



॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत  
राष्ट्रीय शैक्षणिक धोरण-२०२० नुसार  
पदवी तृतीय वर्षाचे अभ्यासक्रम  
(Syllabus) शैक्षणिक वर्ष २०२६-२७  
पासून लागू करण्याबाबत.

### परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २२ एप्रिल २०२६ रोजी संपन्न झालेल्या मा.विद्यापरिषद बैठकीतील विषय क्र.०८/६४-२०२६ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण-२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६-२७ पासून लागू करण्यास मा.विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी.एस्सी. तृतीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६-२७ पासून लागू करण्यात येत आहे.

|    |                                                |
|----|------------------------------------------------|
| 01 | B.Sc. III Year Computer Maintenance            |
| 02 | B.Sc. III Year Information Technology          |
| 03 | B.Sc. III Year Computer Science                |
| 04 | B.C.A. III Year (Single Major)                 |
| 05 | B.Sc. III Year Computer Science (Single Major) |

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://www.srtmun.ac.in) या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,

विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.:शै-१/परिपत्रक/पदवी/बीएस्सी/२०२६-२७/ 93

दिनांक : १०.०७.२०२६

उपकुलसचिव  
शैक्षणिक (१-अभ्यासमंडळे) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :-

- १) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. प्र.कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- ४) मा. संचालक, परिक्षा व मूल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
- ५) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ६) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यांना देवून कळविण्यात येते की, परिपत्रक अभ्यासक्रम संकेतस्थळावर प्रसिध्द करण्यात यावेत.

**SWAMI RAMANAND TEERTH  
MARATHWADA UNIVERSITY, NANDED -  
431 606 (MS)**



**(Credit Framework and Structure of Four Year UG Program  
with Multiple Entry and Exit Option as per NEP-2020)**

**UNDERGRADUATE PROGRAM OF  
SCIENCE & TECHNOLOGY UNDER THE BOS OF  
COMPUTER SCIENCE AND APPLICATION**

**TY-BCA (Single Major)**

**(Bachelor in Computer Application)**

**(Honours and Honours with Research)**

**Under the Faculty of Science & Technology**

***(Revised as per the Govt. Of Maharashtra circular Dt. 13-03-2024)***

**&**

***(Based on the AICTE model curriculum suggested in Sept 2024)***

### **From the Desk of the Dean, Faculty of Science and Technology**

Swami Ramanand Teerth Marathwada University, Nanded, enduring to its vision statement “***Enlightened Student: A Source of Immense Power***”, is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve ***the 3Es, the equity, the efficiency and the excellence*** in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the cumulative grade point average (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employ ability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the Choice Based Credit System (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high calibre graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the students

will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science based to the discipline-specific-based curriculum. All the recommendations of the Sukanu Samiti given in the NEP Curriculum Framework-2023 have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students.

We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the Government of Maharashtra regarding NEP-2020. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employ ability. Introduction of the mandatory On Job Training, Internship program for science background students is praise worthy and certainly help the students to imbibe first hand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

**Dr. M. K. Patil**

***Dean***

Faculty of Science and Technology

### **Program Specific Outcomes:**

**PSO 01:** Students will be able to understand analyses and develop computer programs in the areas related to algorithm, system software, web design and networking for efficient design of computer-based system.

**PSO 02:** Apply standard software engineering practices and strategies in software project development using open-source programming environment to deliver a quality of product for business success.

**PSO 03:** Student will be able to know various issues, latest trends in technology development in the field of AI and thereby, innovate new ideas and solutions to existing problems.

**PSO 04:** Explore technical knowledge in diverse areas of computer applications and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.

### **GENERAL COURSE STRUCTURE & THEME**

#### **A. Definition of Credit:**

|                               |            |
|-------------------------------|------------|
| 1 Hr. Lecture (L) per week    | 1 Credit   |
| 1 Hr. Tutorial (T) per week   | 1 Credit   |
| 1 Hr. Practical (P) per week  | 0.5 Credit |
| 2 Hrs. Practical (P) per week | 1 Credit   |

**B. Course Code and definition:**

| Course Code | Definitions                                   |
|-------------|-----------------------------------------------|
| L           | Lecture                                       |
| T           | Tutorial                                      |
| P           | Practical                                     |
| DSC (CT/CP) | Core Courses                                  |
| AEC         | Ability Enhancement Courses                   |
| MDE         | Multi-Disciplinary Elective course            |
| VEC         | Value added Courses                           |
| SEC (ST/SP) | Skill Enhancement courses                     |
| DSE (ET/EP) | Discipline Specific Elective                  |
| GE/OE       | Open Elective                                 |
| OJT         | On Job Training (Internship/ Apprenticeship ) |
| FP          | Field Project                                 |
| CEP         | Community Engagement and Service              |
| CC          | Co-Curricular Courses                         |
| RM          | Research Methodology                          |
| RP          | Research Project /Dissertation                |

Course Level/Duration/System:

- A.** Eligibility for Admission: As per the regulations of the SRTMUN, AICTE/DTE and Government of Maharashtra, issued from Time-to-time regarding admission process.
- B.** As per NEP-2020 policy, it is a UG program (3/4 years) (6/ 8 Semesters) with multiple entry and exit. The following option will be made available to the students joining BCA Research Program:
1. One year: Under Graduate Certificate in Computer Application
  2. Two years: Under Graduate Diploma in Computer Application
  3. Three years: Bachelor in Computer Application (BCA)
  4. Four years: Bachelor in Computer Application with Honours: BCA (Honours) or Bachelor in Computer Application Honours with Research: BCA (Honours with Research)

**Note:** The students who are eligible for BCA (Honours with Research) shall have choice to pursue either BCA (Honours) or BCA (Honours with Research).

SEMESTER WISE CREDIT DISTRIBUTION: Semester wise credit distribution of proposed BCA [BCA (Honours) and BCA (Honours with research)] program:

| Semester                                                                   | Core Courses | Ability Enhancement Courses (AEC) | Multi-Disciplinary Elective Course (MDE) | Value Added Courses (VEC) | Skill Enhancement courses (SEC) | Discipline Specific Elective (DSE) | Total |
|----------------------------------------------------------------------------|--------------|-----------------------------------|------------------------------------------|---------------------------|---------------------------------|------------------------------------|-------|
| I                                                                          | 8            | 2                                 | 2                                        | 2                         | 5                               | -                                  | 19    |
| II                                                                         | 12           | -                                 | -                                        | 2                         | 7                               | -                                  | 21    |
| III                                                                        | 11           | -                                 | -                                        | 2                         | 4                               | 3                                  | 20    |
| IV                                                                         | 15           | -                                 | -                                        | -                         | 2                               | 3                                  | 20    |
| V                                                                          | -            | -                                 | -                                        | -                         | 6                               | 15                                 | 21    |
| VI                                                                         | 4            | 1                                 | -                                        | -                         | 4                               | 10                                 | 19    |
| <b>Higher Semester -Tentative Structure yet to be defined**</b>            |              |                                   |                                          |                           |                                 |                                    |       |
| <b>BCA (Honours)</b> Tentative Structure yet to be defined**               |              |                                   |                                          |                           |                                 |                                    |       |
| VII                                                                        | -            | -                                 | -                                        | -                         | -                               | -                                  | 19/20 |
| VIII                                                                       | -            | -                                 | -                                        | -                         | -                               | -                                  | 20/21 |
| <b>BCA (Honours with Research)</b> Tentative Structure yet to be defined** |              |                                   |                                          |                           |                                 |                                    |       |
| VII                                                                        | -            | -                                 | -                                        | -                         | -                               | -                                  | 19/20 |
| VIII                                                                       | -            | -                                 | -                                        | -                         | -                               | -                                  | 20/21 |

**Category-wise distribution to be followed as per AICTE norms. \*\***

| Description                 | Core Courses (DSC) | Ability Enhancement Courses (AEC) | Multi-Disciplinary Elective course (MDE) | Value Added Courses (VEC) | Skill Enhancement Courses (SEC) | Discipline Specific Elective (DSE) | Total Credits |
|-----------------------------|--------------------|-----------------------------------|------------------------------------------|---------------------------|---------------------------------|------------------------------------|---------------|
| BCA                         | 50                 | 3                                 | 2                                        | 6                         | 28                              | 31                                 | 120           |
| BCA (Honours)               | 55                 | 3                                 | 5                                        | 6                         | 40                              | 51                                 | 160           |
| BCA (Honours with Research) | 82                 | 3                                 | 2                                        | 6                         | 28                              | 39                                 | 160           |

**Note:**

**\*\* For BCA at SRTMUN, yet to be defined / will be finalised after complete detailing of 4 years BCA as and when approved by BoS / Academic Council/ University norms.**

Choice will be given for Students to take extra credit course from their own institute/college/ department or from other institute/college/ department as per the Admitting Body / University norms.

**Examination:** It will be held twice a year as per the policy of the university, usually as mentioned below.

| Sr. No. | Name of the Examination                                   | Main Examination | Supplementary Examination |
|---------|-----------------------------------------------------------|------------------|---------------------------|
| 1       | BCA –Semester I, III, V, VII (For Honours and Research)   | Winter           | Summer                    |
| 2       | BCA –Semester II, IV, VI, VIII (For Honours and Research) | Summer           | Winter                    |

The examination specified in the preceding paragraph shall be held semester-wise at such places and on such dates as prescribed by the University.

**Mapping of Marks to Grades:** The mapping of marks to grades may be done as per the policy and norms of the university, enacted time to time. The AICTE Model syllabus has recommended following table.

| Range of Marks | Assigned Grade                                                                          |
|----------------|-----------------------------------------------------------------------------------------|
| 91-100         | A <sup>+</sup>                                                                          |
| 81-90          | A                                                                                       |
| 71-80          | B <sup>+</sup>                                                                          |
| 61-70          | B                                                                                       |
| 51-60          | C <sup>+</sup>                                                                          |
| 46-50          | C                                                                                       |
| 40-45          | D                                                                                       |
| < 40           | F (Fail due to less marks)                                                              |
| -              | F <sup>R</sup> (Fail due to shortage of attendance and therefore, to repeat the course) |



### Eligibility Criteria for Higher Semester Examinations:

- 1) The university rules shall be followed when admitting students into the next higher semester for BCA. However, the AICTE Model syllabus has recommended following table

| Sr. No. | Semester | ATKT/Promotion Rules                                                                                                                                                                                                                                                                                     |
|---------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | I        | -----                                                                                                                                                                                                                                                                                                    |
| 2       | II       | Students enrolled in <b>Semester I</b> shall be allowed to keep the term for <b>Semester II</b> , provided they have appeared for at least one paper in the University Examination of Semester I.                                                                                                        |
| 3       | III      | The candidate must pass at least 40% of the total subjects (i.e., 6 papers out of 15, including Practicals) from both <b>Semester I</b> and <b>Semester II</b> combined.                                                                                                                                 |
| 4       | IV       | A student enrolled in <b>Semester III</b> shall be allowed to keep the term for <b>Semester IV</b> , provided they have appeared for at least one paper in the University Examination of Semester III.                                                                                                   |
| 5       | V        | The candidate must have cleared all papers from the first year (i.e., all papers from Semester I and Semester II, including practicals) and must pass at least 40% of the total subjects (i.e., 5 papers out of 12, including practicals) from both <b>Semester III</b> and <b>Semester IV</b> combined. |

- 2) To be eligible for admission to the BCA (Honours) or BCA (Honours with Research) program, a student must have successfully completed a 3-year BCA program.

