **Total Credits: 136**

**Teaching Scheme for Batch 2025-28**

**Semester-IV**

| Course Code | Name of Course | Teaching Scheme | | | Marks Distribution | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | IE | ESE | Total | |
| **A.** | | **Major (Core Courses)** | | | | | | |
| **A.1** | **Theory** | | | | | | | |
| BCACCA4101 | Big Data Analysis | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA4102 | Advanced Data Structure | 3 | - | - | 40 | 60 | 100 | 3 |
| **A.2** | **Practical** | | | | | | | |
| BCACCA4201 | Big Data Analysis Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives** | | | | | | |
| **B.1** | **Theory** | | | | | | | |
| | Professional Elective - IV | 3 | - | - | 40 | 60 | 100 | 3 |
| | Professional Elective - V | 3 | - | - | 40 | 60 | 100 | 3 |
| | Professional Elective - VI | 3 | - | - | 40 | 60 | 100 | 3 |
| **B.2** | **Practical** | | | | | | | |
| | Professional Elective Lab – IV | - | - | 2 | 60 | 40 | 100 | 1 |
| | Professional Elective Lab - V | - | - | 2 | 60 | 40 | 100 | 1 |
| | Professional Elective Lab - VI | - | - | 2 | 60 | 40 | 100 | 1 |
| **C** | | **Multidisciplinary Courses** | | | | | | |
| | MOOC Course-III | 1 | - | - | | | 100 | 2 |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | |
| - | - | - | - | - | - | - | - | - |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | |
| BULCSE4201 | Skill Enhancement Course-IV | - | - | 4 | 60 | 40 | 100 | 2 |
| **F** | | **Value Added Courses (VAC)** | | | | | | |
| - | - | - | - | - | - | - | - | - |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | |
| BCACCA4401 | Industrial Training Seminar-I | | | 2 | 60 | 40 | 100 | 1 |
| **Total** | | 18 | - | 12 | | | | **24** |
| **Total Teaching Hours** | | **30/30** | | | | | | |

**POORNIMA UNIVERSITY, JAIPUR**
**Faculty of Computer Science and Engineering**

**Name of Program: BCA (Common for all)** **Duration: 3 Years** **Total Credits: 135**

**Teaching Scheme for Batch 2025-28**

**Semester-V**

| Course Code | Name of Course | Teaching Scheme | | | Marks Distribution | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | IE | ESE | Total | |
| **A.** | | **Major (Core Courses)** | | | | | | |
| **A.1** | **Theory** | | | | | | | |
| BCACCA5101 | Design and Analysis of Algorithm | 3 | - | - | 40 | 60 | 100 | 3 |
| BCACCA5102 | Machine Learning for Image Classification: Recognizing Mudras in Indian Art and Healing Practices | 3 | - | - | 40 | 60 | 100 | 3 |
| **A.2** | **Practical** | | | | | | | |
| BCACCA5201 | Design and Analysis of Algorithm Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **B.** | | **Minor Stream Courses/ Department Electives** | | | | | | |
| **B.1** | **Theory** | | | | | | | |
| | Professional Elective - VII | 3 | - | - | 40 | 60 | 100 | 3 |
| | Professional Elective - VIII | 3 | - | - | 40 | 60 | 100 | 3 |
| | Professional Elective – IX | 3 | - | - | 40 | 60 | 100 | 3 |
| **B.2** | **Practical** | | | | | | | |
| | Professional Elective Lab – VII | - | - | 2 | 60 | 40 | 100 | 1 |
| | Professional Elective Lab – VIII | - | - | 2 | 60 | 40 | 100 | 1 |
| **C** | | **Multidisciplinary Courses** | | | | | | |
| | MOOC Course-IV | 1 | - | - | - | - | 100 | 2 |
| **D** | | **Ability Enhancement Courses (AEC)** | | | | | | |
| BUACHM5229 | Research Methodology Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **E** | | **Skill Enhancement Courses (SEC)** | | | | | | |
| BULCSE5201 | Skill Enhancement Course-V | 2 | - | - | 60 | 40 | 100 | 1 |
| **F** | | **Value Added Courses (VAC)** | | | | | | |
| BUVCVD5104 | Green Cloud and Edge Computing | 2 | - | - | 40 | 60 | 100 | 2 |
| **G** | | **Summer Internship / Research Project / Dissertation** | | | | | | |
| BCACCA5401 | Industrial Training Seminar-II | | | 2 | 60 | 40 | 100 | 1 |
| **Total** | | 18 | - | 12 | | | | **25** |

| Total Teaching Hours | 30/30 |
|---|---|

**POORNIMA UNIVERSITY, JAIPUR**
**Faculty of Computer Science and Engineering**

**Name of Program: BCA(Common for all)** **Duration: 3 Years** **Total Credits: 136**

**Teaching Scheme for Batch 2025-28**

**Semester-VI**

| Course Code | Name of Course | Teaching Scheme | | | Marks Distribution | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | IE | ESE | Total | |
| A. | | Major (Core Courses) | | | | | | |
| A.1 | Theory | | | | | | | |
| | NIL | - | - | - | - | - | - | - |
| A.2 | Practical | | | | | | | |
| | NIL | - | - | - | - | - | - | - |
| B. | | Minor Stream Courses/ Department Electives | | | | | | |
| B.1 | Theory | | | | | | | |
| | NIL | - | - | - | - | - | - | - |
| B.2 | Practical | | | | | | | |
| | NIL | - | - | - | - | - | - | - |
| C | | Multidisciplinary Courses | | | | | | |
| | NIL | - | - | - | - | - | - | - |
| D | | Ability Enhancement Courses (AEC) | | | | | | |
| | NIL | - | - | - | | | | |
| E | | Skill Enhancement Courses (SEC) | | | | | | |
| | NIL | - | - | - | - | - | - | - |
| F | | Value Added Courses (VAC) | | | | | | |
| | NIL | - | - | - | - | - | - | - |
| G | | Summer Internship / Research Project / Dissertation | | | | | | |
| BCACCA6301 | Major Project | | | 20 | 60 | 40 | 100 | 12 |
| Total | | | - | 20 | | | | 12 |
| Total Teaching Hours | | 20 | | | | | | |

# Professional Elective Courses

## Session 2025-2028

| | For General | | Artificial Intelligence and Data Science | | Cyber Security | | Mobile Application & Full Stack Development | | Artificial Intelligence and Machine Learning (SAS) | | Cloud Technology & DevOps | | Data Analytics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Code | Subject Name | Code | Subject Name | Code | Subject Name | Code | Subject Name | Code | Subject Name | Code | Subject Name | Code | Subject Name |
| Professional Elective –I | BCAECA1101 | Introduction of Emerging Tech | BASECA1101 | Introduction to AI & DS | BCYECA1101 | Fundamentals of Cyber Security | BMFECA1101 | Fundamentals of Mobile Application Development | BCLECA1101 | Base SAS Programming | BCTECA1101 | Fundamentals of Cloud Technology | BDAECA1101 | Introduction to Data Analytics |
| Professional Elective – II | BCAECA2101 | Linux Command Line Essentials for computing | BASECA2101 | Linux Command Line Essentials for AI&DS | BCYECA2101 | Linux Command Line Essentials for Cyber security | BMFECA2101 | Linux Command Line Essentials for Mobile Application | BCLECA2101 | Statistical Foundation for Machine Learning | BCTECA2101 | Linux Command Line Essentials for Cloud | BDAECA2101 | Linux Command Line Essentials for Data Analytics |
| Professional Elective Lab-II | BCAECA2201 | Project based Software Engineering Lab | BASECA2201 | Project based Computational Thinking and Data Science | BCYECA2201 | Project based Network Security & Defense analysis Lab | BMFECA2201 | Project based Mobile Application Development Using kotlin | BCLECA2201 | SAS Programming in Viya | BCTECA2201 | Project Based Azure Resources Management Lab | BDAECA2201 | Project based development in Data Analytics |
| Professional Elective-IV | BCAECA3101 | PHP Framework | BASECA3101 | R Programming | BCYECA3101 | Ethical Hacking | BMFECA3101 | Java Script Frame Work with Angular JS | BCLECA3201 | Application of Machine Learning Using SAS® Viya Lab | BCTECA3201 | Introduction to DevOps Lab | BDAECA3201 | Artificial Intelligence Lab |
| Professional Elective-V | BCAECA3201 | PHP Framework Lab | BASECA3201 | R Programming Lab | BCYECA3201 | Ethical Hacking Lab | BMFECA3201 | Java Script Frame Work with Angular JS Lab | BCLECA3201 | Application of Machine Learning Using SAS® Viya Lab | BCTECA3201 | Introduction to DevOps Lab | BDAECA3201 | Artificial Intelligence Lab |
| Professional Elective-VI | BCAECA4101 | Mobile Application Development | BASECA4101 | Natural Language Processing and Expert System | BCYECA4101 | Cyber Threat intelligence & Bug Bounting | BMFECA4101 | NOSQL database with MONGO DB | BCLECA4101 | Reinforcement Learning | BCTECA4201 | Cryptography and Cloud Security Lab | BDAECA4101 | Data Visualization |
| Professional Elective-VII | BCAECA4102 | Advanced Java Programming | BASECA4102 | Machine Learning | BCYECA4102 | Cyber Forensics | BMFECA4102 | Back Development with Node JS | BCLECA4102 | Advance Java Programming | BCTECA4102 | Cloud Web Services | BDAECA4102 | Machine Learning |
| Professional Elective-VIII | BCAECA4103 | IOT | BASECA4103 | Statistical Foundation of Data Science | BCYECA4103 | Application Security | BMFECA4103 | Introduction to Android Application Development | BCLECA4103 | Deep Learning Using SAS® Software | BCTECA4103 | Linux Server Administration | BDAECA4103 | Programming using R |
| Professional Elective-IX | BCAECA4201 | Mobile Application Development Lab | BASECA4201 | Natural Language Processing and Expert System Lab | BCYECA4201 | Cyber Threat intelligence & Bug Bounting Lab | BMFECA4201 | NOSQL database with MONGO DB Lab | BCLECA4201 | Reinforcement Learning Lab | BCTECA4201 | Cryptography and Cloud Security Lab | BDAECA4104 | Data Visualization Lab |
| Professional Elective-X | BCAECA4202 | Advanced Java Programming Lab | BASECA4202 | Machine Learning Lab | BCYECA4202 | Cyber Forensics Lab | BMFECA4202 | Back Development with Node JS Lab | BCLECA4202 | Neural Network: Essentials | BCTECA4202 | Cloud Web Services Lab | BDAECA4202 | Machine Learning Lab |
| Professional Elective-XI | BCAECA4203 | IOT Lab | BASECA4203 | Data Analytics using R Lab | BCYECA4203 | Application Security Lab | BMFECA4203 | Introduction to Android Application Development Lab | BCLECA4203 | Programming in R Lab | BCTECA4203 | Linux Server Administration Lab | BDAECA4203 | Programming using R Lab |
| Professional Elective-XII | BCAECA5101 | Introduction to Cloud Technology | BASECA5101 | Deep Learning & Computer Vision | BCYECA5101 | Cryptography and Network Security | BMFECA5101 | Advanced Android Application Development | BCLECA5101 | Optimization Concepts for Data Science and Artificial Intelligence | BCTECA5101 | Cloud Migration and Deployment | BDAECA5101 | Deep Learning |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Professional Elective-XIII | BCAECA5102 | Data Mining and Knowledge Management | BASECA5102 | EDA and Data Visualization | BCYECA5102 | Vulnerability Analysis and Penetration Testing | BMFECA5102 | Front End Development with React JS | BCLECA5102 | Python for Time Series Data Analysis | BCTECA5102 | Docker containers and Kubernets fundamentals / | BDAECA5102 | Data Ware house and data Mining / |
| Professional Elective-XIV | BCAECA5103 | Artificial Intelligence | BASECA5103 | Introduction to Gen AI & prompt Engineering | BCYECA5103 | Network Defense for Cyber Security | BMFECA5103 | Introduction to UI/UX | BCLECA5103 | Introduction to Generative AI | BCTECA5103 | Advanced Cloud Technology | BDAECA5103 | Cloud Data Analytics |
| Professional Elective-XV | BCAECA5201 | Advance web Technology Lab(Java Scrip, Angular JS, React JS and NodeJS | BASECA5201 | Deep Learning & Computer Vision Lab | BCYECA5201 | Network Defense for Cyber Security Lab | BMFECA5201 | Advanced Android Application Development Lab | BCLECA5201 | Forecasting Using Model Studio in SAS® Viya® Lab | BCTECA5201 | Cloud Migration and Deployment Lab | BDAECA5201 | Deep Learning Lab |
| Professional Elective-XVI | BCAECA5202 | Salesforce Lab | BASECA5202 | EDA and Data Visualization Lab | BCYECA5202 | Vulnerability Analysis and Penetration Testing Lab | BMFECA5202 | Front End Development with React JS Lab | BCLECA5202 | Python for Time Series Data Analysis Lab | BCLECA5202 | Docker containers and Kubernets fundamentals Lab | BDAECA5202 | Data Ware house and data Mining Lab |

**Comparison according to NEP Guidelines**

***TEP 8 Credit**

| | Broad Category of Course | Credit | |
|---|---|---|---|
| | | **As per NEP** | **PU-BCA** |
| 1 | Major (Core) | 60 | 62 |
| 2 | Minor Stream | 24 | 34 |
| 3 | Multidisciplinary | 09 | 8 |
| **4** | **Ability Enhancement Courses (AEC)** | 08 | 4 |
| 5 | Skill Enhancement Courses (SEC) | 09 | 6 |
| 6 | Value Added Courses common for all UG | 06-08 | 7 |
| 7 | Summer Internship | 02-04 | 2 |
| 8 | Research Project / Dissertation | 12 | 12 |
| | Total | 120 | 135 |

**Summary Year wise credit distribution: -**

| | | Major | Minor | MD | AEC | SEC | VAC | SI | Project | TEP | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I | Credit | 18 | 3 | 0 | 1 | 1 | 2 | | | | 25 |
| II | Credit | 15 | 4 | 2 | 1 | 1 | 1 | | | | 24 |
| III | Credit | 15 | 4 | 2 | 1 | 1 | 2 | | | | 25 |
| IV | Credit | 7 | 12 | 2 | 0 | 2 | | 1 | | | 24 |
| V | Credit | 7 | 11 | 2 | 1 | 1 | 2 | 1 | | | 25 |
| VI | Credit | 0 | 0 | 0 | 0 | 0 | | 0 | 12 | | 12 |
| | | 62 | 34 | 8 | 4 | 6 | 7 | 2 | 12 | 0 | 135 |

# Semester-I

# *Major (Core Courses) Theory*

| Code: BCACCA1101 | Programming Fundamentals of C | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Recall the fundamentals, syntax, and compilation process of the C language. |
| CO – 02 | Understand | Estimate the Data Types and Operations in C. |
| CO – 03 | Apply | Articulate flow control and decision-making structures in C.. |
| CO – 04 | Analyze | Appraise the use of Array and String with solve problems. |
| CO – 05 | Evaluate | To evaluate the C programs using pointers |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | - | 2 | - | - | - | - | - | 3 | - | - | - |
| **CO2** | 2 | 2 | 3 | - | 2 | - | - | - | - | - | 3 | - | 2 | - |
| **CO3** | 2 | 2 | 3 | - | 3 | 2 | - | - | - | - | 3 | - | - | - |
| **CO4** | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | 2 | - |
| **CO5** | 3 | 3 | 3 | 2 | 3 | 2 | - | 2 | - | - | 3 | - | 2 | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| **1.** | **Introduction to C Programming** | **06** |
| **2.** | **Data Types and Operators in C** | **06** |
| **3.** | **Decision Making & Looping** | **08** |
| **4.** | **Function, Array and Strings in C** | **08** |
| **5.** | **Advance Programming in C** | **08** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to C Programming** |
| | • Introduction of Unit<br>• Introduction to computer-based problem solving, Program design and implementation issues- Flowcharts & Algorithms.<br>• Types of Languages – Machine language, assembly language, high level languages, Assemblers, Compilers, Interpreters<br>• Setting Up C Development Environment<br>• C Hello World Program, Compiling a C Program: Behind the Scenes<br>• C Comments, Tokens in C, Identifier in C, Keywords in C.<br>• C Variables, Constants in C, Different Ways to Declare Variable as Constant in C<br>• Scope Rules in C, Internal Linkage and External Linkage in C, Global Variables in C.<br>• Conclusion & Real-Life Application |

| | |
|---|---|
| **2.** | **Data Types and Operators in C** |
| | • Introduction of Unit<br>• Data Types Data Types in C, Data Type Modifiers in C, Literals in C, Escape Sequence in C, Bool in C, Type Conversion in C.<br>• C Input/Output Basic Input and Output in C, Format Specifiers in C, printf in C, Scanf in C,Formatted and Unformatted Input and Output Functions.<br>• Operators in C, Arithmetic Operators in C, Unary Operators in C, Relational Operators in C<br>• Bitwise Operators in C, Logical Operators in C Assignment Operators in C<br>• Increment and Decrement Operators in C Conditional or Ternary Operato (?:) in C size of Operator in C, Operator Precedence and Associativity in C |
| **3.** | **Decision Making & Looping** |
| | • Introduction of Unit<br>• Decision-Making in C, C- if Statement<br>• C if…else Statement, C if-else-if Ladder<br>• Switch Statement in C, Using Range in switch case in C<br>• Loops in C<br>• while looping in C<br>• do…while Loop in C<br>• for versus while Loop<br>• continue Statement in C, break Statement in C, goto Statement in C.<br>• Conclusion of the Unit |
| **4.** | **Function, Array and Strings in C** |
| | • Introduction of Unit<br>• Functions-parameter passing, call by value and call by reference, calling functions with arrays, command line argument, recursion- basic concepts.<br>• C Arrays<br>• Properties of Array in C<br>• Multidimensional Arrays in C<br>• Initialization of Multidimensional Arrays in C |

| | |
|---|---|
| | • Strings in C<br>• An Array of Strings in C<br>• String Functions in C<br>• Conclusion of the Unit |
| **5.** | **Advance Programming in C** |
| | • Introduction of Unit.<br>• Pointers- The & and * operator, pointer expression, assignments, arithmetic, comparison, arrays of pointers, pointers to pointers, initializing pointers, pointers to functions, function retuning pointers.<br>• Structures- Basics, declaring and uses of Structure, typedef.<br>• Unions – Declaration, uses<br>• Enumerated data-types<br>• File Handling – The file pointer, file accessing functions-fopen, fclose, putc, getc, fprintf, reading and writing into a file<br>• Conclusion of the Unit. |

## E. RECOMMENDED STUDY MATERIAL

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Let us C, 6th Edition | Yashwant Kanitkar | 6 Edition | PBP Publication |
| 2. | The C programming Language | Richie and Kenninghan | 2004 | BPB Publication, |
| 3. | Programming in ANSI C 3rdEdition, 2005 | E.Balagurusamy | 3 Edition, 2005 | Programming in ANSI C |
| **Reference Book** | | | | |
| 1. | The C programming Language Richieand Kenninghan PBP Publication,2004 | | | |
| 2. | Programming in ANSI C 3rd Edition, 2005 BalaguruswmyTata McGraw Hill | | | |
| **Online Resources** | | | | |
| 1. | https://www.programiz.com/c-programming/examples | | | |
| 2. | https://www.w3resource.com/c-programming-exercises | | | |

| Code: BCACCA1102 | Introduction to Web Technology | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Recall the fundamental syntax and purpose of essential HTML tags, CSS properties, and basic JavaScript statements used in web page creation. |
| CO – 02 | Understand | Explain the roles of HTML, CSS, and JavaScript in client-side web development, and articulate the concept of the Document Object Model (DOM) and the CSS Box Model. |
| CO – 03 | Apply | Construct well-structured web pages using HTML5 semantic elements, apply various CSS styles for presentation and layout, and implement client-side interactivity using JavaScript. |
| CO – 04 | Analyze | Examine existing web page code to identify errors in HTML structure, CSS styling, or JavaScript logic, and differentiate between effective and inefficient approaches to web design and development. |
| CO – 05 | Evaluate | Assess the responsiveness, usability, and maintainability of simple web pages, and critique their compliance with basic web standards and best practices. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | - | 2 | - | - | - | - | - | 3 | 1 | - | |
| **CO2** | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | 3 | 1 | 2 | - |
| **CO3** | 3 | 2 | 3 | - | 3 | 2 | - | - | - | - | 3 | - | - | - |
| **CO4** | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | 3 | 3 | 2 | - |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | - | - | 2 | 1 | - | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| **1.** | **Foundations of HTML** | **07** |
| **2.** | **Advanced HTML & CSS Fundamentals** | **07** |
| **3.** | **Advanced CSS & Responsive Design** | **08** |
| **4.** | **JavaScript Fundamentals** | **08** |
| **5.** | **Document Object Model (DOM) & Web Data Formats** | **07** |

**B. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Foundations of HTML** |
| | • Introduction to Web Technologies: What is the World Wide Web? Web Browsers, Web Servers. Client-side vs. Server-side scripting (basic overview). Introduction to HTML, HTML Editors, Basic HTML Document Structure<br>• Text Formatting: Headings (<h1> to <h6>), Paragraphs (<p>), Line Breaks (<br>), Horizontal Rules (<hr>).<br>• Text Styling: Bold ( / <b>), Italic ( / <i>), Underline (<u>), Strikethrough (<s>), Superscript (<sup>), Subscript (<sub>).<br>• Quotations & Comments<br>• Semantic HTML5 Elements: Introduction to structural tags like <header>, <nav>, <main>, <section>, <article>, <aside>, <footer> (brief overview of their purpose).<br>• Lists & Tables |

| | |
|---|---|
| | • Hyperlinks & Multimedia: Creating hyperlinks (<a> tag), absolute vs. relative URLs, linking to external documents, internal sections (#), email links.<br>• Images: Inserting images (<img> tag), attributes (src, alt, width, height).<br>• Basic Block & Inline Elements: Understanding the difference ( vs. ).<br>• HTML ID and Class Attributes: Introduction to their use for styling and scripting.<br>• Conclusion of Unit |
| **2.** | **Advanced HTML & CSS Fundamentals** |
| | • HTML Forms, Form Elements, Input Attributes, Basic Form Validation<br>• Inline styles, Internal Styles, External Stylesheets<br>• CSS Selectors: Element, Class, ID, Grouping, Universal<br>• CSS Styling Properties: Colors & Backgrounds, Text & Fonts, Borders, Margins, Padding, Height/Width, Max-width, Display Property<br>• The CSS Box Model: Content, Padding, Border, Margin<br>• Conclusion of Unit |
| **3.** | **Advanced CSS & Responsive Design** |
| | • CSS Positioning & Layout: Positioning, Overflow Property, Floats, Basic Flexbox or Grid<br>• Advanced CSS Features: Lists & Tables Styling, Links Styling: Different states (a:link, a:visited, a:hover, a:active), CSS Text Effects & Shadows, Transitions & Transforms<br>• Introduction to Responsive Web Design: The Viewport Meta Tag, Media Queries (Basic): @media rule for simple responsiveness<br>• Fluid Layouts<br>• Image Gallery & Dropdown Menus<br>• Conclusion of Unit |
| **4.** | **JavaScript Fundamentals** |

| | |
|---|---|
| | • JavaScript Introduction: What is JavaScript? Its role in web development (client-side scripting). How to include JavaScript: Inline, Internal (<script> tag), External JavaScript Files (best practice). Basic Syntax, Statements, Comments.<br>• JavaScript Core Concepts: Variables: var, let, const. Data Types: Numbers, Strings, Booleans, Null, Undefined, Objects. Operators: Arithmetic, Assignment, Comparison, Logical. Control Flow: Conditional statements (if, else if, else), Switch statement. Loops: for loop, while loop, do...while loop, for...in / for...of<br>• Functions & Arrays: Functions: Defining and calling functions, parameters, return values. Arrays:<br>• Creating, accessing, and manipulating arrays. Common Array Methods: push(), pop(), length.<br>• Introduction to Objects & Classes: JavaScript Objects: Object literals, properties, methods. Basic Classes: Introduction to ES6 class syntax (conceptual, for basic understanding of object creation). ●<br>Conclusion of Unit |
| **5.** | **Document Object Model (DOM) & Web Data Formats** |
| | • The Document Object Model (DOM): What is the DOM?, Accessing DOM Elements<br>• Manipulating DOM Elements: Changing HTML content (innerHTML, textContent), Changing CSS styles<br>• (style property), Changing attributes (setAttribute(), getAttribute()), Creating and appending new elements, Removing elements.<br>• Handling Events: Event listeners (addEventListener), common events (click, mouseover, keydown, submit). |
| | • Introduction to XML: What is XML?<br>• Difference between HTML and XML: Focus on structure vs. display.<br>• XML Syntax: Elements, Attributes, Well-formed XML.<br>• XML Document Type Definition (DTD) & XML Schema (Conceptual): Briefly explain their role in defining XML structure.<br>• XML Parsers (Brief mention of SAX/DOM parsers): How XML data is read.<br>• XML DOM (Conceptual): How XML documents can also be accessed via the DOM.<br>• Conclusion of Unit |