**Language of Examination:** The medium of instruction and examination will be English unless otherwise specified in the syllabus, except for Indian or foreign languages selected by students in the AEC course.

## Semester wise Curriculum for UG Course in BCA Semester –V

| Sr. No. | Course Code                                     | Course Title                                                                                                                                            | L | T | P | Credit | % of Assessment |    |       |                   |
|---------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|--------|-----------------|----|-------|-------------------|
|         |                                                 |                                                                                                                                                         |   |   |   |        | UA              | CA | Total | Minimum passing % |
| 1       | SBCAET1301<br>(Choose any one)                  | Professional Elective – III<br>A. Data Science: Introduction to Data Science<br>B. Artificial Intelligence and Machine Learning: Neural Network         | 3 | 0 | 0 | 3      | 60              | 15 | 75    | 40%               |
| 2       | SBCAEP1301<br>(Any one related to above ET1301) | Lab-3: Professional Elective – III<br>A. Data Science: Introduction to Data Science<br>B. Artificial Intelligence and Machine Learning: Neural Network  | 0 | 0 | 4 | 2      | 30              | 20 | 50    | 40%               |
| 3       | SBCAET1302<br>(Choose any one)                  | Professional Elective – IV<br>A. Data Science: Time Series Analysis<br>B. Artificial Intelligence and Machine Learning: Digital Image Processing        | 3 | 0 | 0 | 3      | 60              | 15 | 75    | 40%               |
| 4       | SBCAEP1302<br>(Any one related to above ET1302) | Lab-4: Professional Elective – IV<br>A. Data Science: Time Series Analysis<br>B. Artificial Intelligence and Machine Learning: Digital Image Processing | 0 | 0 | 4 | 2      | 30              | 20 | 50    | 40%               |
| 5       | SBCAET1303<br>(Choose any one)                  | Professional Elective – V<br>A. Data Science: Machine Learning<br>B. Artificial Intelligence and Machine Learning: Natural Language Processing          | 3 | 0 | 0 | 3      | 60              | 15 | 75    | 40%               |
| 6       | SBCAEP1303<br>(Any one related to above ET1303) | Lab 5: Professional Elective – V<br>A. Data Science: Machine Learning<br>B. Artificial Intelligence                                                     | 0 | 0 | 4 | 2      | 30              | 20 | 50    | 40%               |

|                                                                                                                                                                              |            |                                                         |           |           |           |           |            |            |            |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------------------------------------------------|-----------|-----------|-----------|-----------|------------|------------|------------|-----|
|                                                                                                                                                                              |            | and Machine Learning:<br>Natural Language<br>Processing |           |           |           |           |            |            |            |     |
| 7                                                                                                                                                                            | SBCAST1301 | Quantitative Techniques                                 | 0         | 2         | 0         | 2         | 40         | 10         | 50         | 40% |
| 8                                                                                                                                                                            | SBCASP1301 | Internship/Capstone Project                             | 0         | 0         | 8         | 4         | 60         | 40         | 100        | 40% |
| <b>Total</b>                                                                                                                                                                 |            |                                                         | <b>09</b> | <b>02</b> | <b>20</b> | <b>21</b> | <b>370</b> | <b>155</b> | <b>525</b> |     |
| <b>Note: For University Assessment (UA), College Assessment (CA) Evaluation Rules, Practical Assessment and for Question Paper Pattern refer to policy of the university</b> |            |                                                         |           |           |           |           |            |            |            |     |

Note: Professional Electives to be selected from the Proposed Streams with Discipline-Specific Electives - Data Science / Artificial Intelligence and Machine Learning / Full Stack Development proposed by AICTE / Universities as indicated at the appendix – A. However, the more comprehensive list approved by the BoS of SRTMUN shall be made available with curriculum structure of Fourth Year.

\*Students can choose their specialization i.e. Stream with Discipline Specific Elective [DSE] from Second year onwards.

Indicative Appendix –A of AICTE Model syllabus available on below link  
[https://www.aicte-india.org/sites/default/files/Model\\_Curriculum/BCA%20FINAL\(2%20year%20\).pdf](https://www.aicte-india.org/sites/default/files/Model_Curriculum/BCA%20FINAL(2%20year%20).pdf).

### Semester- VI

| Sr. No.      | Course Code                                     | Course Title                                                                                                                                                   | L        | T        | P         | Credit    | % of Assessment |            |            |                   |
|--------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------|-----------|-----------------|------------|------------|-------------------|
|              |                                                 |                                                                                                                                                                |          |          |           |           | UA              | CA         | Total      | Minimum passing % |
| 1            | SBCACT1351                                      | Generative AI                                                                                                                                                  | 2        | 0        | 0         | 2         | 40              | 10         | 50         | 40%               |
| 2            | SBCACP1351                                      | Lab - Generative AI                                                                                                                                            | 0        | 0        | 4         | 2         | 30              | 20         | 50         | 40%               |
| 3            | SBCAET1351                                      | Professional Elective – VI<br>A. Data Science: Big Data Analytics<br>B. Artificial Intelligence and Machine Learning: Deep Learning for Computer Vision        | 3        | 0        | 0         | 3         | 60              | 15         | 75         | 40%               |
| 4            | SBCAEP1351<br>(Any one related to above ET1351) | Lab 6: Professional Elective – VI<br>A. Data Science: Big Data Analytics<br>B. Artificial Intelligence and Machine Learning: Deep Learning for Computer Vision | 0        | 0        | 4         | 2         | 30              | 20         | 50         | 40%               |
| 5            | SBCAET1352                                      | Professional Elective – VII<br>A. Data Science: Exploratory Data Analysis<br>B. Artificial Intelligence and Machine Learning: Predictive Analysis              | 3        | 0        | 0         | 3         | 60              | 15         | 75         | 40%               |
| 6            | SBCAEP1352<br>(Any one related to above ET1352) | Lab 7: Professional Elective – VII<br>A. Data Science: Exploratory Data Analysis<br>B. Artificial Intelligence and Machine Learning: Predictive Analysis       | 0        | 0        | 4         | 2         | 30              | 20         | 50         | 40%               |
| 7            | SBCAE1351                                       | Soft Skills                                                                                                                                                    | 0        | 1        | 0         | 1         | 00              | 25         | 25         | 40%               |
| 8            | SBCASP1351                                      | Major Project                                                                                                                                                  | 0        | 0        | 8         | 4         | 60              | 40         | 100        | 40%               |
| <b>Total</b> |                                                 |                                                                                                                                                                | <b>8</b> | <b>1</b> | <b>20</b> | <b>19</b> | <b>310</b>      | <b>165</b> | <b>475</b> |                   |

**Note: For University Assessment (UA), College Assessment (CA) Evaluation Rules, Practical Assessment and for Question Paper Pattern refer to policy of the university**

Note: Professional Electives to be selected from the Proposed Streams with Discipline-Specific Electives - Data Science / Artificial Intelligence and Machine Learning / Full Stack Development proposed by AICTE / Universities as indicated at the appendix – A. However, the more comprehensive list approved by the BoS of SRTMUN shall be made available with curriculum structure of Fourth Year.

**Note:**

- Students may begin working on the Major Project in the fifth semester in groups of up to three members. This project will be evaluated during the sixth semester.
- BACHELOR IN COMPUTER APPLICATION Degree will be awarded, if a student wishes to exit at the end of Third year.

**Exit Criteria after Third Year of BCA Programme:**

- The students shall have an option to exit after 3rd year of Computer Application Program and will be awarded with a Bachelor's in Computer Application.

**Re-entry Criteria in to Fourth Year (Seventh Semester)**

- The student who takes an exit after third year with an award of BCA may be allowed to re-enter in to Seventh Semester for completion of the BCA (Honours) or BCA (Honours with Research) Program as per the respective University / Admitting Body schedule after earning requisite credits in the Third year.

**Guidelines for the Course Assessment:**

**Continuous Assessment (CA) of theory and practical courses:**

- i. **For Theory Course:** CA shall be carried out over the entire semester. It shall be done by conducting Two Tests (Test I on 40% curriculum) and Test II (on remaining syllabus) and average of the marks scored by a student in these two tests of a particular course /paper shall be taken as the CA score.
- ii. **For Practical Course:** CA shall be the marks scored by a student in the internal practical examination conducted by the concerned teacher.
- iii. **For AE, MD, VA, AE, etc. courses:** CA marks are same as displayed in the structure and are given as per the policy of the university or in absence of university guidelines, as decided by the concerned teacher/ institution.

**End Semester Assessment (80% of the Maximum Marks) of theory and practical courses.**

## Appendix- A

### Proposed Streams with Discipline-Specific Electives - Data Science / Artificial Intelligence and Machine Learning / Full Stack Development proposed by AICTE / Universities.

*Note: The following is indicative. Universities/Institutes may add streams / electives as per their specific requirements. However, the more comprehensive list approved by the BoS of SRTMUN shall be made available with curriculum structure of Fourth Year.*

#### 1. Data Science

| Sl. No | Semester | Professional Elective                      |
|--------|----------|--------------------------------------------|
| 1      | III      | Basics of Data Analytics using Spreadsheet |
| 2      | IV       | Data Visualization                         |
| 3      | V        | Introduction to Data Science               |
| 4      | V        | Time Series Analysis                       |
| 5      | V        | Machine Learning                           |
| 6      | VI       | Big Data Analytics                         |
| 7      | VI       | Exploratory Data Analysis                  |
| 8      | VII      | Business Intelligence & Analytics          |
| 9      | VII      | Data Mining & Warehousing                  |
| 10     | VIII     | Advanced Data Visualization                |
| 11     | VIII     | Cloud Computing for Data Analytics         |
| 12     | VIII     | Data Security & Privacy                    |

#### 2. Artificial Intelligence & Machine Learning

| Sl. No | Semester | Professional Elective               |
|--------|----------|-------------------------------------|
| 1      | III      | Feature Engineering                 |
| 2      | IV       | Introduction to ML                  |
| 3      | V        | Neural Network                      |
| 4      | V        | Digital Image Processing            |
| 5      | V        | Natural Language Processing         |
| 6      | VI       | Deep Learning for Computer Vision   |
| 7      | VI       | Predictive Analysis                 |
| 8      | VII      | Explainable AI                      |
| 9      | VII      | Evolutionary Algorithm              |
| 10     | VIII     | Speech Recognition                  |
| 11     | VIII     | Augmented Reality & Virtual Reality |
| 12     | VIII     | Security aspects of ML              |

**A. For illustration a course / paper of 03 credits / 60 marks has been considered. The Question Paper Pattern of the ESA:**

**Faculty of Science and Technology  
BCA  
Question paper format (As per NEP2020)**

***Time: 2:30 Hrs***

***Max. Marks: 60***

Instructions to the candidates:

1. *Question No. 1 is Compulsory.*
2. *From Q. No. 2 to 5 solve any three questions.*
3. *Figures to the right indicate full marks.*
4. *Assume suitable data, if necessary.*
5. *Use of any electronic media such as mobile phone, digital diary, and electronic calculator is not permitted.*

**Q.1 Attempt the following (any three)  
(Based on all units)**

**(15) Marks**

- a)
- b)
- c)
- d)
- e)

**Q. 2 Attempt of the following (any three)  
(Based on unit 1)**

**(15) Marks**

- a)
- b)
- c)
- d)

**Q. 3 Solve the following (any three)  
(Based on unit 2)**

**(15) Marks**

- a)
- b)
- c)
- d)

**Q. 4 Attempt of the following (any three)  
(Based on unit 3)**

**(15) Marks**

- a)
- b)
- c)
- d)

**Q. 5 Attempt of the following (any three)  
(Based on unit 4)**

**(15) Marks**

- a)
- b)
- c)
- d)

\*\*\*\*\*

**B. For illustration a course / paper of 02 credits / 40 marks has been considered. The Question Paper Pattern of the ESA:**

**Faculty of Science and Technology  
BCA  
Question paper format (As per NEP-2020)**

**Time: 2:00 Hrs**

**Max. Marks: 40**

Instructions to the candidates:

1. *Question No. 1 is Compulsory.*
2. *From Q. No. 2 to 5 solve any three questions.*
3. *Figures to the right indicate full marks.*
4. *Assume suitable data, if necessary.*
5. *Use of any electronic media such as mobile phone, digital diary, and electronic calculator is not permitted.*

**Q.1 Attempt the following (2 Marks each)  
(Based on all units)**

**(10) Marks**

- a)
- b)
- c)
- d)
- e)

**Q. 2 Attempt of the following (any two)  
(Based on unit 1)**

**(10) Marks**

- a)
- b)
- c)

**Q.3 Attempt of the following (any two)  
(Based on unit 2)**

**(10) Marks**

- a)
- b)
- c)

**Q. 4 Attempt of the following (any two)  
(Based on unit 3)**

**(10) Marks**

- a)
- b)
- c)

**Q. 5 Attempt of the following (any two)  
(Based on unit 4)**

**(10) Marks**

- a)
- b)
- c)

\*\*\*\*\*



# **Detailed Syllabus**

## **SEMESTER –V**

## SEMESTER –V

### Professional Elective – III

#### A. Data Science: Introduction to Data Science

|                   |                                     |                 |                  |
|-------------------|-------------------------------------|-----------------|------------------|
| <b>SBCAET1301</b> | <b>Introduction to Data Science</b> | <b>3L:0T:0P</b> | <b>3 Credits</b> |
|-------------------|-------------------------------------|-----------------|------------------|

#### Course Objectives:

**CO1:** To understand the overview and definition of Data Science with its crucial role in current business world.

**CO2:** To understand the importance of mathematics & Statistics in Data Science.

**CO3:** To understand the role of machine learning techniques in Data Science and its different types.

**CO4:** To know the integrated role of computers and its components in Data Science

**CO5:** To understand the flow and process model of data science project management.

#### Course Content:

##### UNIT- I

##### Data Science - An Overview

Introduction to Data Science: Definition and description of Data Science, history and development of Data Science, terminologies related with Data Science, basic framework and architecture, difference between Data Science and business analytics, importance of Data Science in today's business world;

Overview of different Data Science techniques, challenges and opportunities in business analytics, different industrial application of Data Science techniques;

Data science process: overview of data science process, defining the goal, retrieving data, data preparation, data exploration, build the models, cleaning and transforming data, presentation and automation.

##### UNIT-II

##### Data and Data Mining

Data definition, characteristics of data, classification of digital data;

The Data Science Fundamentals: Distributed file system, data integration framework, machine learning framework, system deployment, security;

Data Mining: definition, languages for data science, collection data-hunting, logging, scraping, cleaning data errors. artifacts, data compatibility, dealing with missing values, outlier detection.

##### UNIT-III

##### Machine Learning in Data Science

Machine Learning: Definition, Role of machine learning in Data Science, Applications of machine learning in data science, Types of machine learning – Supervised, semi supervised and unsupervised learning;

Learning models generalities, support vector machines, random forest. Examples;

Regression: linear regression simple linear regression, multiple & Polynomial regression, Sparse model.

## **UNIT-IV**

### **Computers in Data Science**

Role of computer science in Data Science, various components of computer science being used for Data Science, role of relation data base systems in Data Science: SQL, NoSQL, role of data warehousing in Data Science, terms related with data warehousing techniques, various freely available software tools used in Data Science: R, Python.

### **SUGGESTIVE READING:**

1. Data Science for Beginners: Comprehensive guide to the most important basics in Data Science Alex Campbell
2. Data Smart: Using Data Science to Transform Information into Insight 1<sup>st</sup> Edition by John W. Foreman. (2015) Wiley Publication.
3. Data Science from Scratch: First Principles with Python 1st Edition by Joel Grus .
4. Davy Cielen, Arno D.B.Meysman and Mohamed Ali, "Introducing Data Science", Published by Manning
5. Steven S. Skiena, "The Data Science Design Manual", Published by Springer Nature.
6. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk from the Frontline", O'Reilly.
7. Jure Leskovek, Anand Rajaraman and Jeffrey D.Ullman, "Mining of Massive Datasets", Cambridge University Press.

### Professional Elective – III

#### B. Artificial Intelligence and Machine Learning: Neural Network

|                   |                       |                 |                  |
|-------------------|-----------------------|-----------------|------------------|
| <b>SBCAET1301</b> | <b>Neural Network</b> | <b>3L:0T:0P</b> | <b>3 Credits</b> |
|-------------------|-----------------------|-----------------|------------------|

#### Course Objectives

**CO1:** To create different neural networks of various architectures both feed forward and feed backward.

**CO2:** To perform the training of neural networks using various learning rules.

**CO3:** To apply neural network techniques to solve real-world problems

#### Course Content:

##### UNIT - I

##### Introduction to Neural Network

Biological Neuron vs Artificial Neuron: Structure of biological neuron; dendrites, soma, axon; working of synapse; McCulloch-Pitts neuron model; comparison with artificial neuron; limitations of MP neuron.

Network Architectures: Feedforward networks; recurrent networks; single-layer vs multilayer networks; fully connected networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning,

##### UNIT - II

##### Single Layer Perceptrons and Multilayer Perceptron

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Annealing Techniques, Perceptron –Convergence Theorem

Multilayer Perceptron: Back Propagation Algorithm

##### UNIT - III

##### Convolutional Neural Networks (CNNs)

Motivation for CNNs: Limitations of fully connected networks for images; local connectivity; parameter sharing.

CNN Building Blocks: Convolutional layer: kernel, stride, padding, feature maps

CNN Architectures: LeNet-5; AlexNet;

Applications: Image classification; object detection overview; face recognition; medical image analysis.

## **UNIT - IV**

### **Self-Organization Maps**

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations

### **SUGGESTIVE READING:**

1. Neural Networks and Learning Machines    Simon Haykin Pearson Education 2009
2. Introduction to Neural Networks using Matlab S.N. Sivanandam & S.N. Deepa McGraw Hill 2006
3. Fundamentals of Neural Networks    Laurene Fausett Pearson 2004
4. Deep Learning Ian Goodfellow, Yoshua Bengio, Aaron Courville MIT Press 2016
5. Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow Aurélien Géron O'Reilly 2022

### Lab-3: Professional Elective – III

#### A. Data Science: Introduction to Data Science

|                   |                                           |                 |                  |
|-------------------|-------------------------------------------|-----------------|------------------|
| <b>SBCAEP1301</b> | <b>Lab-3 Introduction to Data Science</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|-------------------------------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

#### **Suggestive Laboratory Experiments:**

Practical 1: Introduction to Python for Data Science

Practical 2: Working with Lists and Dictionaries

Practical 3: NumPy Array Operations

Practical 4: Pandas Series and DataFrame

Practical 5: Reading CSV File

Practical 6: Handling Missing Values

Practical 7: Detecting Outliers

Practical 8: Data Cleaning using Pandas

Practical 9: Web Scraping using BeautifulSoup

Practical 10: Logging Data Example

Practical 11: Simple Linear Regression

Practical 12: Multiple Linear Regression

Practical 13: Polynomial Regression

Practical 14: Support Vector Machine

Practical 15: Random Forest Classifier

Practical 16: Scatter Plot, Bar Chart, Pie Chart

Practical 17: Correlation Matrix

Practical 18: Exploratory Data Analysis

Practical 19: K-Means Clustering

Practical 20: Decision Tree Classifier

Practical 21: Logistic Regression

Practical 22: Confusion Matrix

Practical 23: Naive Bayes Classifier

Practical 24: PCA Dimensionality Reduction

Practical 26: Hierarchical Clustering

Practical 27: Association Rule Mining

Practical 28: Time Series Visualization

Practical 29: Heatmap Correlation Analysis

Practical 30: Sentiment Analysis using TextBlob

Practical 31: Image Classification using CNN Basics

Practical 32: Recommendation System using Cosine Similarity

Practical 33: Forecasting using ARIMA

Practical 34: NLP Tokenization using NLTK

**Note:** Above is just a suggestive list of Practicals; faculty must prepare their own bank of practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

### Lab-3: Professional Elective – III

#### B: Artificial Intelligence and Machine Learning: Neural Network

|                   |                             |                 |                  |
|-------------------|-----------------------------|-----------------|------------------|
| <b>SBCAEP1301</b> | <b>Lab-3 Neural Network</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|-----------------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

#### **Suggestive Laboratory Experiments:**

Practical 1: Implementation of McCulloch-Pitts Neuron for AND Gate

Objective: Simulate an MP neuron to perform logical AND operation.

Practical 2: Implementation of McCulloch-Pitts Neuron for OR Gate

Objective: Design an MP neuron model to realize OR logic.

Practical 3: Implementation of McCulloch-Pitts Neuron for NAND Gate

Objective: Demonstrate logical NAND operation using threshold logic.

Practical 4: Single Layer Perceptron for AND Function

Objective: Train a perceptron to classify AND gate inputs.

Practical 5: Single Layer Perceptron for OR Function

Objective: Implement perceptron learning algorithm for OR gate.

Practical 6: Demonstration of Hebbian Learning Rule

Objective: Update weights using Hebbian learning and observe weight changes.

Practical 7: Competitive Learning Network

Objective: Implement a simple winner-takes-all competitive learning model.

Practical 8: Least Mean Square (LMS) Algorithm

Objective: Implement LMS algorithm for adaptive filtering and error minimization.

Practical 9: Perceptron Convergence Theorem Demonstration

Objective: Verify convergence of a perceptron on linearly separable data.

Practical 10: Multilayer Perceptron (MLP) for XOR Problem

Objective: Solve the XOR problem using a hidden layer and backpropagation.

Practical 11: Backpropagation Algorithm Implementation

Objective: Train a simple MLP using the backpropagation learning algorithm.

Practical 12: Convolution Operation on a Grayscale Image

Objective: Apply a convolution kernel (edge detection, blur, sharpen) to an image.

Practical 13: CNN for Handwritten Digit Classification (MNIST Dataset)

Objective: Build and train a simple CNN for digit recognition.

Practical 14: Image Classification using CNN

Objective: Classify images from a small dataset using convolutional and pooling layers.

Practical 15: Self-Organizing Map (SOM) for Data Clustering

Objective: Implement a SOM to cluster and visualize multidimensional data.

**Note:** Above is just a suggestive list of Practicals; faculty must prepare their own bank of practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.



## Professional Elective – IV

### A. Data Science: Time Series Analysis

|            |                      |          |           |
|------------|----------------------|----------|-----------|
| SBCAET1302 | Time Series Analysis | 3L:0T:0P | 3 Credits |
|------------|----------------------|----------|-----------|

#### Course Objectives:

**CO1:** To introduce students to the fundamental concepts, components, and real-world applications of time series data.

**CO2:** To develop the ability to visualize, explore, and interpret time-dependent data using plots, decomposition methods, and seasonal analysis.