**D. RECOMMENDED STUDY MATERIAL:**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| | | | | |

| | | | | |
|---|---|---|---|---|
| **1** | Practical Web Design for Absolute Beginners | AdrianW. West | 2016 | Apress 2016 |
| **2** | Introducing Web Development | Jorg Krause | 2017 | Apress2017 |
| **3** | HTML & CSS: The Complete Reference | Thomas Powell | 2010 Fifth Edition | McGrawHill |
| **Reference Book** | | | | |
| 1 | HTML and CSS: Design and Build Websites – byJon Duckett | | | |
| 2 | Head First HTML and CSS: A Learner's Guide to Creating Standards-Based Web Pages – byElisabeth Robson & Eric Freeman Publisher- ORELLY | | | |
| **Online Resources** | | | | |
| 1 | https://www.w3schools.com/html/html_links.asp | | | |
| 2 | https://www.tutorialrepublic.com/html-tutorial/html-links.php | | | |

| Code: BCACCA1103 | Introduction of Operating System | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Recognize the historical evolution and significance of operating systems in computing. |
| CO – 02 | Understand | Relating the process and how processes are synchronized and scheduled. |
| CO – 03 | Apply | Executing the different approaches to handle deadlocks |
| CO – 04 | Analyze | Integrating different approaches to memory management |
| CO – 05 | Evaluate | Reviewing the structure and organization of the file system. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 3 | - | - |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | 1 | - | - | 3 | 3 | - | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | - | - | 1 | - | - | 3 | 3 | - | - |
| **CO4** | 3 | 3 | 2 | 3 | 3 | - | - | 2 | - | - | 3 | 3 | - | - |
| **CO5** | 3 | 2 | 2 | 2 | 2 | - | - | 1 | - | - | 2 | 3 | - | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| **1** | **Operating System Overview** | **08** |
| **2** | **Process Management** | **08** |
| **3** | **Process Synchronization and Deadlocks** | **08** |
| **4** | **Memory Management** | **09** |
| **5** | **File Management** | **07** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Operating System Overview** |
| | • Introduction of Unit.<br>• Definition, Two views of operating system,<br>• Evolution of operating system, Types of OS (Batch, multiprogramming, Multitasking, Multiprocessing, Time-sharing, Distributed, Real-time OS).<br>• System Call, Handling System Calls, System Programs.<br>• Operating System Structures.<br>• Conclusion of Unit. |
| **2.** | **Process Management** |
| | • Introduction of Unit<br>• Process v/s Program, Process Attributes, Process State Diagram, Process Control Block.<br>• Process Scheduling: Goals, Multiprogramming Schedulingalgorithms (First-Come First-Served, Shortest Job First, Shortest Remaining Time Next).<br>• Interactive System Scheduling (Round-Robin Scheduling, PriorityScheduling).<br>• Threads, Thread v/s Process, User and Kernel Space Threads.<br>• Conclusion of Unit. |
| **3.** | **Process Synchronization and Deadlocks** |
| | • Introduction of Unit<br>• Inter Process Communication, Race Condition, Critical Section<br>• Implementing Mutual Exclusion: Mutual Exclusion with BusyWaiting<br>• Sleep and Wake-up, Semaphore.<br>• Introduction, Deadlock Characterization, Preempt able and Non-preempt able Resources<br>• Resource– Allocation Graph, Conditions for Deadlock.<br>• Handling Deadlocks: Ostrich Algorithm, Deadlock prevention, Deadlock Avoidance.<br>• Deadlock Detection (For Single and Multiple Resource Instances).<br>• Conclusion of Unit. |
| **4.** | **Memory Management** |

| | |
|---|---|
| | • Introduction of Unit<br>• Introduction to Mono-programming vs. Multiprogramming.<br>• Multiprogramming with fixed and variable partitions, Relocation and Protection.<br>• Memorymanagement (Bitmaps & Linked-list), Memory Allocation Strategies<br>• Virtual memory: Paging, Page Table, Page Table Structure, Handling Page Faults.<br>• Page Replacement Algorithms: FIFO, Second Chance, LRU, Optimal, LFU, Belady's Anomaly.<br>• Conclusion of Unit. |
| **5.** | **File Management** |
| | • Introduction of Unit<br>• File Overview: File Naming, File Structure, File Types, File Access, File Attributes, File Operations, Single Level, two Level and Hierarchical DirectorySystems, File System Layout.<br>• Implementing Files: Contiguous allocation, Linked List Allocation, Linked List<br>• Free Space Management: Bitmaps, Linked List.<br>• Conclusion of Unit. |

**E. RECOMMENDED STUDY MATERIAL**

| **S. No** | **Text Books:** | **Author** | **Edition** | **Publication** |
|---|---|---|---|---|
| 1 | Operating system concepts | Silberschatz, Galvin, Gagne | 8th edition | JohnWiley and Sons |
| 2 | Modern Operating System | A.S.Tanenbaum | 2nd Edition | Pearson |
| **Reference Books** | | | | |
| 1. | Operating Systems-S Halder, Alex A Aravind Pearson Education Second Edition 2016. | | | |
| **Online Resources** | | | | |
| 1. | https://www.coursera.org/courses?query=operating%20system | | | |
| 2. | https://hackr.io › tutorials › learn-operating-systems | | | |

| Code: BCACCA1104 | Fundamentals of Computers and Digital Systems | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Recall the fundamental concepts, components, and classifications of computer systems and peripheral devices. |
| CO – 02 | Understand | Explain different number systems and their conversions, and interpret binary arithmetic and data representations. |
| CO – 03 | Apply | Implement appropriate methods to represent, encode, and store various types of digital data in computer memory. |
| CO – 04 | Analyze | Analyze and construct combinational logic circuits using basic logic gates, truth tables, and digital components. |
| CO – 05 | Evaluate | Interpret system issues and determine appropriate hardware or software troubleshooting and maintenance strategies. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | 3 | - | - |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | 1 | - | - | 3 | 3 | - | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | - | - | 1 | - | - | 3 | 3 | - | - |
| **CO4** | 3 | 3 | 2 | 3 | 3 | - | - | 2 | - | - | 3 | 3 | - | - |
| **CO5** | 3 | 2 | 2 | 2 | 2 | - | - | 1 | - | - | 2 | 3 | - | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| **1** | **Introduction to Computers and Hardware Basics** | **08** |
| **2** | **Digital Number Systems** | **09** |
| **3** | **Logic Gates and Digital Circuits** | **09** |
| **4** | **Data Representation and Storage** | **08** |

| | | |
|---|---|---|
| 5 | **Basic Maintenance and Troubleshooting** | **09** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Computers and Hardware Basics** |
| | • Definition & Characteristics of computers<br>• Classification of computers<br>• Modern classification: servers, edge devices, IoT devices<br>• Input and Output Devices<br>• Advanced I/O devices: biometric sensors, VR headsets, speech recognition devices, touchscreen, stylus<br>• Introduction to cloud storage & NVM drives<br>• Processing Devices: CPU (ALU, CU, Registers)<br>• Clock Speed, Cores, GPU, TPU, Raspberry pi and Arduino.<br>**Module 1:** Identify major hardware components<br>**Module 2:** Practice assembling/disassembling system unit. |
| **2.** | **Digital Number Systems** |

| | |
|---|---|
| | • Introduction to Number Systems- Non-Positional Number System, Positional Number system<br>• Binary Arithmetic, Decimal, Binary, Octal, Hexadecimal Number Systems<br>• Number System Conversion<br>• Binary Addition, Subtraction, Multiplication, Division<br>• Signed and Unsigned Numbers: Representation of positive and negative numbers<br>• Nibble, Byte, and Word Concepts, Binary Coded Decimal (BCD)<br>• Introduction to Gray Code and Excess-3 Code.<br>**Module 1:** Practice number system conversions<br>**Module 2:** Implement binary arithmetic operations |
| **3.** | **Logic Gates and Digital Circuits** |
| | • Positive and Negative Logic<br>• Logic functions - NOT, AND, OR, NOR, XOR, EX NOR<br>• Truth tables<br>• Combinational Circuits: Half Adder & Full Adder (Design using Logic Gates)<br>• Multiplexers (MUX) & Demultiplexers (DEMUX) (Basic concepts and applications)<br>• Encoders & Decoders (Binary to Decimal, Priority Encoders)<br>**Module 1:** Simulate logic circuits using software.<br>**Module 2:** Design combinational circuits |
| **4.** | **Data Representation and Storage** |
| | • Data vs. information<br>• Types of data: Numeric, Text, Audio, Images, Video<br>• Representing Numeric Data: Integer Representation: Unsigned Integers, Signed Integers: Signed magnitude<br>• 1's complement, 2's complement<br>• Real Numbers: Fixed-point vs. floating-point representation<br>• ASCII, UNICODE (UTF-8/UTF-16)<br>• Memory Units and Storage Hierarchy: Bit, Byte, KB, MB, GB, TB<br>• Storage devices: Primary storage and Secondary storage.<br>• Storage pyramid: Registers, L1/L2 cache, RAM, SSD/HDD, Quantum data representation (qubits vs. bits).<br>**Module 1:** Convert ASCII values and visualize Unicode<br>**Module 2:** Represent integers and real numbers in memory |

| 5. | **Basic Maintenance and Troubleshooting** |
|---|---|
| | ● Importance of regular maintenance<br>● Types of maintenance: Preventive, Corrective, Predictive<br>● Tools for maintenance (hardware and software tools)<br>● Hardware Maintenance<br>● Software Maintenance<br>● No Power/Boot Failure (PSU, motherboard, RAM issues), OS Crashes/Freezes (Safe Mode, System Restore), Virus/Malware Removal, Slow performance (RAM usage, background processes)<br>● Network Connectivity Issues (IP config, router troubleshooting)<br>● Data Backup and Recovery<br>● Basic Networking Troubleshooting<br>**Module-1:** Perform virus scan, troubleshoot slow system<br>**Module-2:** Demonstrate simple network troubleshooting |

## RECOMMENDED STUDY MATERIAL

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1 | Fundamentals of Computers | V. Rajaraman | V. Rajaraman | PHI Learning |
| 2 | Digital Principles and Applications | Donald Leach, Albert Malvino | 8th | McGraw Hill |
| 3 | Computer Organization and Design | David A. Patterson, John L. Hennessy. | 5th | Morgan Kaufmann |
| 4 | Digital Fundamentals | Thomas L. Floyd | 11th | Pearson |
| **Reference Books** | | | | |
| 1. | **Computer Fundamentals** – P.K. Sinha | | | |
| 2. | **Digital Logic and Computer Design** – M. Morris Mano | | | |
| **Online Resources** | | | | |

| | |
|---|---|
| 1 | https://www.geeksforgeeks.org/fundamentals-of-computer/ |
| 2 | https://www.tutorialspoint.com/computer_fundamentals |
| 3 | https://nptel.ac.in/courses/106105163 |

| Code: BCACCA1105 | Software Engineering | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

On successful completion of the course the learner will be able to:

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO –01 | Remember | Gather and specify requirements of the software projects. |
| CO –02 | Understand | Analyze software requirements with existing tools. |
| CO –03 | Analyze | Differentiate different testing methodologies. |
| CO –04 | Apply | Apply the basic project management practices in real life projects. |
| CO –05 | Evaluate | Work in a team as well as independently on software projects |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 2 | - | 2 | - | - | - | 3 | 2 | - | - |
| CO2 | 3 | 3 | 2 | 2 | 3 | - | - | - | - | - | 3 | 2 | - | - |
| CO3 | 2 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | 2 | - | - |
| CO4 | 2 | 3 | 3 | 2 | 3 | 2 | - | - | - | - | 3 | 2 | 1 | - |
| CO5 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | - | - | - | 3 | 2 | 1 | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | Software Process Models | 8 |
| 2 | Software Design | 8 |
| 3 | Introduction to Software Testing | 10 |
| 4 | Software Quality Management | 8 |
| 5 | Software Project Management | 8 |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Software Process Models** |
| | • Introduction to Unit<br>• How to develop software?<br>• Different models - Waterfall model – Prototyping – evolutionary model- Spiral model– RAD model - Agile models: Extreme Programming, and Scrum-pros and cons of each model<br>• Requirements Analysis-Functional and Non-functional requirements,<br>• Software Requirement Specification (SRS)–Decision tables–Decision Trees<br>• Conclusion of the Unit |
| **2.** | **Software Design** |

| | |
|---|---|
| | • Introduction to Unit<br>• Overview of design process: High-level and detailed design<br>• Cohesion and Coupling Design Methodologies<br>• Function–Oriented software design: Structured Analysis using DFD Structured Design using Structure<br>• Architectural Design, Interface design, Component Level design<br>• Software Reuse and Software Maintenance issues<br>• Conclusion of the Unit |
| **3.** | **Introduction to Software Testing** |
| | • Coding, Code Review, documentation.<br>• Testing: - Unit testing, Black-box Testing, White-box testing,<br>• Cyclomatic complexity measure, coverage analysis, mutation testing,<br>• Debugging techniques, Integration testing, System testing,<br>• Regression testing.<br>• Conclusion of the Unit |
| **4.** | **Software Quality Management** |
| | • Introduction to Unit<br>• Overview of SQA Planning<br>• Software configuration management<br>• Study of ISO9000 &CMM<br>• Software reverse engineering<br>• Software reengineer<br>• Conclusion of the Unit |
| **5.** | **Software Project Management** |
| | • Introduction to Unit<br>• Various phases of Project Management –Planning– Organizing– Staffing– Directing and Controlling, Metrics for project size estimation<br>• Software Project Cost Estimation–COCOMO models<br>• Software Project Scheduling<br>• CASE tools: CASE definitions–CASE Classifications–<br>Analysis and Design Workbenches, Testing Workbenches |

| | |
|---|---|
| | • Conclusion of the Unit |

**E. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Fundamentals of Software Engineering, | RajibMall | PHI | 2018 |
| 2. | Software Engineering | I.Sommerville | Pearson Education | Asia |
| **Reference Book** | | | | |
| 1 | Software engineering, Roger S Pressman | | | |
| 2 | An Integrated Approach to Software Engineering, Pankaj Jalote | | | |
| **Online Resources** | | | | |
| 1 | https://www.javatpoint.com/software-engineering-tutorial | | | |
| 2 | https://www.geeksforgeeks.org/software-engineering/ | | | |
| 3 | https://www.tutorialandexample.com/software-engineering-tutorial | | | |

**PRACTICALS**

| Code: BCACCA1201 | Programming Fundamentals of C Lab | 1 Credit [LTP: 0-0-2] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Outcome |
|---|---|---|
| CO1 | Understand | Understand and apply basic programming concepts (Variables, I/O, Operators) |
| CO2 | Implement | Implement decision-making and loop-based logic |
| CO3 | Apply | Implement multi-dimensional arrays and advanced control structures Programs |
| CO4 | Analyze | Implement real time applications using the power of C language features. |
| CO5 | Evaluate | Overcome and solve possible errors during program execution. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | - | 2 | - | - | - | - | - | 3 | - | - | - |
| **CO2** | 2 | 2 | 3 | - | 2 | - | - | - | - | - | 3 | - | - | - |
| **CO3** | 2 | 2 | 3 | - | 3 | 2 | - | - | - | - | 3 | - | - | - |
| **CO4** | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | - | - |
| **CO5** | 3 | 3 | 3 | 2 | 3 | 2 | - | 2 | - | - | 3 | | - | - |

**C. LIST OF EXPERIMENTS:**

| | |
|---|---|
| **1** | Given the values of the variables x, y and z, write a program to rotate their values such that x has the value of y, y has the value of z, and z has the value of x |
| **2** | Write a program that reads a floating-point number and then displays the right-most digit of the integral part of the number. |
| **3** | Write a C program in which enter 10 elements by the user and perform the operation of sorting in ascending order |

| | |
|---|---|
| **4** | .Write a C Program to convert Decimal number to Binary number |
| **5** | Write a Program to find whether a year is leap or not. |
| **6** | Write a C program to perform the factorial of given number |
| **7** | Write a C program to calculate Fibonacci series of a given n number using recursion. |
| **8** | Find the sum of this series upto n terms 1+2+3+4+5+6+……. |
| **9** | Program to print Armstrong's numbers from 1 to 100. |
| **10** | Write a program to convert years into Minute, Hours, Days, Months, Seconds using switch () statements |

| | |
|---|---|
| **11** | Write a C program to perform Matrix addition and multiplication operations |
| **12** | Write a program to generate the various pattern of numbers |

**D. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Let us C | Yashwant Kanetkar | 6th Edition | PBP Publication |
| 2. | The C programming Language | Richie and Kenninghan | 2ndEdition 2004 | PBP Publication,2004 |
| 3. | Programming in ANSI C | E Balaguruswamy | 3rdEdition, 2005 | Tata McGraw Hill |
| **Reference Book** | | | | |
| 1. | The C programming Language by Richie and Kenninghan, PBP Publication,2004 | | | |
| 2. | Programming in ANSI C 3rd Edition, 2005 by E.Balagurusamy, Tata McGraw Hill | | | |
| **Online Resources** | | | | |
| 1. | https://www.programiz.com/c-programming/examples | | | |
| 2. | https://www.w3resource.com/c-programming-exercises | | | |

| Code: BCACCA1202 | Web Technology Lab | 1 Credit [LTP: 0-0-2] |
|---|---|---|

**A. COURSE OUTCOME**

**CO** **Cognitive Abilities** **OUTCOME**

| CO | Cognitive Abilities | Outcome |
|---|---|---|
| CO1 | Remember | Apply the principles of creating an effective web page, including an in-depth consideration of information architecture. |
| CO2 | Understand | Become familiar with graphic design principles that relate to web design and learn how to implement theories into practice. |
| CO3 | Apply | Develop skills in analyzing the usability of a web site. |
| CO4 | Analyze | Evaluate how to plan and conduct user research related to web usability. |
| CO5 | Evaluate | Learn the language of the web, HTML and CSS. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | - | - | 1 | 3 | 2 | - | - |
| CO2 | 3 | 2 | 2 | 1 | - | 1 | - | - | - | 1 | 2 | 1 | - | - |
| CO3 | 2 | 3 | 3 | 2 | - | 2 | - | - | - | 2 | 3 | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | - | 2 | - | - | - | 2 | 3 | 2 | - | - |
| CO5 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | - | - | 2 | 3 | 2 | - | - |

**C. LIST OF EXPERIMENTS**

| | |
|---|---|
| **1** | Create a web page using basic HTML features like tags, attributes, elements and page title. |
| **2** | Write a HTML program for demonstrating Hyperlinks.<br>a. Navigation from one page to another.<br>b. Navigation within the page |
| **3** | Design a basic page layout using HTML5 semantic elements (<header>, <nav>, <main>, |

| | |
|---|---|
| | <section>, <article>, <footer>) for content organization. |
| **4** | Write a HTML program to develop a static Registration Form. |
| **5** | **Create the following webpage**<br>a) Show the class time table in a tabular format.<br>b) Design a simple image gallery layout on a webpage using HTML elements<br>(e.g., lists or divs) and apply basic CSS for arrangement (e.g., float or display: inline-block). |
| **6** | Create a webpage using HTML for audio and video player. |
| **7** | Write HTML for demonstration of cascading style sheets.<br>a. Embedded stylesheets.<br>b. External stylesheets. c. Inline styles. |
| **8** | Write a JavaScript program to validate the USER LOGIN page. |

| | |
|---|---|
| **9** | Write a program for implementing XML documents for CUSTOMER DETAILS. |
| **10** | Write an internal Document Type Definition to validate XML for CUSTOMER DETAILS. |
| **11** | Write a JavaScript program to read data from a simple XML file (or a hardcoded XML string) and dynamically display its content on an HTML page using DOM |
| **12** | Develop a multi-page static website (e.g., a simple personal portfolio or product landing page) that integrates HTML5 structure, CSS styling, and basic JavaScript, demonstrating responsiveness using the Viewport meta tag and CSS Media Queries |

**D. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Practical Web Design for Absolute Beginners | Adrian W. West | 2016 | Apress 2016 |
| 2. | Introducing Web Development | Jorg Krause | 2017 | Apress2017 |
| 3. | HTML & CSS: The Complete Reference | Thomas Powell | 2010, Fifth Edition | McGraw-Hill |
| **Reference Book** | | | | |
| 1. | HTML and CSS: Design and Build Websites – by Jon Duckett | | | |
| 2. | Head First HTML and CSS: A Learner's Guide to Creating Standards-Based Web Pages – by Elisabeth Robson & Eric Freeman Publisher- ORELLY | | | |
| **Online Resources** | | | | |
| 1. | https://www.w3schools.com/html/html_links.asp | | | |
| 2. | https://www.tutorialrepublic.com/html-tutorial/html-links.php | | | |

| Code: BUVCVD1202 | Exploratory Project | 1 Credit [LTP: 0-0-2] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Outcome |
|---|---|---|
| CO1 | Remember | Prepare document in MS word using pictures and editing properly. |
| CO2 | Understand | Construct forms in MS. Word |
| CO3 | Apply | Protect a document from unauthorized access by assigning password |
| CO4 | Analyze | Prepare worksheet to keep records and how to use mathematical formula in same |
| CO5 | Evaluate | Present a Presentation using MS Power point |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | - | - | - | 3 | 2 | - | - |
| CO2 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | 3 | 2 | - | - |
| CO3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 3 | - | - | - |
| CO4 | 3 | - | 3 | 3 | - | 2 | 1 | 1 | - | - | 3 | - | - | - |
| CO5 | 2 | - | 3 | 2 | 3 | 2 | | 1 | - | - | 3 | 3 | - | - |

**C. LIST OF EXPERIMENTS:**

| | |
|---|---|
| 1 | **MS Word**<br>Prepare a document about any tourist destination of your choice with appropriate pictures and editing features. |

| | |
|---|---|
| **2** | **Create a Document consisting of Bio-data. It includes**<br>• A table giving your qualification and /or experience of work. Table should be Bordered and Shaded.<br>• A Multilevel list giving your areas of interest and further areas of interest. The sub areas should be numbered as 'a','b', etc while the area should be numbered as '1','2',etc.<br>• The information should be divided in —General‖ and —Academic‖ sections.<br>• The header should contain —BIO-DATA ‖while the footer should have page numbers in the format Page1of 10.<br>• Assign a password for the document to protect it from unauthorized access. |
| **3** | Assume that you are coordinating a seminar in your organization. Write a letter to 10 different IT companies asking them to participate in the seminar using mail merge facility. |
| **4** | Prepare a document which contains template of marks card of students. Assume that there are 10 students. The footer for the document should be 'Poornima University Jaipur'. |
| **5** | Prepare a document about any topic in mathematics which uses mathematical symbols. (At least 5 mathematical symbols should be used). Assign a password for the document to protect it from<br>unauthorized access. Demonstrate the use of Hyperlink Option. Sets margins to your document, a font of size and double-spaced document |

| | |
|---|---|
| **6** | **MS-Excel**<br>Open a new work book, save it as JavaCoffeeBar.xls. In sheet 1 write following sales data for Java Coffee bar to show their first 6 months sales.<br>• Select cell B4:D4 and change the horizontal alignment to center and text to 90degree.<br>• All titles should be in bold<br>• Format all cells numbers to currency style and adjust width as necessary.<br>• Add border to data. |
| **7** | Prepare a worksheet to maintain student information. The work sheet should Contain Roll Number, Name and marks in 5 subjects. (Max Marks is 100). Validate the marks. Calculate the total marks. Assign the grade according to the following. Assign grade 'A' if the total marks is above 450. From 401 to 449 assign the grade as 'B'. From 351 to 400 assign the Grade as 'C'. From 300 to 350 the grade to be assigned is 'D'. For the total marks less than 300 No grade is assigned. A student is eligible to get a grade only when he gets 40 and above in all the subjects.<br>In such cases the grade is—FAIL‖.(Assume<br>that there are 10 students) |
| **8** | Prepare a pay-bill using a worksheet. The work sheet should contain Employee Id, Name, Designation, |

| | |
|---|---|
| | Experience and Basic Salary and Job ID. If Job Id is 1 then DA is 40% of the basic salary. HRA is Rs. 4500. If Job Id is 2 then DA is 35% of the basic salary. HRA is Rs.3500. If Job Id is 3 then DA is 30% of the basic salary. HRA is Rs. 2500. If Job Id is 4 then DA is 25% of the basic salary and HRA is RS.2500. For all the other Job ids DA is 20% of the basic salary and HRA is Rs. 1500. For all the above Job ids PF to be deducted is 4%. For the job ids between1-4 Rs.100 to be deducted as Professional Tax. Find the netpay. |
| **9** | For the above employee worksheet perform the following operations<br>• Use filter to display the details of employees whose salary is greater than 10,000.<br>• Sort the employees on the basis of their net pay<br>• Use advance filter to display the details of employees whose designation is "Programmer‖ and Net Pay is greater than 20,000 with experience greater than 2yrs |
| **10** | Using Excel project, the Product sales for any five products for five years.<br>• Compute the total sales of each product in the five years.<br>• Compute the total sales of all the products in five years.<br>• Compute the total sales of all products for each year.<br>• Represent annual sale of all the products using Pie-Chart.<br>• Represent annual sales of all products using Bar Chart.<br>• Represent sale of a product for five years using Pie-Chart.<br>• Label and format the graphs |
| **11** | Create a statement of Telephone Bill Charge for a customer.<br>• Telephone Calls<br>• Up to150calls- free<br>• 151to500calls-0.80percall<br>• 501 to1000calls-1.00percall<br>• 1001to2000-1.25percall<br>• Above2000- 1.40percall |
| **12** | Perform Following:<br>• Using Excel write sales data with columns product, month and sales. Write at least 5 records. Create Pivot Table chart and Report for the data.<br>• Create a macro to change the name of worksheet as Macro Example, merge first three columns of first row and write heading as DATA in green color with yellow background<br>• Link word document in excel worksheet to show the usage of linking and embedding. |
| **13** | MS Power Point<br>Assume that you are going to give a presentation about Information Technology. (Choose some latest technologies). The presentation should have minimum 10 slides. Insert appropriate images wherever necessary. Use proper formatting, Diagrams and tables. Show the usage of action buttons, hyperlinks, and animations. |

# Professional Elective-I

| Code: BCAECA1101 | Introduction to Emerging Technology | 3 Credits [LTP:3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Recall the fundamental concepts of AI, Data Science, Cybersecurity, Cloud, Blockchain, and Android technologies. |
| CO – 02 | Understand | Explain various use-cases, tools, and frameworks related to emerging tech domains. |
| CO – 03 | Apply | Implement basic programs or simulations using relevant tools and platforms (e.g., Jupyter, Android Studio, Azure). |
| CO – 04 | Analyze | Analyze the components, architectures, and working principles of Cloud, Blockchain, and Android platforms. |
| CO – 05 | Evaluate | Evaluate the benefits, challenges, and applications of emerging technologies in real- world scenarios. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | 2 | 2 | 3 | 3 | - | - | 2 | 3 | 3- | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | 2 | - | - | - | - | 3 | - | - | - |
| CO3 | 3 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | 3 | - | - | - |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | - | - | 3 | 3 | - | - |
| CO5 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | 3 | - | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | Introduction to Artificial Intelligence and Data Science | 08 |
| 2 | Introduction to Cyber Security | 09 |

| | | |
|---|---|---|
| **3** | **Introduction to Cloud Computing** | **09** |
| **4** | **Introduction to Blockchain** | **08** |
| **5** | **Introduction to Android and Mobile technology** | **09** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Artificial Intelligence and Data Science** |
| | • Introduction to Artificial Intelligence (AI)<br>• Types of AI: Narrow, General, Super AI<br>• Applications of AI in various domains<br>• Introduction to Data Science and its life cycle<br>• Use of Python in AI & Data Science<br>• Tools and Libraries: Jupyter Notebook, Google Colab, Python<br>• Libraries: NumPy, Pandas, Matplotlib, Seaborn<br>• Introduction to Keras and TensorFlow frameworks |
| | **Module-1:** Explore Python basics using Jupyter Notebook or Google Colab<br>**Module-2:** Visualize data using Matplotlib and Seaborn |
| **2.** | **Introduction to Cyber Security** |
| | • Introduction to Cybersecurity and Importance<br>• Security Concepts: Threats, Vulnerabilities, Risks<br>• CIA Triad: Confidentiality, Integrity, Availability<br>• Types of Cyber Attacks: Malware, Phishing, Ransomware, DDoS<br>• Basics of Network Security: Firewalls, VPNs, IDS/IPS<br>• Introduction to Ethical Hacking and Cyber Ethics<br>• Overview of Indian Cyber Laws and IT Act 2000 |

| | |
|---|---|
| | **Module-1:** Identify phishing or malware attack samples (case-based)<br>**Module-2:** Demonstrate firewall setup or simulate a VPN connection |
| **3.** | **Introduction to Cloud Computing** |
| | • What is Cloud Computing and its Benefits<br>• Characteristics: On-demand, Elasticity, Resource Pooling<br>• Service Models: IaaS, PaaS, SaaS with examples<br>• Deployment Models: Public, Private, Hybrid, Community<br>• Introduction to Microsoft Azure<br>• Basic Azure Services: Virtual Machines, Blob Storage, Web Apps<br>• Use cases and real-world applications |
| | **Module-1:** Create and explore a free Microsoft Azure account<br>**Module-2:** Launch a Virtual Machine and explore Azure dashboard. |
| **4.** | **Introduction to Blockchain** |
| | • Basics of Blockchain and Distributed Ledger Technology (DLT)<br>• Components of Blockchain: Block, Hash, Miner, Node<br>• Hashing Techniques and Cryptography in Blockchain<br>• Consensus Mechanisms: Proof of Work, Proof of Stake<br>• Smart Contracts and Decentralized Applications (Dapps)<br>• Use-cases: Cryptocurrencies, Supply Chain, Voting, Healthcare<br>• Challenges: Scalability, Regulation, Energy consumption |
| | **Module-1:** Simulate block creation and chaining (conceptual demo)<br>**Module-2:** Explore Smart Contract deployment on Ethereum (video or guided walkthrough) |
| **5.** | **Introduction to Android and Mobile technology** |
| | • Introduction to Android OS, Features & Evolution<br>• Android Architecture: Libraries, Runtime, Framework, Applications<br>• Native vs Cross-platform Mobile Development<br>• Kotlin Programming Basics |

| | |
|---|---|
| | • Introduction to Flutter and Dart |
| | • Android Studio: Installation and Interface Walkthrough<br>• Key Components: Activity, Intents, UI Widgets, Layouts<br>**Module-1:** Install Android Studio and configure emulator/device<br>**Module-2:** Create a simple "Hello World" app in Android Studio |

**E. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Artificial Intelligence: A Modern Approach | Stuart Russell, Peter Norvig | 4th Edition, 2020 | Pearson |
| 2. | Cybersecurity for Beginners | Raef Meeuwisse | 2nd Edition, 2017 | Cyber Simplicity |
| 3 | Cloud Computing: Principles and Paradigms | Rajkumar Buyya et al. | 1st Edition, 2011 | Wiley |
| 4 | Mastering Blockchain | Imran Bashir | 3rd Edition, 2020 | Packt Publishing |
| 5 | Android Programming: The Big Nerd Ranch Guide | Bill Phillips, Chris Stewart | 4th Edition, 2021 | Big Nerd Ranch |
| 6 | Flutter for Beginners | Alessandro Biessek | 2nd Edition, 2021 | Packt Publishing |

| Reference Book | |
|---|---|
| 1 | *Artificial Intelligence: A Modern Approach* – Stuart Russell & Peter Norvig, 4th Ed., Pearson |
| 2 | *Data Science from Scratch – Joel Grus, 2nd Ed., O'Reilly* |
| 3 | *Cybersecurity for Beginners – Raef Meeuwisse, Cyber Simplicity* |
| 4 | *Network Security Essentials – William Stallings, Pearson* |
| 5 | *Cloud Computing: Concepts, Technology & Architecture – Thomas Erl, Prentice Hall* |

| | |
|---|---|
| 6 | *Cloud Computing: Principles and Paradigms – Rajkumar Buyya et al., Wiley* |
| 7 | *Mastering Blockchain – Imran Bashir, Packt Publishing* |
| 8 | *Blockchain Basics: A Non-Technical Introduction in 25 Steps – Daniel Drescher, Apress* |
| 9 | *Android Programming: The Big Nerd Ranch Guide – Bill Phillips, Chris Stewart, Big Nerd Ranch* |
| 10 | *Kotlin in Action – Dmitry Jemerov, Svetlana Isakova, Manning* |
| **Online Resources** | |
| 1 | https://www.datacamp.com/ |
| 2 | https://www.tableau.com/analytics/what-is-data-analytics |
| 3 | https://www.geeksforgeeks.org/data-analysis-tutorial/ |
| 4 | https://scikit-learn.org/ |
| 5 | https://www.tensorflow.org/tutorials |
| 6 | https://www.geeksforgeeks.org/cyber-security/ – Conceptual tutorials |
| 7 | https://www.nist.gov/cyberframework |
| 8 | https://www.ibm.com/topics/what-is-blockchain |
| 9 | https://blockgeeks.com/guides/what-is-blockchain-technology/ |
| 10 | https://developer.android.com/ |
| 11 | https://kotlinlang.org/docs/home.html |
| 12 | https://cloud.google.com/training |
| 13 | https://www.edx.org/learn/cloud-computing |
| 14 | https://www.geeksforgeeks.org/cyber-security/ |

| Code: BASECA1101 | Introduction to AI and DS | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Recall key concept of Artificial Intelligence, including its historical development and practical applications in intelligent agents and environments. |
| CO2 | Understand | Interpreting the effective solutions, encompassing various search strategies, heuristic functions, and memory-bounded approaches. |
| CO3 | Apply | Demonstrate the ability to design and implement intelligent systems in practical scenarios. |
| CO4 | Analyze | Evaluate the advanced topics in planning agents, including situation calculus, hierarchical decomposition, resource constraints, and conditional planning. |
| CO5 | Evaluate | Assess the effectiveness of learning models, decision trees, neural networks, belief networks, and reinforcement learning algorithms. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | 2 | 2 | 2 | 2 | - | - | 2 | - | 2 | - |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 3 | - | 2 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 2 | 2 | - | - | - | 3 | 1 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | - | 2 | - |
| **CO5** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | - | 3 | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| **1.** | **Introduction to Artificial Intelligence** | **07** |
| **2.** | **Problem solving by Search** | **08** |
| **3.** | **Knowledge and Reasoning** | **07** |

| | | |
|---|---|---|
| **4.** | **Machine Learning** | **07** |
| **5.** | **NLP and Deep Learning** | **07** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Artificial Intelligence** |
| | • Introduction to Intelligence<br>• Human vs. Machine Intelligence<br>• Defining Artificial Intelligence<br>• Scope of AI<br>• Understanding AI, ML, and Deep Learning<br>• Early History of AI<br>• AI applications in various industries<br>• Conclusion of the Unit |
| **2.** | **Problemsolving by Search** |
| | • Introduction of Unit<br>• Role of search in problem-solving and AI<br>• State Space Representation<br>• Types of Search Strategies<br>• Uninformed search strategies: Breadth-first search, Depth-first search, Uniform- cost search<br>• Informed Search Algorithms: Best-first search, Greedy best-first search, A* search, Hill climbing search, and AO Algorithm*<br>• Constraint Satisfaction Problems (CSP)<br>• Conclusion of the Unit |
| **3.** | **Knowledge and Reasoning** |
| | • Introduction to Building Base<br>• Introduction to Propositional Logic<br>• First Order Logic (FOL)<br>• Situation Calculus<br>• Theorem proving in FOL<br>• Planning partial order planning |

| | |
|---|---|
| | • Uncertain Knowledge and Reasoning<br>• Bayesian Networks<br>• Conclusion of the Unit |
| **4.** | **Machine Learning** |
| | • Introduction to Machine Learning<br>• Applications of Machine Learning<br>• Overview of Machine Learning Types<br>• Supervised Learning - Regression<br>• Supervised Learning - Classification<br>• Unsupervised Learning – Clustering<br>• Unsupervised Learning - Association<br>• Conclusion of the Unit |
| **5.** | **NLP and Deep Learning** |
| | • Introduction to Natural Language Processing (NLP)<br>• Basic NLP Techniques – Tokeniztion, Stemmingand Lemmatization<br>• Introduction to Neural Networks<br>• Perceptron and Multi-layer Perceptron<br>• Integrating NLP and Deep Learning<br>• Conclusion of the Unit |

## E. RECOMMENDED STUDY MATERIAL

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Artificial Intelligence: A Modern Approach | S. Russell and P. Norvig | Third Edition | Prentice Hall |
| 2. | Prolog: Programming for Artificial Intelligence | I. Bratko | Fourth | Addison-Wesley Educational Publishers |

| | | | | |
|---|---|---|---|---|
| | | | editi<br>on | Inc |

| **Reference Book** | |
|---|---|
| 1 | Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, M. Tim Jones. |
| 2 | The Quest for Artificial Intelligence, Cambridge University Press, Nils J. Nilsson.<br>Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, William F. Clocksin and Christopher S. Mellish. |

| **Online Resources** | |
|---|---|
| 1. | https://onlinecourses.nptel.ac.in/noc21_ge20/preview |
| 2. | https://www.coursera.org/learn/introduction-to-ai |
| 3. | https://www.javatpoint.com/artificial-intelligence-tutorial |

| Code: BCYECA1101 | Fundamentals of Cyber Security | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Remembering and Understanding the core concepts of Cyber Security, its principles and, the need for cybersecurity. |
| CO2 | Understand | Understand different cyber threats and vulnerabilities. |
| CO3 | Apply | Determine and Describe security mechanisms and best practices. |
| CO4 | Analyze | Understand legal and ethical aspects of cybersecurity. |
| CO5 | Evaluate | Utilize basic tools for cyber forensic investigations. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | 2 | 3 | 2 | - | - | - | 2 | 2 | - | - |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 3 | - | - | - | - | 3 | 3 | - | - |
| **CO3** | 3 | 2 | 2 | - | 3 | 2 | - | - | - | - | 2 | 3 | - | - |
| **CO4** | 3 | 2 | 3 | - | 3 | 2 | - | - | - | - | 3 | 3 | - | - |
| **CO5** | 3 | 3 | 3 | 2 | 3 | 3 | 2 | - | - | - | 3 | 2 | - | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| **1.** | **Introduction to Cyber Security** | **07** |
| **2.** | **Cyber Threats and Attacks** | **08** |
| **3.** | **Cybersecurity Mechanisms and Best Practices** | **08** |
| **4.** | **Cyber Laws and Ethics** | **07** |
| **5.** | **Digital Forensics and Tools: Case Studies** | **07** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Cyber Security** |
| | • Introduction of Unit<br>• Definition and Need for Cyber Security<br>• Key concepts: Confidentiality, Integrity, Availability (CIA Triad)<br>• Cybersecurity vs Information Security<br>• Types of Security: Network, Information, Endpoint, Application, Cloud<br>• Evolution of Cybersecurity<br>• Common Terms: Threats, Vulnerabilities, Risk, Exploits<br>• Conclusion of the Unit<br>***Learning Outcome:*** *Students will understand the basic concepts and scope of cybersecurity.* |

| | |
|---|---|
| **2.** | **Cyber Threats and Attacks** |
| | • Introduction of Unit<br>• Classification of Threats: Internal vs External, Passive vs Active<br>• Malware: Viruses, Worms, Trojans, Ransomware, Spyware<br>• Social Engineering Attacks: Phishing, Pretexting, Baiting<br>• Denial of Service (DoS) and Distributed Denial of Service (DDoS)<br>• Advanced Persistent Threats (APT)<br>• Case Studies of Recent High-Profile Cyber Attacks<br>• Conclusion of the Unit<br><br>***Learning Outcome:*** *Ability to recognize and categorize different types of cyber attacks and threats.* |
| **3.** | **Cyber security Mechanisms and Best Practices** |
| | • Introduction of Unit<br>• Authentication and Authorization Mechanisms<br>• Cryptography: Basics, Symmetric vs Asymmetric Encryption<br>• Network Security Protocols: HTTPS, SSL/TLS, VPN<br>• Firewalls and Intrusion Detection/Prevention Systems<br>• Security Policies and Password Management<br>• Safe Browsing and Email Security<br>• Security Awareness for End Users<br>• Conclusion of the Unit<br><br>***Learning Outcome:*** *Develop understanding of how to apply security practices in real-world scenarios.* |
| **4.** | **Cyber Laws and Ethics** |
| | • Introduction of Unit<br>• Introduction to Cyber Laws in India (IT Act 2000, and its Amendment in 2008): Important Sections- 3,5,43,46,47,66,67,69,72,79<br>• Digital Signatures and Cybercrime Offenses<br>• Ethical Hacking and Ethical Responsibilities |

| | |
|---|---|
| | • Legal Framework for Data Protection and Privacy (in respect to Bhartiya Sakshya Adhiniyam and Its Important Sections 65,67,69,72,79)<br>• Intellectual Property in Cyber World<br>• Conclusion of the Unit<br><br>***Learning Outcome:*** *Understand the legal and ethical framework governing cyber activities.* |
| **5.** | **Digital Forensics and Tools: Case Studies** |
| | • Introduction of Unit<br>• Basics of Digital Forensics: Need, Process and Types<br>• Incident Response and Handling<br>• Phases of Forensic Investigation: Collection, Preservation, Analysis, Reporting<br>• Overview of Forensic Imaging Tools<br>▪ **Hands-on Introduction to Tools:**<br>▪ Autopsy (GUI-based digital forensics platform)<br>▪ FTK Imager (Forensic Toolkit)<br>▪ Wireshark (Network traffic analyzer)<br>▪ Kali Linux Forensic Tools (Live boot) |

| 5. | **Digital Forensics and Tools: Case Studies** |
|---|---|
| | • Use Cases: Recovery of deleted files, Metadata extraction, Network traffic analysis<br><br>• Conclusion of Unit<br><br>***Learning Outcome:*** *Students will gain introductory hands-on experience with widely used digital forensic tools.* |

**E. RECOMMENDED STUDY MATERIAL**

| S.No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Cryptography and Network Security | William Stallings | Fourth Edition | McGraw Hill India, 2017 |
| 2. | Information security: Principles and Practice | Mark Stamp | Second Edition | John Wiley & Sons, Inc., 2011 |

| | Reference Book |
|---|---|
| 1. | Computer Security: Principles and Practice - William Stallings |
| 2. | Computer Security Fundamentals - Chuck Easttom |
| 3. | Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives - Nina Godbole & Sunit Belapure, |
| 4. | Guide to Computer Forensics and Investigations - Nelson, Phillips, Enfinger, Steuart, |

| | Online Resources |
|---|---|
| 1. | https://onlinecourses.swayam2.ac.in/nou19_cs08 |
| 2. | https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks |
| 3. | https://www.codecademy.com/learn/introduction-to-cybersecurity |
| 4. | https://www.cybrary.it/ – Free security courses |
| 5. | https://tryhackme.com/ – Cybersecurity challenges and labs |
| 6. | https://www.netacad.com/ – Introductory security modules |

| Code: BMFECA1101 | Fundamentals of Mobile Application Development | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO - 01 | Understand | Understand the fundamentals of mobile computing, evolution, Android architecture, and mobile app development tools. |
| CO – 02 | Apply | Identify various mobile platforms and set up development environments like Android Studio and Xcode. |
| CO – 03 | Analyze | Analyze Android application architecture and implement core components including activities, fragments, and intents. |
| CO – 04 | Create | Design interactive and effective user interfaces using UI layouts and control components. |
| CO - 05 | Evaluate | Integrate Firebase, apply testing techniques, and debug Android applications to ensure functionality and reliability. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | 1 | 2 | - | | | - | 2 | - | 2 |
| CO2 | 3 | 3 | - | 2 | 1 | 1 | - | - | - | - | - | 3 | - | 3 |
| CO3 | 2 | 3 | 3 | 3 | 3 | 1 | - | 2 | - | - | 3 | 2 | - | 3 |
| CO4 | 2 | 3 | 3 | 2 | 2 | 2 | - | 2 | - | - | 3 | 3 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 1 | 2 | 1 | - | - | 3 | 1 | 3 | 3 |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of the Unit | Time Required for the unit (Hours) |
|---|---|---|
| 1. | Introduction to Mobile Computing | 06 |
| 2. | Mobile Platform and Development Environment | 06 |
| 3. | Mobile Application Architecture | 08 |
| 4. | Basic UI Designs and Layouts | 08 |

| | | |
|---|---|---|
| **5.** | **Firebase connectivity, Testing and Debugging** | **08** |