**CO3:** To provide practical knowledge of form creation, user input handling, validation techniques.

**CO4:** To understand the concept of stationarity and apply appropriate transformation techniques such as differencing and logarithmic transformation

#### Course Content:

##### Unit I

##### Introduction to Time Series

Definition and examples of time series; Components of time series; Trend and Seasonality; Types of time series data (discrete, continues); Applications (finance, weather, sales, healthcare); Decomposition of time series- Additive and multiplicative model with their merits and demerits

##### Unit II

##### Data preprocessing

Handling missing data, time series visualization, resampling (upsampling/downsampling), and time intervals. Line plots and moving averages; Time plots and seasonal plots

##### Unit III

##### Stationarity & Transformation

Concept of stationarity; Why stationarity is important; Types: Strict stationarity, Weak stationarity; Stationary processes, Methods to achieve stationarity, stationarity vs. non-stationarity, Differencing, autocorrelation function (ACF), partial autocorrelation (PACF), Log transformation

##### Unit IV: Smoothing Techniques

Moving averages, simple exponential smoothing, Double Exponential Smoothing (Holt), and Triple Exponential Smoothing (Holt-Winters).

#### SUGGESTIVE READING:

1. Time Series Analysis and Its Applications: With R Examples – Time Series Analysis and Its Applications by Robert H. Shumway and David S. Stoffer 4<sup>th</sup> Edition
2. Introduction to Time Series and Forecasting – Introduction to Time Series and Forecasting

### Professional Elective – IV

#### B. Artificial Intelligence and Machine Learning: Digital Image Processing

|                   |                                 |                 |                  |
|-------------------|---------------------------------|-----------------|------------------|
| <b>SBCAET1302</b> | <b>Digital Image Processing</b> | <b>3L:0T:0P</b> | <b>3 Credits</b> |
|-------------------|---------------------------------|-----------------|------------------|

#### Course Objectives:

- CO1:** To explain concepts of digital image processing.
- CO2:** To elaborate image processing techniques to enhance image quality.
- CO3:** To identify image compression and segmentation techniques.
- CO4:** To use image restoration techniques.
- CO5:** To identify image processing techniques for feature detection.

#### Course Contents:

##### Unit I

##### Introduction to Image Processing

Image: Pixel, Distance measures, Color fundamentals & models – RGB, HIS, YIQ,  
 Types of an image: Vector and Raster, Types of image processing, Formation of digital image, resolution (Spatial and gray level), Megapixels and Image Quality. Image Acquisition: Cameras and sensors  
 Block Diagram: Fundamental Steps in Digital Image Processing, Advantages and disadvantages  
 Components of an Image Processing System, Difference between Image Sampling & quantization  
 Image file formats: JPEG, PNG, GIF, TIFF, BMP, Image Histogram  
 Operations on images: image addition, subtraction, logical operations, scaling, translation, rotation.  
 Applications of Digital Image Processing

##### Unit II

##### Image Enhancement in Spatial Domain and Frequency Domain

Enhancement Using Arithmetic/Logic Operation  
 Spatial domain enhancement: Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening  
 Frequency domain enhancement: 2-D Discrete Fourier Transform (DFT), Smoothing and Sharpening in frequency domain, Homomorphic filtering

##### Unit III data

##### Image Compression, Image Segmentation and Image Restoration

Data image compression,  
 Fidelity criteria: Objectives, Importance. Image and Video Compression Standards – JPEG, MPEG-1, MPEG-3  
 Lossless compression: Run length coding, Huffman coding  
 Lossy compression techniques – Discrete Cosine Transform (DCT) based compression  
 Image Segmentation: Comparison of Point Detections, Line detection and Edge Detection

Image restoration: Definition, Concepts of restoration: constraint and unconstrained restoration, interactive restoration,

## **Unit IV**

### **Image Analysis**

Feature Extraction: Texture analysis: Definition, Importance of Texture Analysis, overview of Texture Analysis Methods

Shape analysis: Definition, Types of Shapes, concept of Shape Representation

Color analysis: Definition, Color Spaces, Color Feature Extraction: Color Histogram, Color Moments

### **SUGGESTIVE READING**

- 1 S. Amadurai-Rafael C. Gonzalez, Richard E. Woods, Pearson Education India, ISBN:9788177584790, 9788177584790
- 2 Fundamentals of Digital Image Processing Digital Image Processing Fourth edition (30 July 2018) Pearson Education India, ISBN:13978-9353062989
- 3 Alasdair McAndrew A Computational Introduction to Digital Image Processing Chapman and Hall/CRC, ISBN-13?: 978-0367783334
- 4 William K. Pratt. 2nd Edition Digital Image Processing: PIKS Scientific Inside Wiley India Private Limited; Fourth edition, ISBN-13? : ? 978-8126526840
- 5 Kenneth R. Castleman Digital Image Processing Pearson Education India, ISBN-13 978-8131712863

### Lab-4: Professional Elective – IV

#### A. Data Science: Time Series Analysis

|                   |                             |                 |                  |
|-------------------|-----------------------------|-----------------|------------------|
| <b>SBCAEP1302</b> | <b>Time Series Analysis</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|-----------------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

Practical 1: Create a basic time series from monthly sales data

Practical 2: Identify trend component using yearly revenue data

Practical 3: Plot seasonal monthly temperature data

Practical 4: Distinguish discrete and continuous time series data

Practical 5: Time series decomposition using additive model

Practical 6: Multiplicative decomposition example

Practical 7: Compare additive vs multiplicative model

Practical 8: Applications of time series in healthcare

Practical 9: Handle missing values using forward fill

Practical 10: Handle missing values using interpolation

Practical 11: Visualize stock prices using line plot

Practical 12: Resampling daily data into monthly average

Practical 13: Upsampling monthly data into daily data

Practical 14: Create moving average of sales data

Practical 15: Time plot for airline passengers dataset

Practical 16: Seasonal plot using grouped months

Practical 17: Find time intervals between timestamps

Practical 18: Check stationarity visually using plot

Practical 19: Perform Augmented Dickey-Fuller Test

Practical 20: Apply first-order differencing

Practical 21: Apply second-order differencing

Practical 22: Plot ACF

Practical 23: Plot PACF

Practical 24: Log transformation on sales data

Practical 25: Compare stationary vs non-stationary data

Practical 26: Weak and strict stationarity examples

Practical 27: Simple Moving Average forecasting

Practical 28: Simple Exponential Smoothing

Practical 29: Holt's Double Exponential Smoothing

Practical 30: Holt-Winters Triple Exponential Smoothing

Practical 31: Forecast next 6 months using Holt-Winters

Practical 32: Compare SMA and Exponential Smoothing

Practical 33: Forecast hospital patient inflow

Practical 34: Sales forecasting using retail dataset

Practical 35: End-to-end time series project

**Note :** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

### Lab- 4: Professional Elective – IV

#### B. Artificial Intelligence and Machine Learning: Digital Image Processing

|                   |                                 |                 |                  |
|-------------------|---------------------------------|-----------------|------------------|
| <b>SBCAEP1302</b> | <b>Digital Image Processing</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|---------------------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

Practical 1: Implement a program to explore RGB, HIS and YIQ color models.

Practical 2: Write program for addition, subtraction and logical operations.

Practical 3: Implement a program to perform Basic gray level transformations like linear, logarithmic, power law.

Practical 4: Implement a program to perform histogram processing.

Practical 5: Write a program to convert the image to the frequency domain using DFT to analyse its frequency components.

Practical 6: Implement a video compression program

Practical 7: Implement Run Length Encoding for compressing textual data.

Practical 8: Perform the Gaussian Noise to a grayscale image.

Practical 9: Implement Arithmetic Mean Filter for image

Practical 10: Implement Wiener filtering.

Practical 11: Implement Inverse Filtering on color image.

Practical 12: Implement a program for color histogram of an image.

**Note :** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

## Professional Elective – V

### A. Data Science: Machine Learning

|                   |                         |                 |                  |
|-------------------|-------------------------|-----------------|------------------|
| <b>SBCAET1303</b> | <b>Machine Learning</b> | <b>3L:0T:0P</b> | <b>3 Credits</b> |
|-------------------|-------------------------|-----------------|------------------|

#### Course Objectives:

**CO1:** To explain the role of machine learning in AI and data science.

**CO2:** To implement data preprocessing.

**CO3:** To implement feature engineering techniques to prepare data for machine learning models.

**CO4:** To apply supervised learning models to train and evaluate.

**CO5:** To apply unsupervised learning models to train and evaluate.

#### Course Content:

##### Unit - I

##### Introduction to Machine Learning

Basics of ML - Define Machine Learning, Traditional programming vs ML-based approaches, Role and application of ML in artificial intelligence and data science

Types of ML (Supervised, Unsupervised, Reinforcement Learning)-

Supervised Learning: Definition, working principle, examples (classification, regression),

Unsupervised Learning: Definition, working principle, examples, Clustering, dimensionality reduction techniques,

Reinforcement Learning: Concept of agents, rewards, and policy learning, Comparison of different ML types with real-world applications

Applications of ML- Real-world use cases of ML in various domains such as healthcare, finance, e-commerce, etc, challenges in Machine Learning

##### Unit - II

##### Data Preprocessing

Data Cleaning: Introduction to Data Cleaning, Identifying and Handling Noisy Data, Removing Duplicates and Inconsistencies, Standardizing and Normalizing Data, Handling Outliers

Handling Missing Values -Types of Missing Data, Identifying Missing Values, Techniques to Handle Missing Data, Removing Missing Data, Mean, Median, and Mode Imputation, Predictive Imputation (Regression, KNN), Using Algorithms that Support Missing Values

Splitting Dataset for Training and Testing -Importance of Dataset Splitting, Train-Test Split Ratio Selection, Cross-Validation Techniques, K-Fold Cross Validation, Leave-One-Out Cross Validation, Stratified Sampling vs Random Sampling

##### Unit - III

##### Feature Selection

Feature Scaling and Selection-Importance of Feature Scaling, Normalization vs Standardization, Feature Selection Methods, Filter Methods (Correlation, Chi-Square), Wrapper Methods (Forward, Backward Selection), Embedded Methods (Lasso, Decision Trees)

Feature Extraction Techniques - Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA)

Mutual Information-Based Feature Selection, ANOVA(Analysis of Variance) for Feature Selection, Recursive Feature Elimination (RFE) with Cross-Validation (RFECV), Feature Importance from Tree-Based Models (Beyond Decision Trees), XGBoost, LightGBM, Random Forest provide built-in feature importance scores (Gini importance, SHAP values).