**D. DETAILED SYLLABUS**

| UINTS | Unit Details |
|---|---|
| **1.** | **Introduction to Mobile Computing** |
| | • Overview of Mobile Computing<br>• Evolution of Mobile Devices and Application<br>• Introduction of Android Studio and Application |

| | |
|---|---|
| | • Why Android, importance of Mobile App Development<br>• Feature of Android, Android Architecture<br>• Android Application<br>• Difficulties in Mobile Development<br>• Basic Project Structure and components |
| | **Module-1** Install the Android studio in our System.<br>**Module-2** Make first hello screen in Android Studio. |
| **2.** | **Mobile Platform and Development Environment** |
| | • Types of Mobile App<br>• Types of Platforms<br>• Introduction to Major Mobile Platforms: iOS, Android, Windows<br>• Environment setup Java Development Kit (JDK), Android IDEs<br>• Setting-up Development Environment Android Studio, Xcode<br>• Manifest files<br>• . java, kt, XML files and differences<br>• Layouts |
| | **Module-3** Use the Drag and Drop method to make an attractive UI.<br>**Module-4** Use an Intent to a simple app. |
| **3.** | **Mobile Application Architecture** |
| | • Understanding Mobile App Architecture<br>• Component of mobile Applications (Activity, Services, Intents, Fragment, UI, Broadcast-Receivers)<br>• Activity life Cycle and Android Life Cycle<br>• Content Provider, view alert Dialogs<br>• Introduction to Model-view-Controller (MVC), and Model View-View Model (MVVM) Patterns. |
| | **Module-5** Use the different types of Layouts and make a simple Android Application. **Module-6** Use the Intent and Fragment make a simple application like Magine. |
| **4.** | **Basic UI Designs and Layouts** |
| | • Introduction to user Interface (UI) Design |

| | |
|---|---|
| | • Importance of UI in mobile application<br>• UI Layout, Types of Layouts - Linear layout, Relative layout, Table layout, Absolute layout, frame, List View, Grid View<br>• UI Control Component- Text view, Autocomplete Text view, Button, Image Button, Check Box, Toggle Button, Radio Button, Radio Group, Progress Bar, Spinner, Time Picker, Date Picker<br>• Principals of effective UI/UX Designs<br>• Layout Management (Linear Layout, Relative Layout, Constraint Layout)<br>**Module 7** – Make an attractive UI specific use of button image check box<br>**Module 8** – Make an UI using UI component like Date piker, Time Piker and Progress bar also. |
| **5.** | **Firebase connectivity, Testing and Debugging** |
| | • Introduction to Firebase, Importance, Why Firebase<br>• Steps to connect firebase<br>• Adding Firebase to android Applications<br>• Definition of Testing<br>• Types of Testing<br>• Importance of Testing in Mobile app Development<br>• Basic Testing Techniques (Unit Testing, UI Testing)<br>• Debugging Tools and Techniques, Handling Errors and Exceptions<br>**Module 9**- Make a project in Full Stack and using the Firebase in Android.<br>**Module 10**- Make E-Book Project using to store the view data in Firebase. |

**E. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Fundamentals of mobile computing | Prashant Kumar, Rajib | 2nd | PHI |
| 2. | Androidapp development by dummies. | Michael Burton | 1st | Wiley |
| 3. | Computer Science Engineering and Emerging Technologies | Rajeev Sobti, Rachit Garg | 2022 | CRC Press |
| **Reference Book** | | | | |
| 4. | **Handbook of Mobile Application development, Mohammad Sarrab, Naveen Safia, Bentham Books** | | | |
| **Online Resources** | | | | |
| 5. | https://www.geeksforgeeks.org/android-app-development-fundamentals-for-beginners/ | | | |
| 6. | https://developer.android.com/guide/components/fundamentals | | | |

| Code: BCLECA1101 | Base SAS Programming | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE CONTENTS:**

| CO | Cognitive Abilities | Course Outcome |
|---|---|---|
| CO - 01 | Remembering | Recall the SAS programming process. |
| CO – 02 | Applying | Implement SAS programming tools effectively. |
| CO – 03 | Applying | Implement and interpret SAS syntax correctly. |
| CO – 04 | Analyzing | Access and import data into SAS. |
| CO - 05 | evaluating | Explore, filter, format, and sort SAS data. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | 1 | 2 | - | - | - | 3 | - | - | - |
| CO2 | 3 | 2 | - | 3 | 3 | - | - | - | - | - | 3 | 2 | - | - |
| CO3 | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | 3 | 2 | - | - |
| CO4 | 3 | 3 | 2 | 3 | 3 | 1 | - | - | - | - | 3 | 3 | - | - |
| CO5 | 3 | 3 | 2 | 3 | 3 | 1 | 2 | - | - | - | 3 | 3 | - | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of the Unit | Time Required for the unit (Hours) |
|---|---|---|
| 1. | Essentials | 06 |
| 2. | Accessing Data | 06 |
| 3. | Exploring and Validating Data | 08 |
| 4. | Preparing Data | 08 |
| 5. | Analyzing and Reporting on Data | 08 |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Essentials** |
| | ● The SAS programming process.<br>● Using SAS programming tools.<br>● Understanding SAS syntax. |
| **2.** | **Accessing Data** |
| | ● Understanding SAS data.<br>● Accessing data through libraries.<br>● Importing data into SAS. |
| **3.** | **Exploring and Validating Data** |

| | |
|---|---|
| | • Exploring data.<br>• Filtering rows.<br>• Formatting columns.<br>• Sorting data and removing duplicates. |
| **4.** | **Preparing Data** |
| | • Reading and filtering data.<br>• Computing new columns.<br>• Conditional processing. |
| **5.** | **Analyzing and Reporting on Data** |
| | • Enhancing reports with titles, footnotes, and labels.<br>• Creating frequency reports.<br>• Creating summary statistics reports.<br>**Exporting Results**<br>• Exporting data.<br>• Exporting reports.<br>**Using SQL in SAS**<br>• Using Structured Query Language in SAS.<br>• Joining tables using SQL in SAS. |

| Code: BCTECA1101 | Fundamentals of Cloud Technology | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Learn the core concepts of the cloud computing paradigm |
| CO – 02 | Understand | Understand the underlying principles of Cloud Technology and various types of cloud Computing architecture and types. |
| CO – 03 | Apply | Learn to evaluate between different cloud solutions offered by various providers based on their merits and demerits. |
| CO – 04 | Analyze | Integrating the fundamental concepts in cloud infrastructures to understand the trade-offs in power, efficiency and cost. |
| CO – 05 | Evaluate | Access various cloud programming models and apply them to solve problems on the cloud |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | - | - | - | - | 1 | 2 | - | - | - | - | - | 2 | - |
| **CO2** | 3 | 2 | - | - | 1 | 1 | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 3 | 2 | - | 3 | 1 | | 2 | - | - | 2 | 2 | 3 | 1 |
| **CO4** | 2 | 3 | 3 | 2 | 2 | 2 | - | 2 | - | - | 3 | 2 | 3 | 1 |
| **CO5** | 2 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | - | - | 3 | 3 | 3 | 2 |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Fundamentals of Cloud Computing | 07 |
| 2. | Cloud Models | 08 |
| 3. | Cloud Service Model | 08 |

| | | |
|---|---|---|
| 4. | Virtualization in Cloud Computing | 07 |
| 5. | Cloud Service Provider | 07 |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Fundamentals of Cloud Computing** |
| | • Introduction of Unit<br>• Cloud Computing Basics – History of Cloud Computing, Characteristics of Cloud Computing, Need for Cloud computing, Advantages and Possible Disadvantages of cloud computing, Cloud Computing Architecture.<br>• Cloud Computing Services and Technologies-Virtualization, Types of Virtualizations, Service-Oriented Architecture (SOA), Grid Computing<br>• working of cloud computing work, Cloud Computing Applications<br>• Security Risks of Cloud Computing<br>• Conclusion of Unit |
| **2.** | **Cloud Models** |
| | • Introduction of Unit<br>• **Public Cloud**-Characteristics of Public Cloud, Advantages of Public Cloud, Disadvantages of Public Cloud<br>• **Private Cloud-**Characteristics of Public Cloud, Advantages of Public Cloud, Disadvantages of Public Cloud<br>• **Hybrid cloud -**Characteristics of Public Cloud, Advantages of Public Cloud, Disadvantages of Public Cloud<br>• **Community Cloud -**Characteristics of Public Cloud, Advantages of Public Cloud, Disadvantages of Public Cloud<br>• **Multi-Cloud-**Characteristics of Public Cloud, Advantages of Public Cloud, Disadvantages of Public Cloud<br>• Difference between public cloud, private cloud, hybrid cloud, and community cloud<br>• Conclusion of Unit |
| **3.** | **Cloud Service Model** |

| | |
|---|---|
| | • Introduction of Unit<br>• Introducing of service Model-IaaS, PaaS, SaaS<br>• Characteristics of IaaS, PaaS, SaaS<br>• Difference between IaaS, PaaS, and SaaS<br>• Advantages and disadvantages IaaS, PaaS, and SaaS<br>• Conclusion of Unit |
| **4.** | **Virtualization in Cloud Computing** |
| | • Introduction of Unit<br>• Concept behind the Virtualization<br>• Types of Virtualizations<br>• Virtualization work in cloud computing<br>• Virtualization- Data Virtualization, Hardware Virtualization, Software Virtualization, Server Virtualization, Storage Virtualization, OS Virtualization, Linux Virtualization, Windows Virtualization<br>• Conclusion of Unit |
| **5.** | **Cloud Service Provider** |
| | • Introduction of Unit<br>• Cloud Service Provider Companies<br>• Salesforce-services and tools discussion<br>• Amazon Web Services (AWS)- services and tools discussion<br>• Microsoft Azure-services and tools discussion<br>• Google Cloud platform-services and tools discussion<br>• Oracle cloud -services and tools discussion<br>• Conclusion of Unit |

**E. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Cloud computing a practical approach - | Anthony T.Velte<br>, TobyJ. Velte<br>Robert Elsenpeter, | Latest | TMH. |
| 2. | Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - | Michael Miller | 2008 | Que 2008 |
| **Reference Book** | | | | |
| 1 | Cloud computing for dummies- Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Wiley Publishing, Inc, 2010 | | | |
| 2 | Professional Mobile Application Development Jeff McWherter, Scott Pearson Education, 2012 | | | |
| **Online Resources** | | | | |
| 1. | https://www.edx.org/learn/cloud_computing | | | |

| Code: BDAECA1101 | Introduction to Data Analytics | 3Credits [LTP: 3-0-0] |
|---|---|---|

## A. COURSE OUTCOME

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO _ 01 | Remember | Identify key concepts of data, data types, and stages in data analytics. |
| CO _ 02 | Understand | Explain the data analytics lifecycle and the role of data wrangling and cleaning. |
| CO _ 03 | Apply | Use tools like Excel, Python (Pandas), and visualization platforms like Tableau. |
| CO _ 04 | Analyze | Examine datasets using descriptive statistics and visualization techniques. |
| CO _ 05 | Evaluate | Interpret results, evaluate insights, and communicate findings effectively. |

## B. MAPPING OF CO VS PO/PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | 1 | - | - | | | - | 2 | - | - |
| CO2 | 3 | 3 | - | 2 | 1 | 1 | - | - | - | - | - | 3 | - | - |
| CO3 | 2 | 3 | 3 | 3 | - | 1 | - | - | - | - | 3 | 2 | - | - |
| CO4 | 2 | - | - | 2 | - | 2 | - | - | - | - | 3 | 3 | - | - |
| CO5 | 3 | 3 | 2 | 3 | 3 | 1 | - | - | - | - | 3 | 1 | - | - |

## C. OUTLINE OF THE COURSE

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|

| | | |
|---|---|---|
| **1** | **Introduction to Data Analytics** | **07** |
| **2** | **Data Collection and Cleaning** | **09** |
| **3** | **Exploratory Data Analysis & Visualization** | **09** |
| **4** | **Tools and Techniques for Data Analytics** | **08** |
| **5** | **Case Studies and Practical Applications** | **09** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Data Analytics** |
| | • Introduction to Unit, what is Data Analytics?<br>• **Types of Data:** Structured, Semi-Structured, Unstructured.<br>• **Types of Analytics:** Descriptive, Diagnostic, Predictive, Prescriptive.<br>• **Data Analytics Lifecycle:** Discovery, Preparation, Modeling, Evaluation, Deployment.<br>• Difference between Data Analytics, Data Science, and Business Intelligence.<br>• **Skills for a Data Analyst**: Technical (Excel, SQL, Python), Analytical (thinking, problem-solving), Communication.<br>• Roles and Responsibilities of a Data Analyst.<br>• **Ethics and Responsibility in Analytics:** Data privacy, bias in data, responsible use. |
| **2.** | **Data Collection and Cleaning** |

| | |
|---|---|
| | • Introduction to Unit<br>• **Data Sources :** Internal (transaction logs, CRM), External (public datasets, APIs, web scraping).<br>• Primary vs. Secondary Data.<br>• **Data Formats :** CSV, Excel, JSON, SQL, XML.<br>• **Data Quality :** Accuracy, completeness, consistency, timeliness, validity.<br>• **Data Cleaning Steps :** Identifying and handling missing data, duplicate records,<br>• inconsistent formatting.<br>• **Data Wrangling :** Introduction to Pandas for reading files, exploring datasets (head(), info(),<br>• describe())<br>• **Data Integration :** Merging, joining datasets (basic operations in Python) |
| **3.** | **Exploratory Data Analysis & Visualization** |
| | • Introduction to Unit<br>• **Descriptive Statistics :** Measures of central tendency (mean, median, mode) , Measures of dispersion (range, variance, standard deviation), Distribution shapes (normal, skewed)<br>• **Data Summarization :** Frequency tables, cross-tabulation.<br>• **Univariate Analysis :** Analysis of single variable: histograms, box plots, bar charts.<br>• **Bivariate & Multivariate Analysis :** Scatter plots, correlation matrix, pair plots o Categorical vs numerical comparison (group by analysis)<br>• **Data Visualization Principles :** Choosing the right chart, avoiding misleading visuals.<br>• **Visualization Tools :** Excel: Charts, pivot tables, Python: matplotlib, seaborn basics (bar, pie, line, box, heatmap),Tableau/Power BI: Building simple dashboards. |
| **4.** | **Tools and Techniques for Data Analytics** |

| | |
|---|---|
| | • Introduction to Unit<br>• **MS Excel for Analytics:** Functions: VLOOKUP, IF, Pivot Tables, Data Validation, Charting and conditional formatting<br>• **Python for Data Analysis:** Basics of Python (variables, types, functions), Introduction to pandas: series, data frames, importing data<br>• **Overview of Analytical Libraries:** pandas, NumPy, matplotlib and seaborn.<br>• **Using Google Sheets:** Cloud-based collaboration, basic functions.<br>• **Introduction to SQL:** Simple SELECT, WHERE, GROUP BY, ORDER BY queries.<br>• **Overview of BI Tools**: Tableau / Power BI – Importing data, creating visual dashboards, filters, storyboards<br>• **Data Integration:** Merging, joining datasets (basic operations in Python) |
| **5.** | **Case Studies and Practical Applications** |
| | • Introduction to Unit<br>• **Case Study 1:** Retail Sales Data: - Analyzing monthly sales trends, customer segmentation<br>• **Case Study 2:** Healthcare Analytics: - Patient visit patterns, correlation of symptoms and diagnoses<br>• **Interpreting Insights: -** Drawing conclusions from data summaries and visualizations, Asking the right business questions<br>• **Data Visualization Principles:** Choosing the right chart, avoiding misleading visuals.<br>• **Communicating Results:** Writing simple analytical reports, Making data-driven recommendations.<br>• **Mini-Project:** Students choose a dataset (from Kaggle or UCI) , Perform EDA, clean data, generate visualizations, Present findings using a report or dashboard<br>• Ethical Issues in Real-World Analytics: Data ownership, misinformation, algorithmic bias. |

**E. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Data Analytics | Anil Maheshwari | 2023 | Mc Graw Hill |
| 2. | Data Analytics using Python | Bharti Motwani | 2020 | Wiley |

| Reference Book | |
|---|---|
| 1 | Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter : Wes McKinney: O Rielly, 2022 |
| **Online Resources** | |
| 1 | https://www.datacamp.com/ |
| 2 | https://www.tableau.com/analytics/what-is-data-analytics |

1ST SEMESTER

# Ability Enhancement Courses (AEC)

| Code: BEACHM1205 | Applied English Communication Skills- I | 1 Credit [LTP: 0-0-1] |
|---|---|---|

## *A. Course Outcome: -*

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Create | Develop critical and creative thinking by solving hypothetical problems using limited resources. |
| CO – 02 | Evaluate | Exhibit persuasive communication and reasoning in debates and decision-making tasks. |
| CO – 03 | Apply | Demonstrate collaboration and interpersonal skills through group-based storytelling and enactments. |
| CO – 04 | Apply | Enhance public speaking confidence through extempore and stage- based activities. |
| CO – 05 | Create | Present innovative ideas and concepts effectively in front of an audience. |

### B. CO, PO, PSO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 2 | 1 | - | | | 1 | 2 | 2 | | 3 | |
| CO2 | 1 | 2 | 1 | 2 | 3 | 1 | | | 3 | 3 | 1 | 2 | | |
| CO3 | 1 | | 3 | | 2 | | | | 3 | 2 | 2 | 1 | | |
| CO4 | | | | 2 | 2 | | | | 2 | 2 | | 2 | | 1 |
| CO5 | 2 | 3 | 1 | 2 | 2 | | | | 2 | 3 | 2 | 1 | 2 | |

### C. LIST OF EXPERIMENTS

| | |
|---|---|
| 1 | **Team vs Wild** – Scenario-based survival task emphasizing teamwork and critical thinking |
| 2 | **Who Gets the Heart?** – Ethical dilemma debate for persuasive speaking and reasoning. |
| 3 | **Debate** – Structured argumentative speaking to enhance critical thinking and leadership. |
| 4 | **Extempore** – Impromptu individual speeches to build spontaneity and stage confidence. |
| 5 | **Theatrix** – Paired roleplays to practice situational dialogues and collaborative speaking. |
| 6 | **Story Mason** – Group storytelling for stage interaction and creativity. |

| | |
|---|---|
| **7** | **Picture Connector** – Visual storytelling by linking images to construct and narrate a cohesive idea. |
| **8** | **Insane Inventor** – Solo presentation of imaginative products to foster innovation and clarity |
| **9** | **Shopping Roleplay** – Day-to-day dialogue practice in a simulated shopping scenario,<br>**Interpersonal Interaction Practice** – Real-life communication drills for fluent and functional English usage. |
| **10** | **Tourism Pitch** – Team-based promotion of a location to enhance descriptive and persuasive communication. |

1st SEMESTER Value Added Courses (VAC)

| Code: BUVCVE1101 | SWACHH BHARAT | 2 Credit [LTP: 2-0-0] |
|---|---|---|

A. **COURSE OUTCOME:**

| CO | Cognitive Abilities | Course Outcome |
|---|---|---|
| CO1 | Apply | Understand the developmental challenges with reference to sanitation infrastructure and practices |
| CO2 | Apply | Build values of cleanliness, hygiene and waste management in diverse socioeconomic contexts |
| CO3 | Apply | Understand planning of social policy and programs |
| CO4 | Apply | Use waste management techniques at community level |
| CO5 | Analyse | Instill a sense of service towards society and the Nation |

B. **MAPPING OF CO, PO AND PSO:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - |
| CO2 | - | - | - | - | - | - | - | 2 | - | 3 | - | - | - | - |
| CO3 | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - |
| CO4 | - | - | - | - | - | - | - | - | 2 | 3 | - | - | - | - |
| CO5 | - | - | - | - | - | - | - | 2 | 2 | 3 | - | - | - | - |

C. **OUTLINE OF THE COURSE**

| Unit No. | Title of the Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Introduction to Swachh Bharat Abhiyan | 7 |
| 2. | Swachh Bharat: Rural | 6 |
| 3. | Swachh Bharat: Urban | 6 |
| 4. | Prospects and Challenges | 6 |
| 5. | Suggested Activities: Activities to be Undertaken | 5 |

D. **DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Swachh Bharat Abhiyan** |
| | • Introduction of the Unit<br>• Gandhian philosophy of Cleanliness<br>• Swachh Bharat Abhiyan {SBA}<br>• Hygiene, Sanitation & Sustainable Waste Management<br>• Agencies and nodal Ministries for SBA<br>• Different phases of the SBA and its evaluation<br>• Citizens' Responsibilities: Role of Swacchagrahi Conclusion & Real-life applications<br>• Conclusion & Real-life applications |
| **2.** | **Swachh Bharat: Rural** |
| | • Introduction of the Unit<br>• Indicators for Swachh Bharat: Rural<br>i. Sanitation coverage across households (2014 vs. 2022)<br>ii. Open Defecation Free (ODF} Villages: Parameters<br>iii. ODF plus model: Key indicators<br>• Conclusion & Real life applications |
| **3.** | **Swachh Bharat: Urban** |
| | • Introduction of the Unit<br>• Indicators for Swachh Bharat: Urban<br>i. Sustainable sanitation<br>ii. Waste/water and solid waste management<br>iii. Garbage Free Cities<br>• Conclusion & Real-life applications |
| 4. | **Prospects and Challenges** |

| | |
|---|---|
| | • Introduction of the Unit<br>• Attitudes and Perceptions<br>• Operational and Financial issues<br>• Monitoring & Supervision<br>• Community Mobilization<br>• Conclusion & Real-life applications |
| 5. | **Suggested Activities: Activities to be Undertaken** |
| | • Introduction of the Unit<br>• Identify plastic and e-waste in and around the institution and suggest innovative technologies to minimize wastage<br>• Identify events/fests that generate maximum waste and ways to minimize it<br>• Visit canteen/shops and track the lifecycle of wet/dry waste in and around the institution and document the findings in the form of a Project Report<br>• Conduct interviews of stakeholders to understand the level of awareness<br>• Conduct a Clean Audit of the Institution and identify areas for action<br>• Conclusion & Real-life applications |

**A. RECOMMENDED STUDY MATERIAL:**

| Sr. No | Reference Book | Author | Edition | Publication |
|---|---|---|---|---|
| 1 | Swachh Bharat Mission (Grameen) | Department of Drinking Water and Sanitation, Ministry of Jal shakti | 2020 | G. O. I. |
| 2. | Guidelines for Swachh Bharat Mission - Urban | Ministry of Housing and Urban Affairs, Government of India | 2017 | MoHUA |

# 1st SEMESTER
# Skill Enhancement Courses
# (SEC)

| Code: BELCSE1201 | Skill Enhancement Course | 1 Credit [LTP: 0-0-2] |
|---|---|---|

**FACE Domain: Soft Skills 1**

**Course Name: Communication and Workplace Readiness**

Applicable for BTech and BCA (Batch 2029 and 2028)

**COURSE OUTCOMES: On completion of the course a student will be able to:**

- Demonstrate effective communication skills through the use of appropriate body language, email etiquette, and
- impression management in academic and professional settings.
- Apply goal setting, habit formation, and time management strategies to enhance personal productivity and
- academic success.
- Collaborate efficiently in teams by understanding team dynamics, sharing responsibilities, and achieving
- common goals.
- Construct grammatically correct and contextually appropriate sentences using correct tenses, sentence structures,
- speech forms, and punctuation.
- Enhance language fluency and expression using idioms, phrasal verbs, collocations, gerunds, and infinitives in
- both written and spoken communication.

**DETAILED SYLLABUS**

| S.NO. | Topic | Sub-Topics |
|---|---|---|
| 1. | Body Language and Professionalism | Understanding body language helps students communicate more effectively and professionally. This skill enhances their ability to build trust, make positive impressions, and navigate workplace environments with confidence. |
| 2. | Habit Formation | By understanding how habits are formed, students can create positive routines that boost productivity and success. This topic empowers them to adopt habits that support their personal and academic growth, while also learning how to break negative habits |
| 3. | Goal Setting | Goal setting helps students stay focused and motivated. By teaching them to set clear, achievable goals, we ensure they have a roadmap for success, whether in their education, career, or personal life. |
| 4. | Impression Management | Impression management enables students to present themselves effectively in various social and professional settings. This skill is vital for building strong professional relationships, gaining trust, and achieving career success. |
| 5. | Team Building | Team building helps students understand the dynamics of effective collaboration. This topic teaches them how to work together, share responsibilities, and achieve common goals, which are essential skills in almost every workplace. |

| | | |
|---|---|---|
| 6. | Time Management | Time management skills are essential for students to balance academic workloads, personal life, and professional responsibilities. By teaching them how to prioritize tasks and manage their time effectively, we help them reduce stress and increase productivity. |
| 7. | Email Writing | Helps participants write clear and professional emails with the right tone and structure. Covers greetings, body, closings, and common errors to avoid. Includes real-life practice for confident workplace communication. |
| 8. | Classification of sentences | Learning different types of sentence and their application help one to choose appropriate sentence for appropriate function |
| 9. | Tenses | Tense is the skeleton of English language and proper usage of tense forms ensures proper meaning conveyed. |
| 10. | Forms and Speech and Voice | Use of direct and indirect speech is essential for speaking ability in English. Voices help in writing convincing and diplomatic sentence/paragraphs. |
| 11. | Idioms and Phrasal Verbs | Idioms add flavour and richness to the English language. The author/speakers will sound savvy if idioms and phrasal verbs are appropriately used |
| 12. | Collocations, Gerund and Infinitives | Company of words are called collocations and proper use of collocations brings finesse in one's language. Gerund and infinitives usage helps fine-tune one's language |
| 13. | Punctuations | Improper punctuations in written scripts convey meanings different than the intended one. Writing ability is greatly enhanced by proper usage of punctuations. |

Semester-II

# MAJOR (CORE COURSE

| Code: BCACSA2101 | Basic of Mathematics | 3 Credit [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Understand | Understand basic set theory concepts and operations to solve mathematical and real-life problems using logical reasoning. |
| CO – 02 | Apply | Perform basic matrix operations including addition, subtraction, scalar multiplication, matrix multiplication, and compute the adjoint and inverse of matrices. |
| CO – 03 | Apply | Apply and Understanding the concept of determinants, compute minors and cofactors, and apply properties of determinants to solve mathematical problems. |
| CO – 04 | Understand | Solve and interpret linear equations in one and two variables using appropriate algebraic and graphical methods. |
| CO – 05 | Apply | Apply and understand the fundamental of graph theory and their representation, solve real world problem using graph-based model. |

**B. MAPPING OF CO VS PO/PSO**

| A. | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | 2 | | - | - | - | - | - | 3 | - | - | - |
| CO2 | 3 | 2 | - | 2 | 2 | - | - | - | - | - | 3 | - | - | 2 |
| CO3 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | 3 | - | - | 2 |
| CO4 | 2 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 3 | - | 3 | 2 |
| CO5 | 2 | 3 | 3 | 2 | 3 | - | - | - | - | 2 | 3 | - | 3 | 3 |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Sets | 9 |
| 2. | Matrices | 9 |
| 3. | Determinants | 9 |

| | | |
|---|---|---|
| **4.** | **Linear Equations** | **9** |
| **5.** | **Graph Theory** | **9** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Sets** |
| | • Introduction of the Unit<br>• Sets, Subsets, Equal Sets Universal Sets<br>• Finite and Infinite Sets, and Empty sets, Operation on Sets<br>• Union, Intersection and Complements of Sets<br>• Venn Diagram and their applications<br>• Conclusion of the unit |
| **2.** | **Matrices** |

| | |
|---|---|
| | • Introduction of the Unit<br>• Definition, Types of Matrices, Addition, Subtraction,<br>• Scalar Multiplication<br>• Multiplication of Matrices<br>• Adjoint, Inverse of Matrix<br>• Conclusion of the unit |
| **3.** | **Determinants** |
| | • Introduction of the Unit<br>• Determinants: Definition<br>• Minors, Cofactors<br>• Properties of Determinants<br>• Conclusion of the unit |
| **4.** | **Linear Equations** |
| | • Introduction of the Unit<br>• Linear Equations<br>• One variable Linear Equation<br>• Two Variables Linear Equation<br>• Solution of a Linear Equation<br>• Conclusion of the unit. |
| **5.** | **Graph Theory** |
| | • Introduction of the Unit<br>• Introduction to Graphs (Vertices, Edges, Degrees)<br>• Types of graphs: Directed, Undirected, Weighted, Simple, Multi Graph<br>• Representation of Graphs: Adjacency Matric and Adjacency List<br>• Paths, Wakes, Trails, and Cycles<br>• Special Graphs: Complete, Null, Bipartite, Star and Regular graph<br>• Conclusion of the unit |

**RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Matrices and Determinants | R.D. Sharma | Latest | Dhanpat Rai Publications |
| 2. | Modern Algebra | H.K. Pathak | Latest | Krishna Prakashan Mandir |
| 3. | A Textbook of Class XI/XII Mathematics (for Sets, Functions, Linear Equations) | R.S. Aggarwal | Latest | Bharti Bhawan Publishers |

| | | | | |
|---|---|---|---|---|
| 4. | Fundamentals of Mathematics | M.L. Aggarwal | Latest | Arya Publications |
| 5. | Graph Theory with application to engineering and computer science | Nursing Deo | Latest | PHI Learning India |

| Code: BCACCA2101 | Computer Networks | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

On successful completion of the course the learner will be able to:

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Recall fundamental principles of networking, including network types, devices, topologies, and transmission media, facilitating basic network analysis and troubleshooting. |
| CO2 | Understand | Interpret and comprehend key protocols at the Presentation and Application Layers, and fostering a solid understanding of their functions and support within networked environments. |
| CO3 | Apply | Implement Transport Layer protocols (TCP, UDP), Network Layer protocols (IP), as well as basic concepts of routing and switching. |
| CO4 | Analyze | Break-down and deduce the concepts of Data Link Layer principles along with understanding error detection and correction protocols and wireless security protocols for effective network analysis and implementation. |
| CO5 | Evaluate | Assess and dissect the WAN concepts, switching techniques, and various methods of internet and LAN connectivity, enabling them to design and deploy efficient network infrastructures. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | 1 | - | 2 | - | - | - | 1 | 2 | - | - |
| **CO2** | 3 | 2 | 2 | 1 | 1 | - | - | - | - | - | 1 | 2 | - | - |
| **CO3** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 1 | 2 | - | - |
| **CO4** | 3 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | 1 | 3 | - | - |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | 1 | 3 | - | - |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| **1.** | **Networking Fundamentals & Internet** | **09** |
| **2.** | **Basics Presentation &Application Layer** | **07** |

| | | |
|---|---|---|
| **3.** | **Basics of Transport layer &Network, Layer** | **08** |
| **4.** | **Basics of Data Link Layer** | **07** |
| **5.** | **Basics of WAN Technology** | **07** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Networking Fundamentals & Internet** |
| | • Introduction to Computer Networks:<br>• Definition of a computer network, Benefits of networking<br>• Types of Networks- (LAN, MAN, WAN, PAN), Need of networking, Application of computer networks<br>• Network Topologies- (Bus, Ring, Star, Mesh, Hybrid), Advantages and Disadvantages of Each Topology<br>• Networking Devices- (Hub, Switch, Router, Bridge, Gateway, Modem), Functions and Differences between these devices<br>• Transmission Media- Guided Media: (Twisted pair cable (UTP, STP), Coaxial Cable, Optical Fiber), Unguided Media: (Radio Waves, Microwaves, Infrared),<br>• Communication Modes & its types |
| | • Introduction to the Internet: - What is the Internet, History and Evolution of the Internet, Uses of the Internet. |
| **2.** | **Basics Presentation & Application Layer** |
| | • Introduction of OSI Model and TCP/IP model, Comparison between OSI model & TCP/IP model<br>• Presentation Layer Protocol- TLS, SSL, MIME<br>• Introduction of Application layer, Function and Support<br>• Application Layer Protocols: DHCP, DNS, HTTP/HTTPS, FTP, TFTP, SFTP, Telnet,<br>• Email: SMTP, POP3/IMAP, NTP<br>• Conclusion & Real-life Application |
| **3.** | **Basics of Transport layer &Network, Layer** |

| | |
|---|---|
| | • Introduction of Transport Layer<br>• Transport Layer: Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets<br>• Introduction of Network Layer<br>• Internet Protocol (IP), IP Versions, IP Functions, IP v4 Datagram Format, IPv4 addressing, IPv4 address Classes, IPv4 Address types, Subnet Mask and subnetting,<br>• IPv6 address, Types of IPv6 address,<br>• Data Encapsulation,<br>• Routing and Switching concepts<br>• Conclusion & Real-Life Application |
| **4.** | **Basics of Data Link Layer** |
| | • Introduction of Data Link Layer<br>• Application Of Data Link Layer: Framing and Error detection and correction<br>• Protocol: Stop and Wait Protocol, Sliding Window Protocol, Go-Back-N Protocol, Channel Allocation Problem<br>• Multiple Access Protocol: ALOHA, Carrier sense multiple access protocol.<br>• Wireless Networking, Types of Wireless Networks: Ad-hoc mode, Infrastructure mode, Wireless LAN standards: IEEE 802.11.a, IEEE802.11b<br>Conclusion & Real-Life Application |
| **5.** | **Basics of WAN Technology** |
| | • What is a WAN?<br>• WAN Switching, WAN Switching Techniques Circuit switching, Packet switching etc., Casting types.<br>• Connecting to the Internet: PSTN, ISDN, DSL, CATV, Satellite-Based Services, Last Mile Fiber, Cellular Technologies<br>• Connecting LAN: Leased Lines, SONET/SDH, Packet Switching,<br>• Remote Access: Dial-up Remote Access, Virtual LAN, Virtual Private Networking<br>• Conclusion & Real-Life Application |

**E. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| **1.** | Computer Network | AndrewS. Tanenbaum | 2013 | Pearson |
| **2.** | Computer Networking: Top Down Approach | Kurose. Ross | 2017 | Pearson |
| **Reference Book** | | | | |
| 1. | Networking All in One – Doug Lowe 7th edition Publisher- Wiley | | | |
| **Online Resources** | | | | |
| 1. | https://www.edx.org/learn/computer-networking | | | |
| 2. | https://www.youtube.com/watch?v=VwN91x5i25g | | | |

| Code: BCACCA2102 | Python Programming | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

On successful completion of the course the learner will be able to:

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Recall and identify basic Python syntax, including data types, variables, and operators. |
| CO – 02 | Understand | Demonstrate an understand the concept of Decision making in python, Control statements and loop manipulation and how it is implemented in Python. |
| CO – 03 | Apply | Put the different Python Packages like pandas, NumPy, matplot, SciPy along with lists, tuple, set and dictionary and how it is imported in the python notebook. |
| CO – 04 | Analyze | Evaluate and examine object-oriented design principles to create well-structured Python classes and objects. |
| CO – 05 | Evaluate | How to Handle files in python and also evaluate the efficiency and performance of different approaches to solving a programming problem in Python |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | - | - | - | 2 | - | - | - | 3 | 2 | 2 | 1 |
| CO2 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | 3 | 2 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | - | - | - | 3 | 2 | 3 | 2 |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1 | Introduction to Python Programming | 07 |
| 2 | Python Operators and Control Flow statements | 09 |
| 3 | Data Structures, Python Functions and Packages | 09 |
| 4 | Object Oriented Programming | 08 |
| 5 | File I/O Handling and Exception Handling | 09 |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Python Programming** |
| | • Introduction to Unit<br>• What is Python,<br>• Uses of Python Programming Language / Python Applications<br>• Features of Python Programming Language<br>• Python-2 and Python-3 differences<br>• Python environment setup — Installation and working of IDE<br>• Running Simple Python scripts to display 'welcome' message.<br>• Python Data Types: Numbers, String, Tuples, Lists, Dictionary. Declaration and use of data types<br>• Python building blocks — Identifiers, Keywords, Indention, Variables, Comments<br>• Conclusion of unit |
| **2.** | **Python Operators and Control Flow statements** |
| | • Introduction to Unit<br>• Basic Operators: Arithmetic, Comparison/ Relational, Assignment, Logical, Bitwise, Membership, Identity operators, Python Operator Precedence<br>• Control Flow:<br>• Conditional Statements (if, if ... else, nested if)<br>• Looping in python (while loop, for loop, nested loops)<br>• loop manipulation using continue, pass, break, else.<br>• . Conclusion of Unit |
| **3.** | **Data Structures, Python Functions and Packages** |
| | • Introduction to Unit<br>• Lists, Tuple, Sets, Dictionaries<br>• String and Slicing<br>• Use of Python built User defined functions and its types<br>• Command-line Arguments<br>• Python Packages: Introduction, Writing Python packages |

| | |
|---|---|
| | • Using standard packages (e.g. math, SciPy, NumPy, matplotlib, pandas etc.)<br>• User defined packages<br>• Conclusion of Unit |
| **4.** | **Object Oriented Programming** |
| | • Introduction of Unit<br>• Creating Classes and Objects<br>• Inheritance<br>• Method Overloading and Overriding<br>• Data Hiding<br>• Data abstraction, Abstract classes<br>• Types of Methods: Instance Methods, Static Methods, Class Methods<br>• Accessing attributes, Built-In Class Attributes<br>• Destroying Objects<br>• Conclusion of Unit |
| **5.** | **File I/O Handling and Exception Handling** |
| | • Introduction of Unit<br>• Types of Files<br>• File Objects, File Built-in Function, File Built-in Methods<br>• File Built-in Attributes<br>• Read/write operations Reading Text<br>• Errors in Python: Compile-Time Errors, Runtime Errors, Logical Errors<br>• What is Exception?<br>• try…. except…else, try-finally clause<br>• Regular expressions<br>• Conclusion of Unit |

**E. RECOMMENDED STUDY MATERIAL**

| S.No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1 | Python Programming: Using Problem Solving Approach | Reema Thareja | 2nd Edition | Oxford University Press |
| 2 | Python Crash Course, 3rd Edition: A Hands-On, Project-Based Introduction to Programming | Eric Matthes | 3rd Edition | No Starch Press |
| 3 | Ultimate Python Programming | Deepali Srivastava | 2024 | Green Tea Press / O'Reilly |
| **Reference Book** | | | | |
| 1 | Learning Python Lutz, Mark O Rielly, 2009 | | | |
| **Online Resources** | | | | |
| **1** | https://docs.python.org/3/ | | | |
| **2** | https://www.geeksforgeeks.org/python-programming-language/ | | | |
| **3** | https://realpython.com/ | | | |
| **4** | https://www.youtube.com/playlist?list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3 | | | |

| Code: BCACCA2103 | Software Project Management | 3 Credits [LTP: 3-0-0] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Recall foundational concepts of software project management including scope, process, and roles. |
| CO – 02 | Understand | Explain software process models, measurement techniques, and risk analysis approaches. |
| CO – 03 | Apply | Apply project planning and estimation techniques to real-world software projects. |
| CO – 04 | Analyze | Analyze project risks, scheduling issues, and quality assurance needs. |
| CO – 05 | Evaluate | Evaluate software project outcomes using metrics, estimation models, and performance indicators. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | - | - | - | - | - | - | - | 3 | - | - | - | 2 |
| **CO2** | 3 | 2 | 2 | 2 | - | - | - | - | - | 3 | 2 | - | - | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 2 | - | - | - | - | 3 | 2 | - | - | 3 |
| **CO4** | 3 | 2 | 3 | 3 | - | - | - | 2 | - | 3 | 2 | 2 | - | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | - | 2 | 2 | - | 3 | 3 | 2 | 2 | 3 |

**C. OUTLINE OF THE COURSE**

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| **1.** | **Foundations of Software Project Management** | **06** |
| **2.** | **Software Processes and Measurement** | **06** |
| **3.** | **Project Planning and Estimation** | **08** |
| **4.** | **Risk Analysis and Management** | **08** |
| **5.** | **Scheduling, Quality Assurance, and Configuration Management** | **08** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Foundations of Software Project Management** |
| | • Management spectrum<br>  ○ People: roles and responsibilities of project manager, team composition, leadership styles<br>  ○ Product: defining scope, features, deliverables<br>  ○ Process: lifecycle attributes, process improvement, standards<br>  ○ Project: constraints, objectives, success criteria<br>• Organizational structures and governance<br>  ○ Functional, matrix, and projectized organizations<br>  ○ Stakeholder identification and analysis<br>  ○ Project governance: steering committees, decision rights |

| | |
|---|---|
| **2.** | **Software Processes and Measurement** |
| | • Software Process Methodology & it's principles<br>  ○ Working principle of software models and there uses<br>  ○ Tailoring processes to project size and complexity<br>• Software Process & Project Matrix<br>  ○ Definition and purpose of the matrix<br>  ○ Mapping process formality vs. project criticality<br>• Software Measurement Principles<br>  ○ Goals–Question–Metric (GQM) approach<br>  ○ Types of metrics: product, process, project<br>• Size-Oriented Metrics<br>  ○ Lines of Code (LOC): counting rules, advantages, drawbacks<br>  ○ Source Lines of Code (SLOC) vs. physical lines<br>• Function-Oriented Metrics<br>  ○ Function Points: classification, weighting factors, counting procedure<br>  ○ Use-Case Points: actor/transaction weighting, environmental factors<br>  ○ Foundational concepts of Object-Oriented metrics |
| **3.** | **Project Planning and Estimation** |
| | • Objectives<br>  ○ Establishing baselines: scope, schedule, cost, quality<br>  ○ Aligning stakeholder expectations<br>• Work Decomposition Techniques<br>  ○ Work Breakdown Structure (WBS): deliverable-based, phase-based, use-case-based<br>  ○ Decomposition guidelines and pitfalls<br>• Estimation Techniques<br>  ○ Expert judgment, analogy, Delphi method<br>  ○ Parametric models vs. bottom-up estimation<br>• Empirical Estimation Models<br>  ○ Basic, intermediate, detailed models; cost drivers<br>  ○ Application composition, early design, post-architecture<br>  ○ SLIM and Putnam models overview<br>• Developing the Project Plan<br>  ○ Defining tasks, sequencing, dependencies<br>  ○ Resource allocation and leveling<br>  ○ Baseline creation and approval. |
| **4.** | **Risk Analysis and Management** |
| | • Risk Management Process<br>  ○ Phases: identification, analysis, response planning, monitoring and control<br>• Risk Identification<br>  ○ Techniques: brainstorming, checklists, SWOT, cause-and-effect diagrams<br>• Risk Projection (Analysis)<br>  ○ Qualitative analysis: probability, risk categorization<br>  ○ Quantitative analysis: decision trees, Monte Carlo simulation, sensitivity analysis<br>• Risk Refinement (Response Planning)<br>  ○ Response strategies: avoid, mitigate, transfer, accept<br>  ○ Contingency plans and reserves<br>• Risk Monitoring and Control<br>  ○ Tracking identified risks and new risk detection<br>  ○ Risk metrics and dashboards<br>  ○ Escalation procedures |
| **5.** | **Scheduling, Quality Assurance, and Configuration Management** |

| | |
|---|---|
| | • Project Scheduling and Tracking<br>  ○ Network planning: PERT, CPM, critical path analysis<br>  ○ Gantt charts and milestone tracking<br>  ○ Earned Value Management (EVM): CPI, SPI, forecasting<br>• Software Quality Attributes<br>  ○ Quality models and standards: ISO 9001, CMMI, Six Sigma<br>  ○ SQA activities: audits, reviews, process assessments<br>  ○ Metrics for SQA: defect density, MTBF, test coverage |

| | |
|---|---|
| | • Project Scheduling and Tracking<br>  ○ Network planning: PERT, CPM, critical path analysis<br>  ○ Gantt charts and milestone tracking<br>  ○ Earned Value Management (EVM): CPI, SPI, forecasting<br>• Software Quality Attributes<br>  ○ Quality models and standards: ISO 9001, CMMI, Six Sigma<br>  ○ SQA activities: audits, reviews, process assessments<br>  ○ Metrics for SQA: defect density, MTBF, test coverage |

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Software Project Management | Bob Hughes, Mike Cotterell, Rajib Mall | 6th Edition | McGraw-Hill Education |
| 2. | Applied Software Project Management | Andrew Stellman, Jennifer Greene | 1st Edition | O'Reilly Media |
| 3. | Software Engineering: A Practitioner's Approach (Chapters on Project Mgmt) | Roger S. Pressman | 8th Edition | McGraw-Hill Education |
| **Reference Book** | | | | |
| 1. | Managing the Software Process, Watts S. Humphrey, Addison-Wesley | | | |
| 2. | Software Estimation: Demystifying the Black Art, Steve McConnell, Microsoft Press | | | |
| 3 | Software Metrics: A Rigorous and Practical Approach, Norman Fenton, James Bieman, CRC Press | | | |
| **Online Resources** | | | | |
| 1. | Software Project Management Tutorials(GeeksforGeeks - SPM) | | | |
| 2. | Software Engineering (Project Management topics included)(TutorialsPoint) | | | |

**E. RECOMMENDED STUDY MATERIAL**

# PRACTICALS

| Code: BCACCA2201 | Computer Network Lab | 1 Credit [LTP: 0-0-2] |
|---|---|---|

**A. COURSE OUTCOME**

On successful completion of the course the learner will be able to:

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO –01 | Remember | Understand and apply network standards and models, including the OSI and TCP/IP models. |
| CO –02 | Understand | Design and implement different types of network topologies, such as star, mesh, ring, and bus. |
| CO –03 | Analyze | Set up and manage essential network services, such as DNS, DHCP, web servers, email servers, and file transfer services. |
| CO –04 | Apply | Diagnose and resolve network issues using various troubleshooting tools and techniques |
| CO –05 | Evaluate | Analyze network performance and identify potential bottlenecks. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | 3 | 1 | - | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | 1 | - | - | 3 | 1 | - | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | 1 | - | - | 3 | 1 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | 1 | - | - | 3 | 1 | - | - |
| CO5 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 1 | - | - | 3 | 1 | - | - |