## **Unit - IV**

### **Supervised Learning and Unsupervised Learning**

Supervised Learning: Classification Algorithms: Decision Trees, KNN(K-Nearest Neighbours), SVM(Support Vector Machine)

Regression Algorithms: Linear Regression, LogisticRegression, Ridge Regression

Unsupervised Learning: Clustering Techniques:-Define Clustering, Importance of clustering in data analysis, Applications of Clustering

K-Means Clustering: Definition and working principle, Steps involved in the K-Means algorithm, Advantages of K-Means, Disadvantages of K-Means, Hierarchical Clustering: Definition and types, Steps in Hierarchical Clustering, Advantages of Hierarchical Clustering, Disadvantages of Hierarchical Clustering, Comparing K-Means and Hierarchical Clustering

### **SUGGESTIVE READING:**

- 1 Yuxi Liu Python machine learning by examples Packt publication ISBN:978-178355-311-2
- 2 Saikat Dutt, Subramanian Chandramouli , Amit Kumar Das Machine Learning Person ISBN 978-93-530-6669-7,eISBN: 978-93-895-8813-2
- 3 Tom M Mitchell Machine Learning McGraw Hill, First edition ISBN: 13: 978-0070428072
- 4 Aurélien Géron Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems O'Reilly Media ISBN-101492032646
- 5 Sebastian Raschka, Vahid Mirjalili Python Machine Learning Packt Publishing ISBN:978-1800567703
- 6 Introduction to Machine Learning with Python Andreas C Muller and Sarah Guido O'Reilly Media
- 7 The Hundred Page Machine Learning Book Andriy Burkov
- 8 Machine Learning E. Balagurusamy
- 9 Hands on Machine Learning with Scikit Learn Sebastian Raschka and Andreas Muller O'Reilly Media ISBN-978-1492032649



## Professional Elective – IV

### B. Artificial Intelligence and Machine Learning: Digital Image Processing

|            |                             |          |           |
|------------|-----------------------------|----------|-----------|
| SBCAET1302 | Natural Language Processing | 3L:0T:0P | 3 Credits |
|------------|-----------------------------|----------|-----------|

#### Course Objectives:

**CO1:** To explain key concepts linguistics and NLP.

**CO2:** To implement Text Normalization and Text Preprocessing techniques to the text.

**CO3:** To apply Part of Speech, Parsing, Named Entity Recognition techniques to the text.

**CO4:** To generate text embedding in NLP.

**CO5:** To use Transformer in NLP applications.

#### Course Contents:

##### Unit I

##### Natural Language Basics

Overview of NLP, The need of NLP, Areas of study under linguistics

Language Syntax and Structure: Words, Phrases, Clauses, Grammar, Word Order Typology, Word Order-Based Language Classification

Language Semantics: Lexical Semantic Relations, Semantic Networks and Models

Text Corpora: Corpora Annotation and Utilities, Popular Corpora

Applications of NLP.

##### Unit - II

##### Text Normalization and Preprocessing

Regular Expressions: Basic Regular Expression Patterns, Disjunction, Grouping, and Precedence, sets of characters, operators for counting

Text Preprocessing: Removing Special Characters, Expanding Contractions, Case Conversions, Removing Stopwords

Word Tokenization: rule-based tokenization, Byte-Pair Encoding

Lemmatization and stemming, porter stemmer, snowball stemmer

N-grams Vectors: unigram, bigram, trigram, n gram

##### Unit - III

##### Text Syntax, Structure and Feature Extraction

Part-of-speech tagging: English Word Classes, Part-of-Speech Tagging

Named entity recognition: Named Entities and Named Entity Tagging, IOB/ BIO tagging

Parsing Techniques: Partial parsing/chunking, Dependency parsing

Vector Space Models: Words and Vectors, Cosine for measuring similarity

One hot encoding, Bag-of-words, TF-IDF

Word2vec: continuous bag of words, skip gram

Contextual Embeddings: Contextual Embeddings, Word Sense

## **Unit - IV**

### **NLP Application and Transformers**

NLP application for text classification: NLP application pipeline, Evaluating Classification Model, Develop a text classification application

Transformers: Encoder-Decoder Framework, Attention Mechanisms, Transformer architecture, Challenges with Transformers

Transfer Learning in NLP

Hugging Face Transformers: Transformer Applications, The Hugging Face Hub, Hugging Face Tokenizers, Hugging Face Datasets, Hugging Face Accelerate

### **SUGGESTIVE READING:**

- 1 Daniel Jurafsky Speech and Language Processing Pearson Publication ISBN :978-0131873216
- 2 Dipanjan Sarkar Text Analytics with Python ch1 ch5 5.1 Apress ISBN-13 (pbk): 978-1-4842-2387-1
- 3 Steven Bird, Ewan Klein, and Edward Loper Natural Language Processing with python Oreally ISBN:978-0- 596-51649-9
- 4 Akshay Kulkarni Adarsha Shivananda Natural Language Processing Recipes\_ Unlocking TextData with Machine Learning and Deep Learning using Python .Apress ISBN-13 (pbk): 978-1-4842-4266-7
- 5 Pushpak Bhattacharyya and Aditya Joshi Natural Language Processing Willey ISBN:978-93- 5746-238-9
- 6 Natural language Processing with Transformer Lewis Turistall, Leandro Von Werra & Thomas Wolf O'Reilly Media ISBN-13:978-1098103248

## Lab – 5: Professional Elective – V

### A. Data Science: Machine Learning

|                   |                         |                 |                  |
|-------------------|-------------------------|-----------------|------------------|
| <b>SBCAEP1303</b> | <b>Machine Learning</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|-------------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

Practical 1: Installation of IDE with necessary libraries

Practical 2: Implement program for Data Preprocessing Techniques

Practical 3: Implement program to read dataset ( Text, CSV, JSON ,XML)

Practical 4: Implement the classification algorithms on previously prepared dataset

Practical 5: Implement the regression model by using the suitable dataset

Practical 6: Implement program to use clustering algorithms to find patterns in data

Practical 7: Implement program to identify the most important features that contribute to the model accuracy.

Practical 8: Implement program to use k-Nearest Neighbors (KNN) model for Classification on given dataset

Practical 9: Implement program to train an SVM model on given dataset

Practical 10: Implement program to use logistic regression model to classify binary outcomes

Practical 11: Implement program to use PCA technique to reduce the number of features while retaining important information

Practical 12: Implement program to use machine learning model on given dataset

Practical 13: Implement program to use Pandas, Matplotlib to analyze data of previously created model

Practical 14: Implement program to use machine learning model on Boston Housing Dataset (available in Scikit-learn)

Practical 15: Implement a program to segment customers into different groups based on their purchasing behavior features using K-Means Clustering

**Note:** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

### Lab-5 : Professional Elective – V

#### B. Artificial Intelligence And Machine Learning: Natural Language Processing

|            |                             |          |           |
|------------|-----------------------------|----------|-----------|
| SBCAEP1303 | Natural Language Processing | 0L:0T:4P | 2 Credits |
|------------|-----------------------------|----------|-----------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

Practical 1: Implement a program to use text corpus. i) Brown corpus, ii) Penn Treebank Corpus.

Practical 2: i) Write program for Sentence Segmentation Techniques.

ii) Write program Word Segmentation using Re and nltk.

Practical 3: Implement Penn Treebank tokenization, word\_tokenize, wordpunct\_tokenize, sent\_tokenize, Whitespace Tokenizer.

Practical 4: Apply various Lemmatization Techniques and Stemming Techniques such as porter stemmer, Lancaster Stemmer, Snowball Stemmer on text.

Practical 5: a) Write program on Text Normalization using nltk:

- i) Tokenizing text
- ii) Removing special characters
- iii) Expanding contractions
- iv) case conversion.
- b) Generate unigram, bigram, trigram for given text.

Practical 6: Write program for POS tagging on the given text.

Practical 7: Write program to find Named Entity Recognition (NER) for the given text.

Practical 8: i) Implement a program for dependency parse tree on the sentence using nltk or spacy.

ii) Write program for performing chunking on the given text. Extract Noun Phrases, Verb Phrases, Adjective Phrases

Practical 9: Write program to generate word embedding using word2Vec and BERT embedding (use Hugging Face).

Practical 10: Perform the prediction task using NLP and ML classifiers: a) Sentiment analysis b) Fake news detection.

Practical 11: Implement program to fine-tune a pre trained model from Hugging Face's for text classification.

**Note :** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

|                   |                                |                 |                  |
|-------------------|--------------------------------|-----------------|------------------|
| <b>SBCAST1301</b> | <b>Quantitative Techniques</b> | <b>0L:2T:0P</b> | <b>2 Credits</b> |
|-------------------|--------------------------------|-----------------|------------------|

### **Course objectives:**

CO1: To build logical thinking and analytical abilities required for solving computer-related problems.

CO2: To train students in applying mathematical models and quantitative approaches to real-world situations.

CO3: To provide the quantitative background necessary for programming, data analysis, and software development.

CO4: To encourage the use of quantitative tools and software for research, forecasting, and computational analysis.

### **Course Contents:**

#### **Unit I**

##### **Introduction to Number system**

Numbers: Types of numbers, Divisibility tests of numbers

HCF and LCM,

Arithmetic progression,

Geometric progression.

#### **Unit II**

##### **Average, Problem on ages**

Average: Definition of average, Formulae and theoretical problem on average.

Problem on ages: simultaneous equations and their applications and theoretical problems on ages.

#### **Unit III**

##### **Percentage, and Profit and Loss**

Percentage: Concept of percentage, Application of percentage, Results on populations, Result on depreciations and theoretical problem on percentage.

Profit and Loss: Definition of cost price, selling price and profit, Formulae of profit and loss and theoretical problems on profit and loss.

#### **Unit IV**

##### **Time and Work, Time and Distance and Problems on Train**

Time and Work: Concept of time and work, Relationship between time and work and theoretical problems on time and work.

Time and Distance: Concept of time and distance, Formulae of time and distance and theoretical problems on time and distance.

Problems on Train: Formulae of problems on train and theoretical problems on train.

**SUGGESTIVE READING:**

1. Quantitative Aptitude by Dr.R.S Aggrawal , S. Chand and Company Publications
2. Quantitative Aptitude by Abijit Guha Tata McGraw Hill Publications
3. Objective Arithmetic by S.L Gulati Cosmos book hive Pvt,5th edition 2015

|                   |                                    |                 |                  |
|-------------------|------------------------------------|-----------------|------------------|
| <b>SBCASP1301</b> | <b>Internship/Capstone Project</b> | <b>0L:0T:8P</b> | <b>4 Credits</b> |
|-------------------|------------------------------------|-----------------|------------------|

## **INTERNSHIP (08 WEEKS)**

### **INDUSTRY / EMPLOYER EXPECTED OUTCOME**

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Apply skills and practices to industrial processes.

### **COURSE LEVEL LEARNING OUTCOMES (COS)**

Students will be able to achieve & demonstrate the following COs on completion of course based learning

**CO1:** Observe time/resource management and industrial safety aspects.

**CO2:** Acquire professional experience of industry environment.

**CO3:** Establish effective communication in working environment.

**CO4:** Prepare report of assigned activities and accomplishments.

**Note: Credits for Industrial Training are in-line of guidelines of NCrF : The industrial training is of 8 weeks considering 36-40 hours per week engagement of students (as per Guidelines of GR of Maharashtra Govt.) under Self Learning with guidance of industry supervisor / Mentor**

### **General guidelines for organizing Industrial training**

The Industry/organization selected for Industrial training/ internships shall be Government/Public Limited/ Private limited / Startup /Centre of Excellence/Skill Centers/Skill Parks etc.

1. Duration of Training - 08 weeks students engagement time
2. Period of Time slot - Between 4th and 5th semester (08 weeks) i.e. commencement of internships will be immediately following the 4th semester exams.
3. Industry area - Engineering Programme Allied industries of large, medium or small-scale, Organization/Govt./ Semi Govt Sectors.

### **Suggestions-**

1. Department can take help of alumina or parents of students having contact in different industries for securing placement.
2. Students would normally be placed as per their choices, in case of more demand for a particular industry, students would be allocated considering their potentials. However preference for placement would be given to students who have arranged placement in company with the help of their parents or relatives.
3. Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the industry during training before relieving students for training.
4. The faculty members during the visit to industry or sometimes through online mode will check the progress of the student in the training, student attendance, discipline, and project report preparation each week.