**C. List of Programs**

| | |
|---|---|
| **1** | Implement Peer to Peer network and Client Server network using Cisco Packet tracer. |
| **2** | Study & practically implement the cross-wired cable and straight through cable using clamping tool |
| **3** | Demonstration & practically implement the network devices (Switch, Hub, Router). |
| **4** | Creating LAN using different topology using Cisco Packet Tracer |

| | |
|---|---|
| **5** | Troubleshooting Scenarios Network -I (Basic network command and Network configuration commands. |
| **6** | Demonstration of Network Devices and network IP in Detail. |
| **7** | Connect the computers with file sharing in the Local Area Network. |
| **8** | Configure Wi-Fi, Hotspot, and connect other devices (Mobile/Laptop) |
| **9** | Performing an Initial Switch Configuration. |
| **10** | Performing an Initial Router Configuration |
| **ADDITIONAL EXPERIMENTS** | |
| **11** | Configure of VPN using Cisco Packet Tracer/GNS3. |
| **12** | Configuring WEP on a Wireless Router |

**D. RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| **1.** | Computer Network | AndrewS. Tanenbaum | 2013 | Pearson |
| **2.** | Computer Networking: Top Down Approach | Kurose. Ross | 2017 | Pearson |
| **Reference Book** | | | | |
| 1. | Networking All in One – Doug Lowe 7th edition Publisher- Wiley | | | |
| **Online Resources** | | | | |
| 1. | https://www.edx.org/learn/computer-networking | | | |
| 2. | https://www.youtube.com/watch?v=VwN91x5i25g | | | |

| Code: BCACCA2202 | Python Programming Lab | 1 Credit [LTP: 0-0-2] |
|---|---|---|

## A. COURSE OUTCOME:

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO –01 | Remember | Write Python code, develop medium-difficulty applications in Python |
| CO –02 | Understand | Implement Python programs with conditionals and loops |
| CO –03 | Analyze | Apply the concept of List and Dictionary. |
| CO –04 | Apply | Implement Read and write data from/to files in Python |
| CO –05 | Evaluate | Develop Python programs step-wise by defining functions |

## B. MAPPING OF CO VS PO/PSO

| | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | 3 | 2 | 2 | - |
| **CO3** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | 3 | 2 | 2 | - |
| **CO4** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | 2 | 3 | - |
| **CO5** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | 3 | 2 | 3 | - |

## C. LIST OF EXPERIMENTS:

| | |
|---|---|
| **1** | Write a Python program to print basic “Hello, World!” and simple arithmetic operations. |
| **2** | Develop a program to demonstrate input (), data types, type conversion, and formatted output. |
| **3** | Write a program to create a calculator for basic arithmetic operations using conditional statements and functions. |
| **4** | Implement a menu-driven program to perform CRUD operations on a List (add, delete, search, sort) with proper user interaction. |
| **5** | Create a dictionary of students with roll number as key and marks as values. Implement search, update, and average calculation functions. |

| | |
|---|---|
| **6** | Write a function to count vowels and consonants in a paragraph fetched from a text file. Use file I/O and string processing. |
| **7** | Write a program to implement a contact book using dictionary and functions (add, edit, delete, search contacts). |
| **8** | Develop a Python script to demonstrate recursive function for factorial, Fibonacci, and power calculation. |
| **9** | Define a class Employee with attributes name, ID, and salary. Implement methods for reading, displaying, and updating salary. |
| **10** | Create a base class Shape and two derived classes Rectangle and Circle. Demonstrate method overriding and area calculation using inheritance. |
| **ADDITIONAL EXPERIMENTS** | |
| **11** | Write a Python program to read from a file, reverse the contents, and write it to another file. |
| **12** | Write a program to demonstrate exception handling by catching division-by-zero, file-not-found, and custom errors using try-except-raise. |

## D. RECOMMENDED STUDY MATERIAL

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1 | Python Programming: Using Problem Solving Approach | Reema Thareja | 2nd Edition | Oxford University Press |
| 2 | Python Crash Course, 3rd Edition: A Hands-On, Project-Based Introduction to Programming | Eric Matthes | 3rd Edition | No Starch Press |
| 3 | Ultimate Python Programming | Deepali Srivastava | 2024 | Green Tea Press / O'Reilly |
| **Reference Book** | | | | |
| 1 | Python Programming, Dr. R. Nageswara Rao, Dreamtech Press, 2018 | | | |
| **Online Resources** | | | | |
| **1** | https://docs.python.org/3/ | | | |
| **2** | https://www.geeksforgeeks.org/python-programming-language/ | | | |
| **3** | https://realpython.com/ | | | |
| **4** | https://www.youtube.com/playlist?list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3 | | | |

| Code: BCACCA2203 | Linux and Shell Script Lab | 1 Credit [LTP: 0-0-2] |
|---|---|---|

## A. COURSE OUTCOME:

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO –01 | Remember | Use Shell Script to create files and handle text documents. |
| CO –02 | Understand | Create child processes, background processes and zombies. |
| CO –03 | Analyze | Familiarize basic concept of shell programming. |
| CO –04 | Apply | Demonstrate use of system calls. |
| CO –05 | Evaluate | Demonstrate inter process communication. |

## B. MAPPING OF CO VS PO/PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 3 | - | - | - | - | - | 3 | 3 | - | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | 3 | - | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | 3 | - | - |

## C. LIST OF EXPERIMENTS:

| | |
|---|---|
| 1 | Study and Practice on various commands like man, passwd, tty, script, clear, date, cal, cp,<br>mv,ln, rm,<br>unlink, mkdir, rmdir, du, df, mount, umount, find, unmask, ulimit, ps, who, w. |
| 2 | Study and Practice on various commands like cat, tail, head , sort, nl, uniq, grep, egrep,fgrep,cut, paste,<br>join, tee, pg, comm, cmp, diff, tr, awk, tar, cpio. |
| 3 | a) Write a Shell Program to print all .txt files and .c files. |

| | |
|---|---|
| | b) Write a Shell program to move a set of files to a specified directory. |
| 4 | c) Write a Shell program to display all the users who are currently logged in after a specified time.<br>d) Write a Shell Program to wish the user based on the login time. |
| 5 | a) Simulate cat command. b) Simulate cpcommand. |
| 6 | a) Simulate head command. b) Simulate tail command. |
| 7 | a) Simulate mv command. b) Simulate nlcommand. |
| 8 | Write a program to handle the signals like SIGINT, SIGQUIT, SIGFPE. |
| 9 | Implement the following IPC forms<br>a) FIFO b) PIPE |
| 10 | Implement message queue form of IPC. |
| **ADDITIONAL EXPERIMENTS** | |
| 11 | Implement a shared memory form of IPC. |
| 12 | Write a Socket program to print system date and time (Using TCP/IP). |

## D. RECOMMENDED STUDY MATERIAL

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | UNIX Shell Scripting | Randal Michael | 2003 | Wiley |
| 2. | Bash Cookbook | Carl Albing, JP Vossen | 2017 | O'Reilly |
| 3. | Linux Command Line and Shell Scripting Bible | Richard Blum , ChristineBresnahan | 2015 | Wiley |
| **Reference Book** | | | | |
| 1. | Linux Command Line and Shell Scripting Bible 4th Edition by Richard Blum | | | |
| **Online Resources** | | | | |
| 1. | https://www.tutorialspoint.com/unix/shell_scripting.htm | | | |
| 2. | https://www.javatpoint.com/shell-scripting-tutorial | | | |

# Professional Elective-II

**Code: BCAECA2101 Linux Command Line Essentials for computing 3 Credits [LTP: 3-0-0]**

## A. COURSE OUTCOME:

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Recall the historical development of LINUX and its architecture. Comprehend the use of standard streams, redirection, pipes, the tee command, and command-line editing in Linux shells. |
| CO2 | Understand | Comprehend the concept of standard streams in Linux and their significance in command-line interactions. |
| CO3 | Apply | Apply the concept of inodes (Index Nodes) in UNIX file systems and understand their role in file management. |
| CO4 | Analyze | Examine process scheduling and the mechanisms for starting new processes, including issues related to waiting, zombie processes, and orphan processes. |
| | Evaluate | Assess the implementation of message queues, understanding msgget, msgsnd, msgrcv, and msgctl operations. |

## B. MAPPING OF CO VS PO/PSO

| | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | - | 2 | 1 | - | - | - | 3 | 1 | - | - |
| CO2 | 3 | 2 | 2 | 3 | - | 2 | 1 | - | - | - | 3 | - | - | - |
| CO3 | 3 | 3 | 2 | 3 | - | 2 | 1 | - | - | - | 3 | - | - | - |
| CO4 | 3 | 3 | 2 | 3 | - | 3 | 1 | - | - | - | 3 | - | - | - |
| CO5 | 3 | 3 | 2 | 3 | 1 | 3 | 1 | - | - | - | 3 | 2 | - | - |

## C. OUTLINE OF THE COURSE

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|

| | | |
|---|---|---|
| **1.** | **Introduction to Linux CLI for Computing** | **07** |
| **2.** | **Introduction to shells** | **08** |
| **3.** | **Unix file structure** | **08** |
| **4.** | **Process and signals** | **07** |
| **5.** | **Inter process communication** | **07** |

## D. DETAILED SYLLABUS

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Linux CLI for Computing** |
| | • Introduction of Unit<br>• INTRODUCTION TO LINUX AND LINUX UTILITIES: A brief history of LINUX, architecture of LINUX,<br>• features of LINUX, introduction to vi editor.<br>• Linux commands- man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir,<br>• rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions,<br>• process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask,<br>• ulimit, ps, w, finger, arp, ftp, telnet, rlogin. Text Processing utilities and backup utilities , tail, head ,<br>• sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio<br>• Conclusion of Unit. |

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|---|---|
| **2.** | **Introduction to shells** |
| | • Introduction of Unit<br>• Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command,<br>• Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.<br>• Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste,<br>• Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.<br>• Conclusion of Unit |
| **3.** | **Unix file structure** |
| | • Introduction of Unit<br>• Grep: Operation, grep Family, Searching for File Content.<br>• Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.<br>• UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors,<br>• system calls and device drivers.<br>• Conclusion of Unit |
| **4.** | **Process and signals** |
| | • Introduction of Unit<br>• PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets.<br>• File locking: creating lock files, locking regions, use of read and write with locking, competing locks,other lock commands, deadlocks.<br>• Conclusion of Unit |
| **5.** | **Inter process communication** |

| | |
|---|---|
| | • Introduction of Unit<br>• Inter Process Communication: Pipe, process pipes, the pipe call, parent and child<br>• processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.<br>• Introduction To Sockets: Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications.<br>• Awk and perl Programming: Awk pattern scanning and processing language, BEGIN and END patterns, Awk arithmetic and variables, Awk built in variable names and operators, arrays, strings, functions, perl; the chop() function, variable and operators, $_ and $. , Lists, arrays, regular expression and substitution, file handling, subroutines, formatted printing.<br>• Conclusion of Unit |

## E. RECOMMENDED STUDY MATERIAL

| S. N | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | *Advanced Programming in the UNIX Environment* | *W. Richard. Stevens* | 3rd edition | Pearson Education |
| 2. | Unix and shell Programming | *Stephen Kochan, Patrick Wood* | Latest | Sams |

| Code: BASECA2101 | Linux Command Line Essentials for AI&DS | 3 Credits [LTP: 3-0-0] |
|---|---|---|

## A. COURSE OUTCOME

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Recall the historical development of LINUX and its architecture. Comprehend the use of standard streams, redirection, pipes, the tee command, and command-line editing in Linux shells. |
| CO2 | Understand | Comprehend the concept of standard streams in Linux and their significance in command-line interactions. |
| CO3 | Apply | Apply the concept of inodes (Index Nodes) in UNIX file systems and understand their role in file management. |
| CO4 | Analyze<br>Evaluate | Examine process scheduling and the mechanisms for starting new processes, including issues related to waiting, zombie processes, and orphan processes.<br>Assess the implementation of message queues, understanding msgget, msgsnd, msgrcv, and msgctl operations. |
| CO5 | | Assess the use of IPC status commands for monitoring and managing IPC resources effectively. |

## B. MAPPING OF CO VS PO/PSO

| | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | - | 2 | - | 1 | - | - | - | 3 | 3 | - | - |
| CO2 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | 3 | 2 | - | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | 3 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 1 | 1 | - | - | - | - | 3 | 3 | - | - |
| CO5 | 3 | 3 | 3 | 3 | 1 | 1 | - | - | - | - | 3 | 3 | - | - |

## C. OUTLINE OF THE COURSE

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Introduction to Linux CLI for AI&DS | 07 |
| 2. | Introduction to shells | 08 |
| 3. | Unix file structure | 08 |
| 4. | Process and signals | 07 |
| 5. | IPC and System Utilities for AI & DS | 07 |

## D. DETAILED SYLLABUS

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Linux CLI for AI&DS** |
| | • Introduction of Unit<br>• INTRODUCTION TO LINUX AND LINUX UTILITIES: A brief history of LINUX,architecture of LINUX,features of LINUX, introduction to vi editor.<br>• Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir,<br>• rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions,Installing Python via package manager – apt, yum, Executing python script using terminal, passing arguments using sys.argv<br>• Installing Jupyter using pip or conda. Starting notebook from terminal, introduction to Python CLI tools for Data science (csvkit, numpy, pandas, matplotlib)<br>• Conclusion of Unit |

| | |
|---|---|
| **2.** | **Introduction to shells** |
| | • Introduction of Unit<br>• process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask,<br>• ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head ,<br>• sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio<br>•<br>• Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes,<br>• Command Execution, Command-Line Editing, Quotes, Command Substitution, Aliases, Variables, Predefined Variables, Options<br>• Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste,<br>• Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.<br>• Conclusion of Unit |
| **3.** | **Unix file structure** |

| | |
|---|---|
| | • Introduction of Unit<br>• Grep: Operation, grep Family, Searching for File Content.<br>• Sed :Scripts, Operation, Addresses, commands, Applications, grep and sed.<br>• UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors,<br>• system calls and device drivers.<br>• Conclusion of Unit |
| **4.** | **Process and signals** |
| | • Introduction of Unit<br>• PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets.<br>• File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.<br>• Conclusion of Unit |
| **5.** | **IPC and System Utilities for AI & DS** |
| | • Introduction of Unit<br>• Inter Process Communication: Pipe, process pipes, the pipe call, parent and child<br>• processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.<br>• Introduction To Sockets: Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications.<br>• Secure Shell (SSH) for AI & DS : Remote Access, Secure Data Transfer<br>• Terminal Multiplexers for AI & DS: Persistent Sessions, Multitasking<br>• Version Control with Git CLI: Code Management, Collaboration, Reproducibility<br>• Conclusion of Unit |

## E. RECOMMENDED STUDY MATERIAL

| S. N | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | *Advanced Programming in the UNIX Environment* | *W. Richard. Stevens* | 3rd edition | Pearson Education |
| 2. | Unix and shell Programming | *Stephen Kochan, Patrick Wood* | Latest | Sams |

| Reference Book | |
|---|---|
| 1. | Linux System Programming, *Robert Love, O'Reilly*, SPD. |
| 2. | Advanced Programming in the UNIX environment, 2nd Edition, *W.R.Stevens*, Pearson Education. |
| 3. | UNIX Network Programming, *W.R. Stevens*, PHI.<br>UNIX for Programmers and Users, 3rd Edition, *Graham Glass, King Ables*, Pearson Education |

| Online Resources | |
|---|---|
| 1. | https://www.tutorialspoint.com/unix/shell_scripting.htm |
| 2. | https://www.javatpoint.com/shell-scripting-tutorial |

**Code: BCYECA2101 Linux Command Line Essentials for Cyber security 3 Credits[LTP: 3-0-0]**

## A. COURSE OUTCOME:

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Recall the historical development of LINUX and its architecture. Comprehend the use of standard streams, redirection, pipes, the tee command, and command-line editing in Linux shells. |
| CO2 | Understand | Comprehend the concept of standard streams in Linux and their significance in command-line interactions. |
| CO3 | Apply | Apply the concept of inodes (Index Nodes) in UNIX file systems and understand their role in file management. |
| CO4 | Analyze | Examine process scheduling and the mechanisms for starting new processes, including issues related to waiting, zombie processes, and orphan processes. |
| CO5 | Evaluate | Assess the implementation of message queues, understanding msgget, msgsnd, msgrcv, and msgctl operations. Assess the use of IPC status commands for monitoring and managing IPC resources effectively. |

## B. MAPPING OF CO VS PO/PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | - | 2 | - | 1 | - | - | - | 3 | 1 | - | - |
| CO2 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | 3 | 1 | - | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | | - | - | - | - | 3 | 1 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 3 | 1 | - | - | - | - | 3 | 1 | - | - |
| CO5 | 3 | 3 | 3 | 3 | 3 | 1 | - | - | - | - | 3 | 1 | - | - |

## C. OUTLINE OF THE COURSE

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Introduction to Linux CLI for Cyber Security | 07 |
| 2. | Introduction to shells | 08 |

| | | |
|---|---|---|
| **3.** | **Unix file structure and Log Forensics** | **08** |
| **4.** | **Process and signals** | **07** |
| **5.** | **IPC Monitoring and Management in Cybersecurity** | **07** |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Linux CLI for Cyber Security** |
| | • Introduction of Unit<br>• INTRODUCTION TO LINUX AND LINUX UTILITIES: A brief history of LINUX, architecture of LINUX,<br>• features of LINUX, introduction to vi editor.<br>• Installing Kali Linux<br>• Linux commands- man, echo, printf, script, passwd, uname, who, date, pwd, cd, mkdir,<br>• rmdir, ls, cp, mv, rm, cat, more, wc, lp, tar, gzip, file handling utilities, security by file permissions, useradd, groupadd,<br>• |

| | |
|---|---|
| | • process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask,<br>• ulimit, ps, w, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head ,<br>• sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, pg, comm, cmp, diff, tr, awk, cpio<br>• Conclusion of Unit |
| **2.** | **Introduction to shells** |

| | |
|---|---|
| | • Introduction of Unit<br>• Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command,<br>• Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.<br>• Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste,<br>• Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.<br>• Conclusion of Unit |
| **3.** | **Unix file structure and Log Forensics** |
| | • Introduction of Unit<br>• Grep: Operation, grep Family, Searching for File Content.<br>• Sed :Scripts, Operation, Addresses, commands, Applications, grep and sed.<br>• UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors, Important Forensics directories - /etc, /var/log, /tmp<br>• system calls and device drivers, disabling unused services,- systemctl, chkconfig<br>• Conclusion of Unit |
| **4.** | **Process and signals** |
| | • Introduction of Unit<br>• PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets.<br>• File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.<br>• Conclusion of Unit |
| **5.** | **IPC Monitoring and Management in Cybersecurity** |
| | • Introduction of Unit<br>• Inter Process Communication: Pipe, process pipes, the pipe call, parent and child<br>• processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.<br>• Introduction To Sockets: Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications. |

| | |
|---|---|
| | • Cyber Security commands for IPC: ipcs, ipcrm, lsof, netstat/ss.<br>• Conclusion of Unit |

## E. RECOMMENDED STUDY MATERIAL

| S. N | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | *Advanced Programming in the UNIX Environment* | *W. Richard. Stevens* | 3rd edition | Pearson Education |
| 2. | Unix and shell Programming | *Stephen Kochan, Patrick Wood* | Latest | Sams |
| **Reference Book** | | | | |
| 1. | Linux System Programming, *Robert Love, O'Reilly*, SPD. | | | |
| 2. | Advanced Programming in the UNIX environment, 2nd Edition, *W.R.Stevens*, Pearson Education. | | | |
| 3. | UNIX Network Programming, *W.R. Stevens*, PHI.<br>UNIX for Programmers and Users, 3rd Edition, *Graham Glass, King Ables*, Pearson Education | | | |
| **Online Resources** | | | | |
| 1. | https://www.tutorialspoint.com/unix/shell_scripting.htm | | | |
| 2. | https://www.javatpoint.com/shell-scripting-tutorial | | | |

| Code: BCTECA2101 | Linux Command Line Essentials for Cloud | 3 Credits [LTP: 3-0-0] |
|---|---|---|

## A. COURSE OUTCOME

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Recall the historical development of LINUX and its architecture.<br>Comprehend the use of standard streams, redirection, pipes, the tee command, and command-line editing in Linux shells. |
| CO2 | Understand | Comprehend the concept of standard streams in Linux and their significance in command-line interactions. |
| CO3 | Apply | Apply the concept of inodes (Index Nodes) in UNIX file systems and understand their role in file management. |
| CO4 | Analyze | Examine process scheduling and the mechanisms for starting new processes, including issues related to waiting, zombie processes, and orphan processes. |
| CO5 | Evaluate | Assess the implementation of message queues, understanding msgget, msgsnd, msgrcv, and msgctl operations.<br>Assess the use of IPC status commands for monitoring and managing IPC resources effectively. |

## B. MAPPING OF CO VS PO/PSO

| | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | 2 | - | 1 | - | - | - | 3 | - | - | - |
| CO2 | 3 | 2 | - | - | 2 | - | - | - | - | - | 3 | - | - | - |
| CO3 | 3 | 3 | - | 2 | 3 | - | - | - | - | - | 3 | - | - | - |
| CO4 | 3 | 3 | - | 3 | 3 | 1 | - | - | - | - | 3 | - | - | - |
| CO5 | 3 | 3 | - | 3 | 3 | 1 | - | - | - | - | 3 | - | - | - |

## C. OUTLINE OF THE COURSE

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Introduction to Linux CLI for Cloud Computing | 07 |
| 2. | Introduction to shells | 08 |
| 3. | Unix file structure and virtualization | 08 |
| 4. | Process and signals | 07 |

| | | |
|---|---|---|
| 5. | IPC and Monitoring Cloud | 07 |

## D. DETAILED SYLLABUS

| Unit | Unit Details |
|---|---|
| 1. | **Introduction to Linux CLI for Cloud Computing** |
| | • Introduction of Unit<br>• INTRODUCTION TO LINUX AND LINUX UTILITIES: A brief history of LINUX,<br>• architecture of LINUX,<br>• features of LINUX, introduction to vi editor.<br>• Linux distribution used in cloud : Ubuntu Server, CentOS, Alpine<br>• Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir,<br>• rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions,<br>• process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, chown, useradd, groupadd, usermode<br>• ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head ,<br>• sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio<br>• Conclusion of Unitulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head ,<br>• sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio<br>• Conclusion of Unit |
| 2. | **Introduction to shells** |
| | • Introduction of Unit<br>• Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command,<br>• Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.<br>• Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste,<br>• Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.<br>• Conclusion of Unit |
| 3. | **Unix file structure and virtualization** |

| | |
|---|---|
| | • Introduction of Unit<br>• Grep: Operation, grep Family, Searching for File Content.<br>• Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.<br>• UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors,<br>• system calls and device drivers.<br>• Introduction to Linux based Hypervisor(VirtualBox),<br>• Conclusion of Unit |
| **4.** | **Process and signals** |
| | • Introduction of Unit<br>• PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, nice, renice, raise, alarm, pause, abort, system, sleep functions, signal sets.<br>• File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.<br>• Conclusion of Unit |
| **5.** | **IPC and Monitoring Cloud** |
| | • Introduction of Unit<br>• Inter Process Communication: Pipe, process pipes, the pipe call, parent and child<br>• processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.<br>• Introduction To Sockets: Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications.<br>• Connecting to Cloud Virtual Machines using SSH, Uploading and Downloading Files in Cloud (AWS, GCP, Azure CLI)<br>• Monitoring Cloud VM Performance (top, df, free, journalctl), Using Cloud Command-Line Tools (awscli, gcloud, az),Managing Storage with rclone, aria2, and wget<br>• Securing Cloud Access: SSH keys and Firewall Configuration.<br>Conclusion of Unit |