### **Roles and Responsibilities of students:**

1. Students may interact with the mentor to suggest choices for suitable industry, if any. If students have any contact in industry through their parents or relatives then the same may be utilized for securing placement for themselves and their peers.
2. Students have to fill the forms/formats duly signed by institutional authorities along with a training letter and submit it to a training officer/mentor in the industry on the first day of training.
3. Students must carry with him/her Identity card issued by the institute during the training period.
4. Students should follow industrial dressing protocols, if any. In absence of specific protocol students must wear college uniform compulsorily.
5. Students will have to get all necessary information from the training officer/mentor at industry regarding schedule of training, rules and regulation of the industry and safety norms to be followed. Students are expected to observe these rules, regulations and procedures.
6. Students must be fully aware that if they disobey any rule of industry or do not follow the discipline then non-disciplinary action will be taken .
7. Students must maintain a weekly diary (Format 6) by noting daily activities undertaken and get it duly signed from industry mentor or Industrial training in charge.
8. In case students face any major problems in industry such as an accident or any disciplinary issue then they should immediately report the same to the mentor at the institute.
9. Prepare a final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from a mentor as well as industry training in charge.
10. Students must submit the undertaking as provided in Format

### **Typographical guidelines for Industry Training report**

Following is the suggestive format for preparing the training report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following

- The training report shall be computer typed (English- British) and printed on A4 size paper.
- Text Font -Times New Roman (TNR), Size-12 point
- Subsection heading TNR- 12 point bold normal
- Section heading TNR- 14 capital bold
- Chapter Name/ Topic Name – TNR- 16 Capital
- All text should be justified. (Settings in the Paragraph)
- The report must be typed on one side only with double space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.

The training report must be hardbound/ Spiralbound with a cover page in black color. The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the cover.

The training report, the title page should be given first then the Certificate followed by the acknowledgment and then contents with page numbers.



### **Suggestive format of industrial training report**

Following format may be used for training report. Actual format may differ slightly depending upon the nature of Industry/ Organization.

- **Title Page**
- **Certificate**
- **Abstract**
- **Acknowledgement**
- **Content Page**

**\*\* For further details please go through the link given below:**

**<https://srtmun.ac.in/wp-content/uploads/2025/03/OnJobTrainingCircular.pdf>**

### **Suggested learning strategies during training at Industry**

- Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc.
- They should also refer to the handbook of the major machines and operations, testing, quality control and testing manuals.
- Students may also visit websites related to other industries wherein similar products are being manufactured.

## **CAPSTONE PROJECTS**

### **INDUSTRY / EMPLOYER EXPECTED OUTCOME**

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

Apply professional skills for solving , executing and demonstrating solutions to real-world problems

### **COURSE LEVEL LEARNING OUTCOMES (COS)**

Students will be able to achieve & demonstrate the following COs on completion of course based learning

**CO1:** Elaborate the identified field problem from the perspective of project work at institute.

**CO2:** Conduct feasibility & viability analysis (using data collection, experiments, Simulation Coding) to validate required resources, cost, support of the project work.

**CO3:** Apply the acquired knowledge and skills in providing solutions to the real field/industrial problems.

**CO4:** Present Project and its output/ findings / achievements along with its exhibits.

### **General guidelines for PROJECT WORK**

- The Project- problems must be related to the programme or may be interdisciplinary, based on the industry expected outcomes.
- The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work they would like to execute.
- Project titles are to be finalized in co-ordination/consultation with the faculty mentor. Study type project is NOT advisable.
- Students are required to prepare a prototype/working model/software of the Project and simultaneously prepare a report.
- Students shall Submit One Hard copy and one soft copy each of Project Report and soft-copy of the project code or the working model.
- Project shall address National Thrust area such as Environment, Digitization, Automation, sustainability and similar domains.
- Student shall try to use the national and international standards wherever possible (processes / materials / equipment etc. )

### **Criteria of Assessment /Evaluation of Project work**

#### **A. College Assessment (CA) criteria**

The College Assessment (CA) of the students for 40 marks is to be done based on following criteria.

| <b>Sr.No</b> | <b>Criteria</b>                                             | <b>Marks</b> |
|--------------|-------------------------------------------------------------|--------------|
| 01           | Project Selection & Problem definition                      | 10           |
| 02           | Literature survey and data collection/ Gathering            | 05           |
| 03           | Design / concept of project/ Working - Execution of Project | 10           |
| 04           | Stage wise progress as per Action plan/milestone            | 10           |
| 05           | Quality Report Writing                                      | 05           |

## **B. University Assessment (UA) Criteria**

- The University Assessment (UA) for 60 marks is to be done and based on following criteria. This assessment shall be done by the faculty mentor and External examiner.

| <b>Sr.No</b> | <b>Criteria</b>                                  | <b>Marks</b> |
|--------------|--------------------------------------------------|--------------|
| 01           | Capstone Project Completion as per plan          | 10           |
| 02           | Project related Requirement Analysis & Designing | 10           |
| 03           | Developing a Solution with proper justifications | 20           |
| 04           | Project Report Writing                           | 10           |
| 05           | Project Presentation                             | 10           |

### **Typographical instructions/guidelines for Project report writing**

Following is the suggestive format for preparing the Project report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following.

- a. The PROJECT report shall be computer typed (English- British) and printed on A4 size paper.
- b. Text Font -Times New Roman (TNR), Size-12 point
- c. Subsection heading TNR- 12 point bold normal
- d. Section heading TNR- 14 capital bold
- e. Chapter Name/ Topic Name – TNR- 16 Capital
- f. All text should be justified. (Settings in the Paragraph)
- g. The report must be typed on one side only with 1.5 line space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.
- h. The report must be Spiralbound with cover page in colour. The title of project, name of the candidate, year of submission, name of the institute, etc shall be printed on the cover.

### **Project Report**

On completion of the project work, every student will submit a project report which should contain the

following:

1. Cover Page
2. Title page
3. Certificate by the Guide
4. Acknowledgment (The candidate may thank all those who helped in the execution of the project.)
5. Abstract (It should be in one page and include the purpose of the study, the methodology used.)
6. Table of Contents (if any)

Detailed description of the project (This should be split in various chapters/sections with each chapter/section describing a project activity in totality).

Chapter–1 Introduction (background of the Industry or User based Problem/Task)

Chapter–2 Literature Survey (to finalize and define the Problem Statement)

Chapter–3 Scope of the project

Chapter–4 Methodology/Approach, if any

Chapter-5 Details of designs, working and processes

Chapter-6 Results and Applications

7. Conclusion

8. References

**NOTE:**

1. Project report must contain only a relevant and short mention – technology or platform or tools used. It must be more focussed on project work and its implementation

2. Students can add/remove/edit chapter names as per the discussion with their guide

# **SEMESTER –VI**

|                   |                      |                 |                  |
|-------------------|----------------------|-----------------|------------------|
| <b>SBCACT1351</b> | <b>Generative AI</b> | <b>2L:0T:0P</b> | <b>2 Credits</b> |
|-------------------|----------------------|-----------------|------------------|

### Course Objectives:

**CO1:** To understand the history and fundamentals of artificial intelligence and generative AI.

**CO2:** To learn basic concepts of neural networks without deep mathematical complexity.

**CO3:** To explore how AI generates text images and creative content.

**CO4:** To apply popular generative AI tools in real world and creative task.

### Course Content:

#### Unit - I

##### Foundations of AI and Generative AI

What is Artificial Intelligence? – Brief history from 1950s to today

Machine Learning vs Deep Learning – Simple differences with real-life examples

What is Generative AI? – Definition, significance, and difference from traditional AI

Types of AI models: Discriminative vs Generative (with everyday examples)

Introduction to Neural Networks: Neurons, layers, weights – no heavy math

How a Neural Network learns: Forward pass and Backpropagation (conceptual)

Parameters and Hyperparameters – what are they and why do they matter?

Introduction to Transfer Learning – using pre-trained models

Ethical aspects of AI: bias, fairness, responsible AI usage

Future of Generative AI – current trends and career opportunities

#### Unit - II

##### Generative AI Models – Text and Language

Language Models: What are they? How do machines understand language?

Introduction to Transformer Architecture – Encoder, Decoder (conceptual level)

Attention Mechanism – intuitive explanation with examples

Word Embeddings: How words are represented as numbers

GPT Models (GPT-2, GPT-3, GPT-4): How they work and what they can do

BERT – Understanding vs Generating text

Exploring ChatGPT: Features, capabilities, and limitations

Prompt Engineering: Writing effective prompts to get better AI outputs

Hallucinations in LLMs – what they are and how to handle them

Introduction to Retrieval Augmented Generation (RAG) – basic concept

Use cases: Chatbots, code generation, summarization, translation

#### Unit – III

##### Generative AI for Images and Creativity

Introduction to Computer Vision – how machines see images

What is a GAN (Generative Adversarial Network)? Generator vs Discriminator

How GANs are trained – adversarial game explained simply

Variational Autoencoders (VAEs) – Encoder-Decoder architecture

Stable Diffusion – how text-to-image generation works

DALL-E 2 and DALL-E 3 – capabilities and usage

Introduction to Visual Transformers (ViT) – brief overview  
Neural Style Transfer – blending content and style  
Challenges: Mode Collapse, Stability, Ethical concerns in image generation  
Deepfakes – how they work and the risks they pose  
Hands-on: Using AI tools for image generation and creative art

## **Unit – IV**

### **Generative AI Applications and Tools**

Generative AI in Art and Creativity – Music, Painting, Story generation  
Generative AI in Healthcare – Drug discovery, medical imaging  
Generative AI in Finance – Report generation, fraud detection concepts  
Generative AI in Education – Personalized learning, content generation  
Introduction to Fine-tuning: Customizing pre-trained models (conceptual)  
Open-source AI tools: Hugging Face, GPT4All, Llama – overview and demo  
Introduction to LangChain – building simple AI pipelines  
Real-world deployment challenges – cost, latency, bias, safety  
Introduction to AI Agents – AutoGPT, basic agent concepts  
Legal and ethical considerations – copyright, plagiarism, data privacy  
Project discussion: End-to-end mini AI project ideas

### **SUGGESTIVE READING:**

1. Altaf Rehmani – "Generative AI for Everyone: Understanding the Essentials and Applications" – BlueRose One, 2024. (Primary text; easy language, no math background required.)
2. Numa Dhamani – "Introduction to Generative AI" – Kindle Edition, 2024. (Good for conceptual understanding.)
3. Charu C. Aggarwal – "Neural Networks and Deep Learning: A Textbook". (Reference for neural network basics; use selected chapters only.)
4. David Foster – "Generative Deep Learning" – O'Reilly, 2024. (Advanced reference; use Chapter 1 & 2 for conceptual overview.)
5. Denis Rothman – "Transformers for Natural Language Processing and Computer Vision", 3rd ed., Packt, 2024.
6. Josh Kalin – "Generative Adversarial Networks Cookbook" – Packt. (Practical GAN recipes in Python.)

### Lab: Generative AI

|                   |                      |                 |                  |
|-------------------|----------------------|-----------------|------------------|
| <b>SBCACP1351</b> | <b>Generative AI</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|----------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

Practical 1: Exploring ChatGPT – Writing Prompts and Comparing Outputs

Practical 2: Prompt Engineering – Designing Effective Prompts

Practical 3: Text Generation using a Pre-trained GPT-2 Model

Practical 4: Building a Simple Chatbot with OpenAI API

Practical 5: Summarisation and Translation using LLMs

Practical 6: Sentiment Analysis using a Pre-trained BERT Model

Practical 7: Image Generation with DALL-E via API

Practical 8: Text-to-Image with Stable Diffusion (Hugging Face)

Practical 9: Neural Style Transfer – Blend Two Images

Practical 10: Building a Simple GAN to Generate Hand-written Digits

Practical 11: Face Generation using a Pre-trained GAN

Practical 12: AI Music Generation using MusicGen

Practical 13: Deploying an LLM App using Gradio

Practical 14: Introduction to LangChain – Build a Q&A Pipeline

Practical 15: Mini Project – Build an AI-powered Application

**Note :** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.



## Professional Elective – VI

### A. Data Science: Big Data Analytics

|                   |                           |                 |                  |
|-------------------|---------------------------|-----------------|------------------|
| <b>SBCAET1351</b> | <b>Big Data Analytics</b> | <b>3L:0T:0P</b> | <b>3 Credits</b> |
|-------------------|---------------------------|-----------------|------------------|

#### Course Objectives:

**CO1:** To illustrate different phases of big data with respect to real world application.

**CO2:** To demonstrate the use of Hadoop core components for big data processing.

**CO3:** To apply NoSQL database concepts and architecture patterns to manage big data.

**CO4:** To use Hive and Pig for data processing and transformation within big data environments.  
to train and evaluate.

**CO5:** To apply unsupervised learning models to train and evaluate.

#### Course Content:

##### Unit - I

##### Introduction to Big Data Analytics and Data Architecture

Classification of Data : Structured, Semi-structured and Unstructured

Introduction :Big Data Definitions, Need of Big Data

Big Data Characteristics : Volume, Velocity, Variety, Veracity

Big Data Types

Big Data Processing Architecture Design

Big Data Analytics : Data analytics Definitions, Phases in Analytics

Big Data Analytics Applications : Big Data in Marketing and Sales, Big Data and Healthcare, Big Data in Medicine, Big Data in Advertising

##### Unit - II

##### Introduction to Hadoop and MapReduce

Introduction to Hadoop

Hadoop and its Ecosystem : Hadoop Core Components, Features of Hadoop, Hadoop Ecosystem Components

Hadoop Distributed File System :HDFS data storage, HDFS Commands for interacting with files in HDFS

MapReduce Framework and Programming Model : Hadoop MapReduce Framework, MapReduce Programming Model

Hadoop Yarn : Hadoop 2 Execution Model

MapReduce : Map Tasks, Key-Value Pair, Grouping by Key, Partitioning, Combiners, Reduce Tasks, Details of MapReduce Processing Steps

### **Unit - III**

#### **NoSQL Databases and Big Data Management**

Introduction NoSQL in Big Data

NoSQL Data Store : NoSQL, CAP theorem, Schema-less Models

NoSQL Data Architecture Patterns :Key-Value Store, Document Store, Tabular Data, Object Data Store. Graph Database

NoSQL to manage Big Data

MongoDB Database

### **Unit - IV**

#### **Hive and Pig**

Introduction to Hive : Hive Characteristics, Limitations

Hive Architecture

Hive Data Types and File Formats

Hive Integration and Workflow Steps

Hive Built-in functions

HiveQL : HiveQL DDL, HiveQL DML, HiveQL for Querying the Data

Introduction to Pig : Applications of Apache Pig, Features of Pig, Compare Pig with SQL, MapReduce, and Hive

Pig Architecture

Pig Latin Data Model

### **SUGGESTIVE READING:**

1 Raj Kamal, Preeti Saxena Big Data Analytics: Introduction to Hadoop, Spark, and Machine-Learning McGraw Hill Education, New Delhi. ISBN: 9789353164962

2 Seema Acharya, Subhashini Chellappan Big Data and Analytics Wiley India Pvt. Ltd., ISBN:9788126554782

3 M. Vijayalakshmi, Radha Shankarmani Big Data Analytics Publication details: Wiley c2017, 2022 N. Delhi Edition: 2nd ed. c2017, ISBN:9788126565757

4 Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia Learning Spark: Lightning-Fast Data Analytics O'Reilly Media Publication Date: January28, 2015 ISBN-10: 1449358624 ISBN-13:978-1449358624

5 Pramod J. Sadalage, Martin Fowler NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence Addison-Wesley August 10, 2012 ISBN:978-0321826626

6 Tom White Hadoop: The Definitive Guide 4th Edition, Released April 2015,Publisher(s): O'Reilly Media, Inc. ISBN:9781491901632.

## Professional Elective – VI

### B. Artificial Intelligence and Machine Learning: Deep Learning for computer vision

|            |                                      |          |           |
|------------|--------------------------------------|----------|-----------|
| SBCAET1351 | C. Deep Learning for computer vision | 3L:0T:0P | 3 Credits |
|------------|--------------------------------------|----------|-----------|

#### Course Objectives:

**CO1:** To introduce basic deep learning algorithms.

**CO2:** To understand real world problem which will be solved by deep learning methods

**CO3:** To identify deep learning techniques suitable for a real-world problem.

#### Course Content:

##### Unit - I

##### Introduction to Deep Learning and Computer Vision

What is Deep Learning and Why is it Important

Overview of Computer Vision and Its Applications

History of Deep Learning and its Applications in Computer Vision.

Introduction to Neural Networks: Biological Inspiration for Artificial Neural Networks

Basic Structure and Components of a Neural Network

Activation Functions and Loss Functions.

Introduction to feedforward Neural Network

##### Unit II

##### Training of feedforward Neural Network

Representation Power of Feed forward Neural Networks, Training of feed forward neural network, Gradient Descent, Activation Function and Initialization Methods: Sigmoid, Tanh, Relu, Xavier and He initialization.

##### UNIT III

##### Deep learning for computer vision

Introduction to convnets, training a convnet from scratch on a small dataset

Using a pretrained convent

Visualizing what convnets learn.

Deep learning for text and sequences: Working with text data

Understanding recurrent neural networks

Advanced use of recurrent neural networks

Sequence processing with convnets.

##### UNIT IV

##### Advanced deep-learning best practices

Going beyond the Sequential model: the Keras functional API

Differentiate between Sequential API and Functional API in Keras.

advantages of the Keras Functional API

model architecture design using the Keras Functional API

Inspecting and monitoring deep-learning models using Keras callbacks

Model Checkpoint in Keras  
Tensor Board Getting the most out of your models.

### **SUGGESTIVE READING**

1. “Deep Learning with Python” by Francois Chollet, 2018 Edition, Manning Publications.
2. “Deep Learning with Python” by Nikhil Ketkar, Jojo Moolayil, Second Edition, Apress.
3. “Python Deep Learning” by Ivan Vasilev, Daniel Slatter, Second Edition, Packt Publications.
4. Other web sources suggested by the teacher concerned and the college librarian including reading material.
5. Adrian Rosebrock. "Deep Learning for Computer Vision with Python." Py Image Search, 2021.

### Lab-6: Professional Elective – VI

#### A. Data Science: Big Data Analytics

|                   |                           |                 |                  |
|-------------------|---------------------------|-----------------|------------------|
| <b>SBCAEP1351</b> | <b>Big Data Analytics</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|---------------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

- Practical 1: Conduct a Case Study on Big Data and Big Data Analysis
- Practical 2: Install Hadoop Ecosystem on Local Cluster
- Practical 3: Configure Hadoop Ecosystem on Local Cluster
- Practical 4: Install Hadoop on multiple nodes
- Practical 5: Configure Multi-Node Hadoop Cluster
- Practical 6: Use Monitoring tools to Observe Cluster Resources
- Practical 7: Perform Basic File Operation using HDFS
- Practical 8: Perform Backup and Restore of Datasets in HDFS
- Practical 9: Execute Word Count MapReduce Program
- Practical 10: Process Large CSV Dataset Using MapReduce
- Practical 11: Install NoSQL Database (MongoDB) and Create Collections
- Practical 12: Create a schema for unstructured data in MongoDB
- Practical 13: Run basic aggregation queries on Unstructured dataset in MongoDB
- Practical 14: Perform Basic MongoDB Operations Demonstrating CAP Theorem Behavior
- Practical 15: Install and Configure Hive
- Practical 16: Execute Data Queries Using HiveQL
- Practical 17: Run Pig Scripts for data transformation
- Practical 18: Execute User Defined Functions (UDF) in Pig for Data Normalization

**Note :** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

### Lab-6: Professional Elective – VI

#### B. Artificial Intelligence and Machine Learning: Deep Learning for computer vision

|                   |                                             |                 |                  |
|-------------------|---------------------------------------------|-----------------|------------------|
| <b>SBCAEP1351</b> | <b>A. Deep Learning for computer vision</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|---------------------------------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

Practical 1: Setting Up Deep Learning Environment

Practical 2: Single Neuron (Perceptron) from Scratch

Practical 3: Visualising Activation Functions

Practical 4: Feedforward Neural Network with Keras

Practical 5: Gradient Descent – Visual Demo

Practical 6: Xavier and He Weight Initialisation

Practical 7: MNIST Digit Classification (FFNN)

Practical 8: First Convolutional Neural Network

Practical 9: Visualising CNN Filters & Feature Maps

Practical 10: Transfer Learning with VGG16

Practical 11: Text Preprocessing for Deep Learning

Practical 12: Sentiment Analysis – Simple RNN

Practical 13: Sentiment Analysis – LSTM vs RNN

Practical 14: Text Classification with Conv1D

Practical 15: Functional API – Multi-Input Model

Practical 16: Sequential API vs Functional API

Practical 17: Callbacks: Early Stopping & Checkpoint

Practical 18: TensorBoard Training Monitor

Practical 19: Data Augmentation for CNNs

Practical 20: Mini Project – End-to-End Classifier

**Note :** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

## Professional Elective – VII

### A. Data Science: Exploratory Data Analysis

|                   |                                  |                 |                  |
|-------------------|----------------------------------|-----------------|------------------|
| <b>SBCAET1352</b> | <b>Exploratory Data Analysis</b> | <b>3L:0T:0P</b> | <b>3 Credits</b> |
|-------------------|----------------------------------|-----------------|------------------|

#### Course Objectives:

**CO1:** Understand the types and structures of data

**CO2:** Apply descriptive statistical methods

**CO3:** Clean and preprocess raw datasets

**CO4:** Visualise data distributions and relationships

**CO5:** Derive insights through feature engineering and advanced EDA

#### Course Content:

##### Unit - I

##### Introduction to EDA

EDA fundamentals – Understanding data science - Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA- Microsoft Excel , Python – Visual Aids for EDA – Overview of EDA workflow

##### Unit - II

##### EDA Using Python

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations, Data transformation techniques

##### Unit - III

##### Univariate Analysis, Bivariate & Multivariate Analysis

Univariate Analysis: Introduction, Frequency Distributions, Histograms, Box Plots, Density Plots, Bar Charts, Pie Charts, QQ Plots

Bivariate & Multivariate Analysis: Introduction, Scatter Plots, Correlation Analysis, Heatmaps, Pair Plots, Cross-tabulation, Grouped Visualisations

##### UNIT IV

##### Advanced EDA Techniques

Feature Engineering, Dimensionality Reduction (PCA), Time Series Exploration, Text Data EDA, Dashboard Creation with Plotly/Seaborn

EDA case studies – Random distribution, Random Walk, standard resistor, Heat flow meter.