**E. RECOMMENDED STUDY MATERIAL**

| S. N | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | *Advanced Programming in the UNIX Environment* | *W. Richard. Stevens* | 3rd edition | Pearson Education |
| 2. | Unix and shell Programming | *Stephen Kochan, Patrick Wood* | Latest | Sams |

| Reference Book | |
|---|---|
| 1. | Linux System Programming, *Robert Love, O'Reilly*, SPD. |
| 2. | Advanced Programming in the UNIX environment, 2nd Edition, *W.R.Stevens*, Pearson Education. |
| 3. | UNIX Network Programming, *W.R. Stevens*, PHI.<br>UNIX for Programmers and Users, 3rd Edition, *Graham Glass, King Ables*, Pearson Education |

| Online Resources | |
|---|---|
| 1. | https://www.tutorialspoint.com/unix/shell_scripting.htm |
| 2. | https://www.javatpoint.com/shell-scripting-tutorial |

**Code: BMFECA2101 Linux Command Line Essentials for Mobile Application 3 Credits [LTP: 3-0-0]**

## A. COURSE OUTCOME

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Recall the historical development of LINUX and its architecture. Comprehend the use of standard streams, redirection, pipes, the tee command, and command-line editing in Linux shells. |
| CO2 | Understand | Comprehend the concept of standard streams in Linux and their significance in command-line interactions. |
| CO3 | Apply | Apply the concept of inodes (Index Nodes) in UNIX file systems and understand their role in file management. |
| CO4 | Analyze | Examine process scheduling and the mechanisms for starting new processes, including issues related to waiting, zombie processes, and orphan processes. |
| CO5 | Evaluate | Assess the implementation of message queues, understanding msgget, msgsnd, msgrcv, and msgctl operations.<br>Assess the use of IPC status commands for monitoring and managing IPC resources effectively. |

## B. MAPPING OF CO VS PO/PSO

| | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 2 | - | 1 | - | - | - | 3 | - | - | - |
| CO2 | 3 | 2 | - | - | 2 | - | - | - | - | - | 3 | - | - | - |
| CO3 | 3 | 3 | - | - | 3 | - | - | - | - | - | 3 | - | - | - |
| CO4 | 3 | 3 | - | - | 3 | 1 | - | - | - | - | 3 | - | - | - |
| CO5 | 3 | 3 | 3 | 3 | 3 | 1 | - | - | - | - | 3 | - | - | - |

## C. OUTLINE OF THE COURSE

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Introduction to Linux CLI for Mobile & Android development | 07 |
| 2. | Introduction to shells | 08 |
| 3. | Unix file structure | 08 |

| | | |
|---|---|---|
| **4.** | **Process and signals** | **07** |
| **5.** | **IPC and Mobile Development** | **07** |

## D. DETAILED SYLLABUS

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Linux CLI for Mobile & Android development** |
| | • Introduction of Unit<br>• INTRODUCTION TO LINUX AND LINUX UTILITIES: A brief history of<br>• LINUX, architecture of LINUX,<br>• features of LINUX, introduction to vi editor.<br>• Installing android studio and SDK using CLI, setting $ANDROID_HOME, $PATH<br>• Linux commands- man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, |

| | |
|---|---|
| | • rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions,<br>• process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask,<br>• ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head ,<br>• sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio<br>• Conclusion of Unit |
| **2.** | **Introduction to shells** |
| | • Introduction of Unit<br>• Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command,<br>• Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.<br>• Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste,<br>• Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.<br>• Conclusion of Unit |
| **3.** | **Unix file structure** |
| | • Introduction of Unit<br>• Grep: Operation, grep Family, Searching for File Content.<br>• Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.<br>• UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors,<br>• Basic introduction of Gradle and its Configuration Files( build.gradle, settings.gradle)system calls and device drivers.<br>• Conclusion of Unit |
| **4.** | **Process and signals** |
| | • Introduction of Unit<br>• PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets.<br>• File locking: creating lock files, locking regions, use of read and write with locking, competing locks,other lock commands, deadlocks. |

| | |
|---|---|
| | • Conclusion of Unit |
| **5.** | **IPC and Mobile Development** |
| | • Introduction of Unit<br>• Inter Process Communication: Pipe, process pipes, the pipe call, parent and child<br>• processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands. |
| | • Introduction of Mobile applications,Java JDK,Android SDK Command Line Tools<br>• Introduction to ADB (Android Debug Bridge),<br>• Basic commands:Installing ADB: sudo apt install adb,Connecting real Android devices via USB,Commands: adb devices, adb install, adb uninstall, adb logcat.<br>• Conclusion of Unit |

**RECOMMENDED STUDY MATERIAL**

| **S. N** | **Text Books:** | **Author** | **Edition** | **Publication** |
|---|---|---|---|---|
| 1. | *Advanced Programming in the UNIX Environment* | *W. Richard. Stevens* | 3rd edition | Pearson Education |
| 2. | Unix and shell Programming | *Stephen Kochan, Patrick Wood* | Latest | Sams |
| **Reference Book** | | | | |
| 1. | Linux System Programming, *Robert Love, O'Reilly*, SPD. | | | |
| 2. | Advanced Programming in the UNIX environment, 2nd Edition, *W.R.Stevens*, Pearson Education. | | | |
| 3. | UNIX Network Programming, *W.R. Stevens*, PHI.<br>UNIX for Programmers and Users, 3rd Edition, *Graham Glass, King Ables*, Pearson Education | | | |
| **Online Resources** | | | | |

| | |
|---|---|
| 1. | https://www.tutorialspoint.com/unix/shell_scripting.htm |
| 2. | https://www.javatpoint.com/shell-scripting-tutorial |

**Code: BCLECA2101 Statistical Foundation for Machine Learning (SAS) 3 Credits [LTP: 3-0-0]**

### A. COURSE OUTCOMES:

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Student will be able to understand the foundation of ML |
| CO – 02 | Understand | The implementation of statistical concepts will be easier after achieving this |
| CO – 03 | Apply | Implementation of regression models for predictions |
| CO – 04 | Analyze | Exploration of Logistic regression |
| CO – 05 | Evaluate | The statistical methods important for ML will be evaluated. |

### B. MAPPING MATRIX OF CO, PO, & PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | 2 | - | - | - | - | - | 3 | 2 | - | - |
| CO2 | 3 | 3 | - | - | 2 | - | - | - | - | - | 3 | 2 | - | - |
| CO3 | 3 | 3 | - | 2 | 3 | - | - | - | - | - | 3 | 1 | - | - |
| CO4 | 3 | 3 | - | 3 | 3 | - | - | - | - | - | 3 | 1 | - | - |
| CO5 | 3 | 3 | - | 2 | 3 | - | - | - | - | - | 3 | 1 | - | - |

### C. OUTLINE OF THE COURSE

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Basics of Statistics and Machine Learning | 7 |
| 2. | Fundamental Statistical Concepts | 7 |
| 3. | Explanatory Modeling Using Linear Regression | 9 |
| 4. | Predictive Modeling Using Logistic Regression | 8 |
| 5. | Statistical Foundations of Machine Learning | 8 |

**D. DETAILED SYLLABUS**

| Unit | Unit Details |
|---|---|
| 1. | **Basics of Statistics and Machine Learning** |
| | Relevance of statistics in big data and machine learning. Terminology and vocabulary.<br>Introduction to SAS Viya and SAS Studio. |
| 2. | **Fundamental Statistical Concepts** |
| | Introduction to statistical analysis.<br>Descriptive statistics.<br>Inferential statistics. |
| 3. | **Explanatory Modeling Using Linear Regression** |
| | Correlation and simple linear regression.<br>Multiple regression and model selection.<br>Model diagnostics. |
| 4. | **Predictive Modeling Using Logistic Regression** |
| . | Introduction to predictive modeling.<br>Categorical associations.<br>Logistic regression model.<br>Model deployment. |
| 5 | **Statistical Foundations of Machine Learning** |
| . | Overview of machine learning.<br>Data pre-processing for machine learning models. Model evaluation, estimation, and post-training tasks. |

**E. RECOMMENDED STUDY MATERIAL:**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1 | Applied Statistics and Probability for Engineers | Douglas C. Montgomery and George C. Runger | Latest | Wiley Publications |
| 2 | Machine Learning: An Applied Mathematics Introduction | Paul Wilmott | Latest | Panda |
| **Reference Book** | | | | |
| 1 | Pattern Recognition and Machine Learning, Christopher Bishop, Springer | | | |
| 2 | TheElements of Statistical Learning, Trevor Hastie, Robert Tibshirani, and Jerome Friedman, | | | |

| | |
|---|---|
| | Springer |
| **Online Resources** | |
| 1 | https://www.geeksforgeeks.org/machine-learning/ |
| 2 | https://www.w3schools.com/ai/ai_statistics.asp |

| Code: BDAECA2101 | Linux Command Line Essentials for Data Analytics | 3 Credits [LTP: 3-0-0] |
|---|---|---|

## A. COURSE OUTCOME

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO1 | Remember | Recall the historical development of LINUX and its architecture.<br>Comprehend the use of standard streams, redirection, pipes, the tee command, and command-line editing in Linux shells. |
| CO2 | Understand | Comprehend the concept of standard streams in Linux and their significance in command-line interactions. |
| CO3 | Apply | Apply the concept of inodes (Index Nodes) in UNIX file systems and understand their role in file management. |
| CO4 | Analyze | Examine process scheduling and the mechanisms for starting new processes, including issues related to waiting, zombie processes, and orphan processes. |
| CO5 | Evaluate | Assess the implementation of message queues, understanding msgget, msgsnd, msgrcv, and msgctl operations.<br>Assess the use of IPC status commands for monitoring and managing IPC resources effectively. |

## B. MAPPING OF CO VS PO/PSO

| | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | 2 | - | 1 | - | - | - | 3 | - | - | - |
| CO2 | 3 | 2 | - | - | 2 | - | - | - | - | - | 3 | - | - | - |
| CO3 | 3 | 3 | - | 2 | 3 | - | - | - | - | - | 3 | - | - | - |
| CO4 | 3 | 3 | - | 3 | 3 | 1 | - | - | - | - | 3 | - | - | - |
| CO5 | 3 | 3 | - | 3 | 3 | 1 | - | - | - | - | 3 | - | - | - |

## C. OUTLINE OF THE COURSE

| Unit No. | Title of The Unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | Introduction to Linux CLI for Data Analytics | 07 |
| 2. | Introduction to shells and statistical visualization | 08 |

| | | |
|---|---|---|
| **3.** | **Unix file structure and python integration** | **08** |
| **4.** | **Process and signals** | **07** |
| **5.** | **IPC and Data Processing** | **07** |

## D. DETAILED SYLLABUS

| Unit | Unit Details |
|---|---|
| **1.** | **Introduction to Linux CLI for Data Analytics** |
| | • Introduction of Unit<br>• INTRODUCTION TO LINUX AND LINUX UTILITIES: A brief history of<br>• LINUX, architecture of LINUX,<br>• features of LINUX, introduction to vi editor.<br>• Linux commands- man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir,<br>• rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions, |
| | • process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask,<br>• ulimit, ps, w, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio<br>• Converting between .csv, .tsv, .json, .xml using CLI (csvkit, jq, xmlstarlet)<br>• CLI tools for Data analytics : csvkit, numpy, pandas, matplotlib<br>Conclusion of Unit |

| | |
|---|---|
| | • |
| **2.** | **Introduction to shells and statistical visualization** |
| | • Introduction of Unit<br>• Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command,<br>• Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.<br>• Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste,<br>• Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.<br>• Sample stats with datamash : mean, median, mode<br>• Visualization using termgraph and gnuplot<br>• Conclusion of Unit |
| **3.** | **Unix file structure and python integration** |
| | • Introduction of Unit<br>• Grep: Operation, grep Family, Searching for File Content.<br>• Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.<br>• Installing python via apt, yum,<br>• Running python script from terminal<br>• Installing Jupyter usinf pip, conda and starting Notebook from terminal<br>• UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors,<br>• system calls and device drivers.<br>• Conclusion of Unit |
| **4.** | **Process and signals** |
| | • Introduction of Unit<br>• PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets. |

| | |
|---|---|
| | • File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.<br>• Conclusion of Unit |
| **5.** | **IPC and Data Processing** |
| | • Introduction of Unit<br>• Inter Process Communication: Pipe, process pipes, the pipe call, parent and child<br>• processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.<br>• Task Automation using cron, Shell Scripting for Data Cleaning and Scheduling, Batch Data Processing with xargs,GNU parallel for Large File Handling,Visualizing Large Datasets using split, cat, pv, zip,termgraph/gnuplot .<br>• Conclusion of Unit |

## E. RECOMMENDED STUDY MATERIAL

| **S. N** | **Text Books:** | **Author** | **Edition** | **Publication** |
|---|---|---|---|---|
| 1. | *Advanced Programming in the UNIX Environment* | *W. Richard. Stevens* | 3rd edition | Pearson Education |
| 2. | Unix and shell Programming | *Stephen Kochan, Patrick Wood* | Latest | Sams |
| **Reference Book** | | | | |
| 1. | Linux System Programming, *Robert Love, O'Reilly*, SPD. | | | |
| 2. | Advanced Programming in the UNIX environment, 2nd Edition, *W.R.Stevens*, Pearson Education. | | | |
| 3. | UNIX Network Programming, *W.R. Stevens*, PHI.<br>UNIX for Programmers and Users, 3rd Edition, *Graham Glass, King Ables*, Pearson Education | | | |
| **Online Resources** | | | | |

| | |
|---|---|
| 1. | https://www.tutorialspoint.com/unix/shell_scripting.htm |
| 2. | https://www.javatpoint.com/shell-scripting-tutorial |

Professional Elective

# Lab-II

| Code: BCAECA2201 | Project based Software Engineering -LAB | 1 Credit [LTP: 0-0-2] |
|---|---|---|

## A. COURSE OUTCOME:

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Understanding Software Development Life Cycle (SDLC). |
| CO – 02 | Understand | Explore Software Requirement Analysis. |
| CO – 03 | Apply | Apply design principles to create software architecture |
| CO – 04 | Analyze | Implement the Applications |
| CO – 05 | Evaluate | Implement All the Software techniques used for development. |

## B. MAPPING OF CO VS PO/PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | - | 3 | - | 1 | 1 | - | - | 3 | 2 | - | 3 |
| **CO2** | 3 | 2 | 2 | - | 3 | - | 1 | - | - | - | 3 | 2 | 2 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO4** | 2 | 3 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO5** | 2 | 3 | 3 | 3 | 2 | 1 | 2 | - | - | - | 3 | - | 3 | 3 |

## C. List of programs

| | |
|---|---|
| **Part - A** | Below list of experiments focuses on Project Development and Project Management Skill. It gives you complete understanding of scratch to end scenario of any project. |

| | |
|---|---|
| | **Experiment 1: Book Search in Library System**<br><br>**Objective**: Develop a system to search for books in a library.<br><br>• **Task 1**: Implement search by book title.<br>• **Task 2**: Implement search by author name.<br>• **Task 3**: Display availability status (available/borrowed).<br><br>**Experiment 2: Book Borrowing System**<br><br>**Objective:** Develop a book borrowing system in a library.<br><br>• Task 1: Authenticate user with username and card number.<br>• Task 2: Check borrow limit.<br>• Task 3: Issue book based on availability.<br><br>**Experiment 3: Book Return Management Objective**:<br>Handle returning of borrowed books.<br><br>• Task 1: Accept book return details.<br>• Task 2: Validate user and book information.<br>• Task 3: Update book availability and user record. |

| | |
|---|---|
| **Part - B** | **Experiment 4: Banking System – User Login and Authentication**<br>**Objective:** Design secure login functionality for a banking application.<br>• Task 1: User login with card number and PIN.<br>• Task 2: Validate against secure database.<br>• Task 3: Redirect to dashboard on success.<br><br>**Experiment 5: Banking System – Account and Balance Management**<br>**Objective**: Implement account type selection and balance view.<br>• **Task 1**: Display options for fixed deposit or credit account.<br>• **Task 2**: Show corresponding balance.<br>• **Task 3**: Prevent unauthorized access to account details.<br><br>**Experiment 6: Banking System – Transaction Module**<br>**Objective**: Manage withdrawal and deposit transactions.<br>• **Task 1**: Input transaction type and amount.<br>• **Task 2**: Validate transaction rules (e.g., sufficient balance).<br>• **Task 3**: Update balance and provide confirmation.<br><br>**Experiment 7: Airline Reservation – Flight Search**<br>**Objective**: Develop a flight information lookup system.<br>• **Task 1**: Search flight by flight number or destination.<br>• **Task 2**: Display flight timing and availability.<br>• **Task 3**: Display seat availability in real-time.<br><br>**Experiment 8: Airline Reservation – Ticket Booking Objective**:<br>Implement airline ticket reservation functionality.<br>• **Task 1**: Collect passenger details (name, sex, age, etc.).<br>• **Task 2**: Check seat availability.<br>• **Task 3**: Generate and issue ticket with complete details. |

| | |
|---|---|
| | **Experiment 9: Airline Reservation – Ticket Cancellation**<br>**Objective**: Develop module for cancelling booked tickets.<br>• **Task 1**: Accept ticket number and passenger verification.<br>• **Task 2**: Cancel booking and update seat availability.<br>• **Task 3**: Handle refund rules or confirmations.<br><br>**Experiment 10: Employee Management – Employee Mode Objective**:<br>Design system to display employee details.<br>• **Task 1**: Input employee ID.<br>• **Task 2**: Display employee name, department, date of joining, and salary.<br>• **Task 3**: Protect sensitive data with access control.<br><br>**Experiment 11: Employee Management – Admin Mode**<br>**Objective**: Admin panel to manage employee records.<br>• **Task 1**: Login with admin credentials.<br>• **Task 2**: Add, update, or delete employee records.<br>• **Task 3**: View logs of changes for audit purposes.<br><br>**Experiment 12: Hospital Management System Objective**:<br>Create a complete hospital information system.<br>• **Task 1**: Admin login and manage patient/doctor data.<br>• **Task 2**: Doctor login to view and update illness and treatment details.<br>• **Task 3**: Generate reports per patient or doctor. |

D. **RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1. | Fundamentals of Software Engineering, | RajibMall | PHI | 2018 |
| 2. | Software Engineering | I.Sommerville | Pearson Education | Asia |
| **Reference Book** | | | | |
| 1 | Software engineering, Roger SPressman | | | |
| 2 | An Integrated Approach to Software Engineering, Pankaj Jalote | | | |
| **Online Resources** | | | | |
| 1 | https://www.javatpoint.com/software-engineering-tutorial | | | |
| 2 | https://www.geeksforgeeks.org/software-engineering/ | | | |
| 3 | https://www.tutorialandexample.com/software-engineering-tutorial | | | |

**Code: BASECA2201 Project based Computational Thinking and Data Science 1 Credit[LTP: 0-0-2]**

## A. COURSE OUTCOME

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Write Python code, develop medium-difficulty applications in Python. |
| CO – 02 | Understand | Explore Libraries used in Python. |
| CO – 03 | Apply | Apply visualization techniques using Python libraries |
| CO – 04 | Analyze | Implement the Analytics Process on the data. |
| CO – 05 | Evaluate | Implement All the EDA techniques used for Data Analysis. |

## B. MAPPING OF CO VS PO/PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | - | - | 2 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO4 | - | - | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| CO5 | - | - | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| WT. AVG | 3 | - | 2.5 | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 |

## C. LIST OF EXPERIMENTS:

| | |
|---|---|
| **1** | Installation and configuration of Jupiter, set working directory. |
| **2** | Install Packages and and calling installed packages. |
| **3** | Implement basic data structures of python<br>(a) List<br>(b) Tuple<br>(c) Set<br>(d) Dictionary |

| | |
|---|---|
| **4** | Explore various functions in Pandas.<br>(a) Series<br>(b) Data frame |
| **5** | Explore various functions in NumPy |
| **6** | Explore various charts for Visualization used in Matplotlib. |
| **7** | Explore Outlier detection using Boxplot. |
| **8** | Using EDA (Exploratory Data Analysis) find out the missing values in the data frame and fill values with Mean, Median and Mode. |
| **9** | Using Label Encoder replace Object columns in numeric columns. |
| **10** | Using One-Hot Encoding replace Categorical Columns in the form of 0-1 |
| **11** | Using Heat Map find out the Correlation between the features of the Data frame. |
| **12** | Split the Dataframes in Train & Test |

D. **RECOMMENDED STUDY MATERIAL**

| **S. No** | **Text Books:** | **Author** | **Edition** | **Publication** |
|---|---|---|---|---|
| 1 | Core Python Programming | Chun, JWesley | 2007 | Pearson, |
| 2 | Python for Data Analysis | Wes McKinney | 2017 | ORielly, |
| **Reference Book** | | | | |
| 1 | Learning Python Lutz, Mark, O Rielly, 2009 | | | |
| **Online Resources** | | | | |
| 1 | https://www.learnpython.org/ | | | |
| 2 | https://realpython.com/start-here/ | | | |

| Code: BCYECA2201 | Project Base Network Security and Defense Analysis Lab | 1 Credit [LTP:0-0-2] |
|---|---|---|

## A. COURSE OUTCOME

**On successful completion of the course the learner will be able to:**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Develop expertise in identifying and classifying various cyber threats and attack methodologies. |
| CO – 02 | Understand | Acquire foundational and advanced knowledge to diagnose and mitigate security vulnerabilities in real-world scenarios. |
| CO – 03 | Apply | Gain proficiency in utilizing Autopsy forensic tools for digital investigations and incident response. |
| CO – 04 | Analyze | Execute memorycapture and in-depth analysis to detect malicious activities and anomalies within system memory. |
| CO – 05 | Evaluate | Conduct comprehensive network traffic analysis using Network Miner tools to assess security incidents and forensic artifacts. |

## B. MAPPING OF CO VS PO/PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | 2 | - | - | 2 | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | - | - | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| CO4 | - | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| CO5 | - | 1 | - | 2 | 2 | - | - | - | - | - | - | - | - | - |
| WT. AVG | - | 2 | - | - | 2 | - | - | - | - | - | - | - | - | - |

## C. List of Programs:

| LIST OF LABS | |
|---|---|
| 1 | Conduct port scanning using Nmap to identify open ports and assess network vulnerabilities. |

| | |
|---|---|
| **2** | Deploy and configure a honeypot, monitoring network interactions to analyze potential cyber threats. |
| **3** | Install and utilize Jscript/Cryptool (or an equivalent tool) to demonstrate asymmetric and symmetric cryptographic algorithms, hashing techniques, and digital signatures/PKI authentication mechanisms. |
| **4** | Generate a set of at least 10 secure passwords (12-character length) using OpenSSL command-line utilities. |
| **5** | Implement footprinting techniques for gathering target system information using Dmitry-Dmagic and UAtester or any other latest tool. |
| **6** | Utilize network sniffers such as Wireshark to capture and analyze real-time network communication. |
| **7** | Perform real-time traffic analysis and packet logging using Snort for intrusion detection and security monitoring. |
| **8** | Conduct email forensic analysis utilizing the Autopsy tool to extract metadata and investigate suspicious emails. |
| **9** | Execute registry analysis and retrieve system boot-time logs using the Process Monitor tool for forensic investigations. |
| **10** | Performfile type detection and classification using the Autopsy tool for digital forensic analysis. |
| | **Additional Experiment** |
| **11** | Capture and analyze volatile memory artifacts using FTK Imager to uncover malicious activities. |
| **12** | Conduct network forensic analysis using Network Miner to extract and examine network traffic data. |

D. **RECOMMENDED STUDY MATERIAL**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1 | Real Digital Forensics for Handheld Devices, | E. P. Dorothy | 2013 | Auerback Publications, |
| 2 | The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, | J. Sammons | 2012 | Syngress Publishing |
| **Reference Book** | | | | |
| 1 | . Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010. | | | |
| 2. | Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C. H. Malin, E. Casey and J. M. Aquilina, Syngress, 2012. | | | |
| 3. | The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A. Reyes, Syngress, 2007 | | | |

| Online Resources | |
|---|---|
| 1 | http://tryhackme.com/ |
| 2 | http://vulnhub.com/ |
| 3. | http://pentesterslab.com/ |
| 4. | http://hackthebox.com/ |
| 5. | http://capturetheflag.com.br/ |
| 6. | http://ctf.komodosec.com/ |
| 7. | http://attackdefense.com/ |

| Code: BCTECA2201 | Project Based Azure Resources Management Lab | 1 Credit [LTP: 0-0-2] |
|---|---|---|

## A. COURSE OUTCOME

Students will be able to:

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Understand the Azure Portal and manage core cloud infrastructure resources using GUI-based tools |
| CO – 02 | Understand | Configure and deploy secure services in Azure like App Services, Storage, and Cost Management. |
| CO – 03 | Apply | Enable security recommendations and apply best practices using Azure governance tools. |
| CO – 04 | Analyze | Apply basic monitoring and automation for VMs and services in Azure. |
| CO – 05 | Evaluate | Analyze network behavior using built-in diagnostic tools and understand Azure networking basics. |

## B. MAPPING OF CO VS PO/PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | - | 2 | 2 | - | - | - | - | - | - | - | - | - |
| CO3 | - | - | - | 2 | 1 | - | - | - | - | - | - | - | - | - |
| CO4 | - | - | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - |
| CO5 | - | - | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - |
| WT. AVG | - | - | 2 | 2 | 3 | - | - | - | - | - | - | 0.4 | - | - |

## C. List of Programs:

| | |
|---|---|
| 1 | **Create an Azure Free Account and Explore Azure Portal**<br>Sign up for a free Azure account and explore key services in Azure Portal. |
| 2 | **Create and Manage Azure Resource Group**<br>Learn to create, view, and delete a Resource Group using Azure Portal and CLI. |
| 3 | **Deploy a Virtual Machine in Azure**<br>Create a Linux/Windows VM, configure size, storage, and connect using RDP/SSH. |

| | |
|---|---|
| 4 | **Create a Windows VM and Use RDP**<br>Launch a Windows VM and access it using Remote Desktop (RDP). |
| 5 | **Upload a File to Azure Blob Storage**<br>Create a storage account and upload a photo or PDF to blob storage. |
| 6 | **Apply Basic NSG Rule (Firewall)**<br>Block ping (ICMP) traffic to your VM using NSG inbound rules. |
| 7 | **Use Azure Cost Calculator**<br>Check estimated cost of the VM you created using the built-in calculator. |
| 8 | **Delete a Resource Group to Free Resources**<br>Safely delete your entire resource group with one click. |
| 9 | **Enable Azure Advisor**<br>Turn on Azure Advisor and check performance/security recommendations. |
| 10 | **Turn On Monitoring for a VM**<br>Enable "Monitoring > Insights" for a VM to check CPU/RAM usage. |
| 11 | **Create a Tag for Resources**<br>Add tags to your VM like “department: BCA” to organize resources. |
| 12 | **Deploy a Hello World App on App Service**<br>Use a quick start template to deploy a "Hello World" app on Azure Web App. |

## A. RECOMMENDED STUDY MATERIAL

| S. No. | Text Books | Author(s) | Edition | Publication |
|---|---|---|---|---|
| 1 | Microsoft Azure Administrator Exam Ref AZ-104 | Michael Washam, Jonathan Tuliani | 2nd Edition | Microsoft Press |
| 2 | Learn Azure in a Month of Lunches | Iain Foulds | 1st Edition | Manning Publications |
| 3 | Azure for Architects | Ritesh Modi | 2nd Edition | Packt Publishing |
| 4 | Exam Ref AZ-900 Microsoft Azure Fundamentals | Jim Cheshire | Latest | Microsoft Press |
| 5 | Azure Strategy and Implementation Guide | Peter De Tender, Greg Leonardo, Jason Milgram | 3rd Edition | Packt Publishing |
| **Reference Book** | | | | |
| 1. | *Microsoft Azure Administrator Exam Ref AZ-104, 2nd Edition, by Michael Washam and Jonathan Tuliani, Microsoft Press* | | | |
| 2. | *Learn Azure in a Month of Lunches, 1st Edition, by Iain Foulds, Manning Publications* | | | |
| **Online Resources** | | | | |
| 1. | https://learn.microsoft.com/en-us/training/paths/azure-fundamentals/ | | | |
| 2. | https://learn.microsoft.com/en-us/training/azure/ | | | |

**Code: BMFECA2201 Project based Mobile Application Development Using Kotlin 1 Credit[LTP: 0-0-2]**

## A. COURSE OUTCOME

Students will be able to:

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Install and configure WordPress on local and remote servers. |
| CO – 02 | Understand | Design and customize WordPress themes using HTML, CSS, and graphic design principles. |
| CO – 03 | Apply | Develop custom plugins to extend WordPress functionality. |
| CO – 04 | Analyze | Analyze and improve website usability using UX best practices. |
| CO – 05 | Evaluate | Optimize WordPress sites for performance and SEO. |

## B. MAPPING OF CO VS PO/PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | - | - | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | - | - | - | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
| WT. AVG | 3 | - | 2.6 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |

## C. LIST OF EXPERIMENTS:

| | |
|---|---|
| 1 | Create first Hello world App by using Kotlin. |
| 2 | Create Navigation Between Activities App. |
| 3 | Make a Simple List View App |

| | |
|---|---|
| 4 | Create a Digital Clock by using Kotlin. |
| 5 | Make a Simple Calculator by using Kotlin. |
| 6 | Make an attractive UI specific use of button image check box. |
| 7 | Use the Intent and Fragment make a simple application like Magazine. |
| 8 | Make an UI using UI component like Date piker, Time Piker and Progress bar also. |
| 9 | How to create a Stopwatch app using Android Studio. |
| 10 | Registration Form with Validation. |
| 11 | Make a project in Full Stack and using the Firebase in Android. |
| 12 | Make any E-Book Project using to store the view data in Firebase. |

## D. RECOMMENDED STUDY MATERIAL

| S. No. | Text Books | Author(s) | Edition | Publication |
|---|---|---|---|---|
| 1 | **Android Programming with Kotlin for Beginners Edition** | **John Horton** | **Second** | **Packet Publishing** |
| 2 | **Kotlin Programming: The Big Nerd Ranch Guide** | **David Greenhalgh, Josh Skeen, Andrew Bailey** | **2nd Edition** | **Big Nerd Ranch Guides** |
| **Reference Book** | | | | |
| 1. | *Microsoft Azure Administrator Exam Ref AZ-104, 2nd Edition, by Michael Washam and Jonathan Tuliani, Microsoft Press* | | | |
| 2. | *Learn Azure in a Month of Lunches, 1st Edition, by Iain Foulds, Manning Publications* | | | |
| **Online Resources** | | | | |
| 1. | https://learn.microsoft.com/en-us/training/paths/azure-fundamentals/ | | | |
| 2. | https://learn.microsoft.com/en-us/training/azure/ | | | |

| Code: BDAECA2201 | Project based development in Data Analytics | 1 Credit[LTP: 0-0-2] |
|---|---|---|

**A. COURSE OUTCOME**

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Identify key concepts of data, data types, and stages in data analytics. |
| CO – 02 | Understand | Explain the data analytics lifecycle and the role of data wrangling and cleaning. |
| CO – 03 | Apply | Examine datasets using descriptive statistics and visualization techniques. |
| CO – 04 | Analyze | Use tools like Excel, Python (Pandas), and visualization platforms like Excel/Matplotlib. |
| CO – 05 | Evaluate | Interpret results, evaluate insights, and communicate findings effectively. |

**B. MAPPING OF CO VS PO/PSO**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | 3 | - | 1 | 1 | - | 1 | 3 | 2 | - | 3 |
| CO2 | 3 | 2 | 2 | - | 3 | - | 1 | - | - | 1 | 3 | 2 | 2 | 3 |
| CO3 | 2 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | 3 | - | 3 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 2 | - | - | - | - | 1 | 3 | - | 3 | 3 |
| CO5 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | - | - | 2 | 3 | - | 3 | 3 |

**C. LIST OF EXPERIMENTS**

| | |
|---|---|
| 1 | Identify and describe structured vs unstructured data using sample datasets (CSV, JSON, Excel). |
| 2 | Load datasets using Pandas and perform initial data exploration using head (), info(), and describe(). |
| 3 | Perform data cleaning: handle missing values, remove duplicates, fix format issues. |
| 4 | Use MS Excel to perform analysis using Pivot Tables, Conditional Formatting, and VLOOKUP. |

| | |
|---|---|
| 5 | Create visualizations in Excel and draw basic insights (bar chart, pie chart, line graph). |
| 6 | Perform univariate and bivariate analysis using Seaborn (histograms, boxplots, pairplots). |
| 7 | Merge and join multiple datasets using Pandas and explore the results. |
| 8 | Execute SQL queries: SELECT, WHERE, GROUP BY, ORDER BY using sample database. |
| 9 | Design a basic interactive dashboard in Excel using pivot charts, and conditional formatting. |
| 10 | Conduct a domain-based case study (e.g., Retail or Healthcare) using EDA and visualization. |
| 11 | Work in groups to summarize findings and make data-driven recommendations. |
| 12 | Mini-project: Choose dataset from Kaggle/UCI, perform EDA, cleaning, visualization, presentation. |

## D. RECOMMENDED STUDY MATERIAL

| S. No. | Text Books | Author(s) | Edition | Publication |
|---|---|---|---|---|
| **1** | Data Analytics | Anil Maheshwari | 2023 | McGraw Hill |
| **2** | Data Analytics using Python | Bharti Motwani | 2020 | Wiley |
| **3** | Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter | Wes McKinney | 2022 | O'Reilly |
| **Reference Book** | | | | |
| 1. | Data Analytics using Python, Bharti Motwani, 2020, Wiley | | | |
| **Online Resources** | | | | |
| 1. | https://www.datacamp.com/ | | | |
| 2. | https://www.tableau.com/analytics/what-is-data-analytics | | | |
| 3. | https://www.geeksforgeeks.org/data-analysis-tutorial/ | | | |
| 4. | https://www.kaggle.com/datasets | | | |

| Code: BCLECA2201 | SAS Programming in Viya | 1 Credit [LTP: 0-0-2] |
|---|---|---|

## A. COURSE OUTCOMES

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Remember | Remember and apprehend the SAS platform, and running SAS code on SAS computer server. |
| CO – 02 | Understand | Understand the accessing of DBMS date, modifying Data step code to run in SAS cloud Analytic services (CAS) |
| CO – 03 | Apply | Try to apply the various procedure in SAS Viya and running CAS-embedded SAS procedure |
| CO – 04 | Analyze | Analyze how SQL code can modify to run CAS and column alteration. |
| CO – 05 | Evaluate | Evaluate the CAS action and understand CASL. |

## B. MAPPING MATRIX OF CO, PO, & PSO

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | - | 3 | — | 2 | — | - | - | 3 | 2 | 2 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 3 | — | 2 | — | - | - | 3 | 3 | 3 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 3 | - | 2 | 1 | - | - | 3 | 2 | 3 | 2 |
| CO4 | 2 | 3 | 2 | 3 | 3 | 1 | 2 | 2 | - | - | 2 | 2 | 3 | 1 |
| CO5 | 2 | 3 | 2 | 3 | 3 | 1 | 3 | — | - | - | 2 | 2 | 3 | 2 |

## C. OUTLINE OF THE COURSE

| Unit No. | Title of the unit | Time required for the Unit (Hours) |
|---|---|---|
| 1. | **Connect to Cloud Analytic Services (CAS). Access and use caslibs** | 07 |
| 2. | **Load SAS data sets, CSV files, and Microsoft Excel files into CAS.** | 08 |
| 3. | **Save SASHDAT files. Modify Base SAS programs to execute in CAS.** | 07 |
| 4. | **Modify SQL procedure code to execute in CAS using FedSQL.** | 08 |
| 5. | **Use CAS-enabled functions and procedures.** | 07 |

**D. DETAILED SYLLABUS**

| 1. Unit | Unit Details |
|---|---|
| **1.** | **Connect to Cloud Analytic Services (CAS).Access and use caslibs** |
| | • Introducing the SAS Viya platform.<br>• SAS Viya programming interfaces.<br>• SAS Viya servers and processing environments<br>• Overview of running SAS code on the SAS Compute Server.<br>• SAS Viya Compute Server overview.<br>• Running SAS 9 Code on the Compute Server in SAS Viya.<br>• CAS fundamentals.<br>• Understanding caslibs. |
| **2.** | **Load SAS data sets, CSV files, and Microsoft Excel files into CAS.** |
| | • Introduction of Unit<br>• Loading data to in-memory tables.<br>• Accessing DBMS data.<br>• Saving and dropping in-memory tables<br>• Modifying DATA step code to run in SAS Cloud Analytic Services (CAS)<br>• .Conclusion of Unit |
| **3.** | **Save SASHDAT files. Modify Base SAS programs to execute in CAS.** |
| | • Introduction of Unit<br>• Introduction to SAS procedures in SAS Viya.<br>• Running CAS-enabled SAS procedures.<br>• Conclusion of Unit |
| **4.** | **Modify SQL procedure code to execute in CAS using FedSQL.** |
| . | • Introduction of Unit<br>• Modifying SQL code to run in CAS.<br>• Column data types in CAS.<br>• Conclusion of Unit |
| **5** | **Use CAS-enabled functions and procedures.** |
| . | • Introduction to CASL.<br>• Using CAS actions. |

**E. RECOMMENDED STUDY MATERIAL:**

| S. No | Text Books: | Author | Edition | Publication |
|---|---|---|---|---|
| 1 | The Little SAS Enterprise Guide Book | Susan Slaughter & LoraDelwiche | Late st | SAS |
| 2 | SAS Certification Prep Guide | | 3rd | SAS Institute |
| **Reference Book** | | | | |
| 1 | Learn SAS By example A Programmer Guide By Ron Cody | | | |
| **Online Resources** | | | | |
| 1 | https://www.sas.com/de_de/training/courses/learning-formats/e-learning.html | | | |

2nd SEMESTER

# Ability Enhancement Courses (AEC)

| Code: BEACHM2213 | QUANTITATIVE AND VERBAL APTITUDE TRAINING-I | 1 Credit [LTP: 0-0-1] |
|---|---|---|

## *A. Course Outcome: -*

| CO | Cognitive Abilities | Course Outcomes |
|---|---|---|
| CO – 01 | Understand | Understand concepts of number systems, percentages, and interest to solve quantitative problems. |
| CO – 02 | Analyze | Analyze data from tables, pie charts, and bar graphs to derive conclusions and evaluate the sufficiency of information. |
| CO – 03 | Apply | Demonstrate accuracy in solving logical reasoning problems involving arrangements, blood relations, and visual patterns. |
| CO – 04 | Apply | Apply grammatical rules and sentence structures to identify and correct errors in English usage. |
| CO – 05 | Create | Develop effective reading, comprehension, and vocabulary skills to enhance verbal aptitude and communication. |

### B. CO, PO, PSO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | | | | | | 1 | 2 | | | |
| CO2 | 2 | 3 | 3 | 3 | 1 | | | | | 1 | | 2 | | |
| CO3 | 2 | 2 | 3 | 2 | | | | | 2 | 2 | 1 | | 2 | |
| CO4 | 1 | 1 | | | 2 | | | | 1 | 3 | | 1 | | |
| CO5 | 2 | 1 | | | 3 | | | | 1 | 3 | 1 | | 3 | |

### C. LIST OF EXPERIMENTS

| | |
|---|---|
| 1 | **Number System** – I Number system, Power cycle |
| 2 | **Number System** – II Remainder cycle, Factors, Multiples, HCF & LCM |
| 3 | **Reading Comprehension**- Speed Reading Strategies, RC types, Tackling Strategies |
| 4 | **Data Arrangement** – Linear and Circular Arrangements, Multi-dimensional Arrangement, Blood Relations |
| 5 | **Time and Work** – Work with efficiencies, Pipes and Cisterns, Work equivalence, Division of wages |

| | |
|---|---|
| **6** | **Sentence Correction –** I Subject-Verb Agreement, Modifiers, Parallelism |
| **7** | **Sentence Correction** – II Pronoun Agreement, Verb Tenses, Comparisons, Prepositions, Determiners |
| **8** | **Reasoning-** Coding-Decoding, Series, Analogy, Odd Man Out, Visual Reasoning |
| **9** | **Percentage & Interest** –Percentages, Percentage Change, S.I, C.I., Relation between S.I. and C.I. |
| **10** | Verbal & DI Sentence Completion, Para-jumbles, Vocabulary, DI & DS |

# 2nd SEMESTER

# Skill Enhancement Courses (SEC)

| Code: BELCSE2201 | Skill Enhancement Course | 1 Credit [LTP: 0-0-2] |
|---|---|---|

**FACE Domain: Fundamental of Programming**
**Course: Basic Programming and Logic Building**
Applicable for BTech and BCA (Batch 2029, 2028)

**COURSE OUTCOMES: On completion of the course a student will be able to:**

- Demonstrate basic input and output operations using formatted printing and user input methods.
- Apply various operators to perform arithmetic, relational, logical, and bitwise operations in programs.
- Implement conditional logic using if-else, nested conditions, and switch-case constructs.
- Develop iterative solutions using loops such as for, while, and do-while, along with loop control statements.
- Generate mathematical sequences like Fibonacci, arithmetic, and geometric series using programming logic.

**DETAILED SYLLABUS**

| S.NO. | Topic | Sub-Topics |
|---|---|---|
| 1. | **Input & Output** | **System.out.println():** Used to display output on the console. Allows formatted output with printf() or format().<br><br>**Practical Exercise:** Write a program to print a personalized greeting message using System.out.println().<br><br>**Scanner class:** Reads user input from the console. Supports methods like nextInt(), nextDouble(), nextLine() for different data types.<br><br>**Practical Exercise:** Write a program to take two numbers as input from the user and display their sum. |
| 2. | **Operators** | **Arithmetic operators:** Perform basic mathematical operations like addition, subtraction, multiplication, division, modulus, exponentiation, and floor division.<br><br>**Relational operators:** Compare values and return Boolean results like greater than, less than, equal to, or not equal.<br><br>**Logical operators:** Combine multiple conditions using logical connectors like AND, OR, and NOT.<br><br>**Assignment operators:** Assign values to variables and combine them with arithmetic or logical operations.<br><br>**Bitwise operators:** Perform operations at the binary level, manipulating individual bits in integers.<br><br>**Practical Exercise:** Create a program to find to all the operators. |
| 3. | **Decision Making** | **if, elif, else statements:** Control the program flow based on conditions. Execute specific blocks of code depending on whether conditions are met.<br><br>**Practical Exercise:** Write a program to determine if a number is positive, negative, or zero.<br><br>**Nested conditions:** Allow the inclusion of an if statement inside another if to test complex logic. |

| | | |
|---|---|---|
| | | **Practical Exercise:** Create a program to check if a number is divisible by both 2 and 3.<br>**switch-case:** Selects among multiple options based on the value of an expression.<br>**Practical Exercise:** Create a program that accepts a number (1-7) and prints the corresponding day of the week. |

| | | |
|---|---|---|
| 4. | **Looping** | **for loop:** Used to iterate over sequences like ranges, lists, or strings, executing a block of code for each element.<br><br>**Practical Exercise:** Write a program to print the squares of numbers from 1 to 10.<br><br>**while loop:** Executes a block of code as long as the condition is true, often used when the number of iterations is unknown.<br><br>**Practical Exercise:** Write a program to find the sum of natural numbers up to a given limit using a while loop.<br><br>**do-while loop:** Similar to while, but guarantees at least one iteration.<br><br>**Practical Exercise:** Create a program to repeatedly ask the user for input until a valid number is provided.<br><br>**Loop control statements:** break stops the loop, continue skips the current iteration, and pass is a placeholder for future code without affecting execution.<br><br>**Practical Exercise:** Demonstrate the use of break to exit a loop when a condition is met. |
| 5. | **Series Programming** | **Series Programming:** It involves generating various types of sequences like arithmetic, geometric, Fibonacci, etc. These series are useful in mathematics and algorithm design.<br>**Practical Exercise:** Write a program to generate the Fibonacci series up to n terms.<br>**Arithmetic and Geometric Series:** The arithmetic series involves generating numbers by adding a constant difference to the previous term. The nth term is given by Tn = a + (n-1) * d. A geometric series is a sequence where each term is found by multiplying the previous term by a constant ratio r. The nth term is Tn = a * r^(n-1), where a is the first term and r is the common ratio. The sum of the first n terms is S = a * (1 - r^n) / (1 - r). This series often appears in financial calculations such as compound interest.<br><br>**Practical Exercise:** Write a program to generate the first n terms of an arithmetic and geometric series. |
| 6. | **Pattern Programming** | **Star Pattern:** Pattern programming involves printing specific patterns (e.g., stars, numbers) arranged in different shapes like triangles, squares, pyramids, etc. These patterns help practice loops and conditional statements.<br><br>**Practical Exercise:** Write a program to print the following pyramid of stars:<br><br>*<br><br>***<br><br>*****<br><br>**Number and Alphabet Pattern:** In number patterns, numbers are arranged in specific sequences, often following simple rules. Examples include printing numbers in ascending or descending order in different shapes.<br><br>**Practical Exercise:** Write a program to print a number triangle pattern like:<br><br>1<br><br>1 2<br><br>1 2 3 |