**SUGGESTIVE READING:**

1. Python for Data Analysis – Wes McKinney, O'Reilly Publications.
2. Exploratory Data Analysis – Pearson Publications.
3. Hands-On Exploratory Data Analysis with Python – Packt Publications.
4. Introduction to Machine Learning with Python – O'Reilly Publications.
5. Applied Multivariate Statistical Analysis – Pearson Publications.
6. Data Mining Concepts and Techniques – Morgan Kaufmann Publications.
7. Seaborn Statistical Data Visualization – Documentation and reference material for advanced visualizations.
8. Data analysis using Microsoft Excel by Michael R. Middleton
9. Python Data science handbook by Jake Vender Plas O'Reilly Publications.
10. Naked Statistics by Charles Wheelan
11. Exploratory data analysis with Python By Gran Ville J. Mathsson



## Professional Elective – VII

### B. Artificial Intelligence and Machine Learning: Predictive Analysis

|            |                     |          |           |
|------------|---------------------|----------|-----------|
| SBCAET1352 | Predictive Analysis | 3L:0T:0P | 3 Credits |
|------------|---------------------|----------|-----------|

#### Course Objectives:

**CO1:** To enhance the skills on linear and logistic regression.

**CO2:** To apply forecasting techniques in making effective business decisions

#### Course Content:

##### Unit - I

##### Introduction to Predictive Modelling

Introduction – Meaning – Models – Types of Models – Process of predictive modelling Tidying Data and Measuring Performance – Tidying data – Categorizing data quality – Performance metrics – Cross Validation – Curves.

##### Unit - II

##### Regression Analysis

Simple Regression Analysis: Concept Fundamentals of Regression Analysis - Requirements in Regression Model Building - Model Diagnostics - Interpretation of Regression results for Management Decision.

Multiple Regression Analysis: Concept - Significance of Multiple Regression Analysis - Structure of Model Estimation - Testing Rule of Multiple Regression Analysis

Nonlinear Regression and Regression Modeling

Non-Linear Regression Analysis: Concept - Types of Non-linear Regression Models-

Model Transformation - Difference between Linear and Non-linear Regression Models.

Diagnostics of Regression Modelling: Model Diagnostics - Multicollinearity - Autocorrelation

##### Unit - III

##### Dummy modelling and Panel Data Model Dummy modelling

Dummy independent modelling-linear probability Model-Logit model-Probit model

Panel Data Model: Concept - Panel Data Models - Fixed Effects Model - Random Effects

Model - Forms of Panel Data Models - Applications to use Panel Data Models.

##### Unit-IV

##### Time Series Forecasting , Data Mining and Simulation

Concept - Forecasting Techniques - Measures of Forecast Error - Trend Analysis - Time Series Models - Auto Regressive Model - Applications of Time Series Models.

Data Mining and Simulation: Data Mining: Concept - Data Interpretation – Data Reduction Classification and Clustering Techniques - Association Rule Mining - Cause and Effect Model.

Simulation: Concept - Monte Carlo Simulation - Discriminant Event Simulation - Application Using Simulation.

#### SUGGESTIVE READING:

1. Anil Maheshwari, **Data Analytics**, McGraw Hill Education, 1st Edition, 2017.
2. V.K. Jain, **Fundamentals of Business Analytics**, Dreamtech Press, 2017.

3. K.P. Soman, Shyam Diwakar, and V. Ajay, **Insight into Data Mining: Theory and Practice**, PHI Learning, 2006.
4. C.R. Kothari and Gaurav Garg, **Research Methodology: Methods and Techniques**, New Age International Publishers, 4th Edition, 2019.
5. Discrete event system simulation by Jerry Barks, John S. Carson, Barry L. Nelson & David M. Nicol
6. Tidying Data & Categorizing Data Quality: the accuracy dimension by **Jack** E. Olson
7. The Book of Why the New Science of Cause and Effect by Judea Pearl and Dana Mackenzie
8. Business analysis using regression a case book by Edwork C. Mathouse

### Lab-7: Professional Elective – VII

#### A. Data Science: Exploratory Data Analysis

|                   |                           |                 |                  |
|-------------------|---------------------------|-----------------|------------------|
| <b>SBCAEP1351</b> | <b>Big Data Analytics</b> | <b>0L:0T:4P</b> | <b>2 Credits</b> |
|-------------------|---------------------------|-----------------|------------------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

Practical 1: To load a CSV dataset into a Pandas DataFrame and perform initial exploration including viewing rows, data types, and basic statistics.

Practical 2: To identify data types, check unique values, and analyse value distributions for each column in a dataset.

Practical 3: To perform data selection operations including row/column selection, boolean filtering, and conditional subsetting.

Practical 4: To compute and interpret mean, median, and mode for numerical columns of a dataset.

Practical 5: To calculate variance, standard deviation, range, and interquartile range (IQR) and interpret data spread.

Practical 6: To calculate and interpret skewness and kurtosis of data distributions and understand their implications.

Practical 7: To detect, visualise, and handle missing values using various imputation and dropping strategies.

Practical 8: To detect and treat outliers in numerical data using the IQR method and Z-Score method.

Practical 9: To apply data transformation techniques including log transformation, Min-Max scaling, and Standard scaling.

Practical 10: To convert categorical variables into numerical format using Label Encoding and One-Hot Encoding.

Practical 11: To visualise the distribution of individual numerical variables using histograms and Kernel Density Estimation (KDE) plots.

Practical 12: To create box plots and violin plots for understanding data spread, median, and detecting outliers visually.

Practical 13: To visualise categorical data distributions using bar charts, pie charts, and count plots.

Practical 14: To explore relationships between two numerical variables using scatter plots and regression lines.

Practical 15: To compute Pearson/Spearman correlation coefficients and visualise relationships using a correlation heatmap.

Practical 16: To explore all pairwise relationships in a dataset simultaneously using seaborn pair plots.

Practical 17: To create new meaningful features from existing ones to enhance data representation for analysis.

Practical 18: To perform exploratory data analysis on time series data including trend, seasonality, and rolling statistics.

Practical 19: To apply PCA for dimensionality reduction and visualise high-dimensional data in 2D/3D.

Practical 20: To create an interactive EDA dashboard using Plotly Express and Plotly subplots for comprehensive data exploration.

**Note :** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

### Lab-7: Professional Elective – VII

#### B. Artificial Intelligence and Machine Learning: Predictive Analysis

|            |                     |          |           |
|------------|---------------------|----------|-----------|
| SBCAEP1351 | Predictive Analysis | 0L:0T:4P | 2 Credits |
|------------|---------------------|----------|-----------|

**Note:** Practicals are suggestive and as per CO-PO Mappings. Concerned teacher has freedom to modify, select all or a subset of these depending upon coverage of syllabus points. However, the modified list must match with CO-PO mapping.

- Practical 1: Exploring a Dataset and Identifying Variables
- Practical 2: Data Tidying and Handling Missing Values
- Practical 3: Computing Performance Metrics (Accuracy, RMSE,  $R^2$ )
- Practical 4: Implementing K-Fold Cross Validation
- Practical 5: Simple Linear Regression – Salary Prediction
- Practical 6: Multiple Linear Regression – House Price Prediction
- Practical 7: Residual Analysis and Model Diagnostics
- Practical 8: Detecting Multicollinearity Using VIF
- Practical 9: Polynomial Regression for Non-Linear Relationships
- Practical 10: Regression with Dummy Variables
- Practical 11: Logistic Regression (Logit Model) – Binary Classification
- Practical 12: Fixed Effects vs Random Effects Panel Data Model
- Practical 13: Time Series Decomposition and Trend Analysis
- Practical 14: AR, MA, and ARIMA Modeling for Forecasting
- Practical 15: K-Means Clustering – Customer Segmentation
- Practical 16: Decision Tree Classification
- Practical 17: Association Rule Mining Using Apriori Algorithm
- Practical 18: Monte Carlo Simulation – Estimating Value at Risk
- Practical 19: Linear Probability Model vs Logit vs Probit – Comparison
- Practical 20: Random Forest Classifier and Feature Importance

**Note :** Above is just a suggestive list of Practicals; faculty must prepare their own bank of Practicals in a similar way. As per the curriculum guidelines, a minimum of 15 practicals can be conducted based on the requirements and available resources.

|                  |                    |                 |                  |
|------------------|--------------------|-----------------|------------------|
| <b>SBCAE1351</b> | <b>Soft Skills</b> | <b>0L:1T:0P</b> | <b>1 Credits</b> |
|------------------|--------------------|-----------------|------------------|

### Course Objectives:

**CO1:** Develop effective verbal, non-verbal, written, and technical communication skills for academic and professional environments.

**CO2:** Improve presentation and public speaking abilities to communicate confidently before small and large audiences.

**CO3:** Enhance interview skills, self-grooming, body language, and confidence required for career opportunities.

**CO4:** Analyze personal strengths and weaknesses using SWOT analysis to support personality development and self-improvement.

**CO5:** Understand business, personal, and social etiquette along with cultural sensitivity required in diverse environments.

### Course Content:

#### Unit I

##### Presentation and Technical Writing Skills

- Speaking to a small group and large audience
- Barriers to communication and non- verbal communication
- Language skills
- Types of presentation and use of aids
- Effective public speaking
- Language in Technical Communication
- Letters, Memos, Electronic Communication
- Formal and Informal Reports

#### Unit II

##### Inter-personal and Interview Skills

- Attitude
- Negotiation skills
- Social Conversation
- Values and ethics
- Managing stress
- Writing a resumé
- Types of interviews
- Self-grooming and body language
- Interview preparation techniques

#### Unit III

##### Personality Enrichment and Leadership Skills

- Positive attitude

- SWOT Analysis
- Self-confidence and motivation
- Projecting a positive social image
- Persuading and negotiating
- Team work
- Maintaining morale
- Inspiring others

## **Unit IV**

### **Etiquette and Creativity**

- Personal, Social, Business Etiquette
- Understanding cultural differences
- Brainstorming
- Mind mapping
- Visualising
- Thinking out of the box
- Improving creative abilities

### **Suggested Reading:**

1. Developing Reading Skills – Françoise Grellet, Cambridge University Press, Cambridge 2007
2. Cambridge First Certificate: Listening and Speaking – Sue O' Connell with Lousie Hashemi, Cambridge University Press, Cambridge 2000
3. Inspired to Write – Jean Withrow, Gay Brookers and Martha Cumings, Cambridge University Press, New York, 2004
4. How to Build a Better Vocabulary- Maxwell Nurnberg and Morris Rosenblum, Warner Books, New York 1989
5. Technical Communication : A Practical Approach, (Sixth edition) – William Sanborn Pfeifer and T.V.S.Padmaja, Pearson, New Delhi 2006
6. Personality Development – Elizabeth Hurlock, Tata McGraw Hill, New York 1976
7. The Etiquette Book :A Complete Gide to Modern Manners- Jodi R.R. Smith, Sterling Publications, New York 2011
8. Winning at Interviews (Second edition) – Edgar Thorpe and Showick Thorpe, Pearson, New Delhi 2009
9. 365 Steps to Self-Confidence – David Lawrence Preston, Jaico Publishers, Mumbai 2007
10. Operations Team Leadership – Graham R Little, Jaico Publishers, Mumbai 2006
11. Objective English for Competitive Examinations – Hari Mohan Prasad and Uma Rani Sinha, Tata McGraw Hill, 2010

|                   |                      |                 |                  |
|-------------------|----------------------|-----------------|------------------|
| <b>SBCASP1351</b> | <b>Major Project</b> | <b>0L:0T:8P</b> | <b>4 Credits</b> |
|-------------------|----------------------|-----------------|------------------|

### Course Objectives

- CO1:** To solve industrial (or society or research) problems.
- CO2:** To plan, schedule, and monitor the software project.
- CO3:** To learn Development, coding, and testing of a large project cohesively.
- CO4:** To learn Documentation of projects.

### Major Project Guidelines

- The project proposal should be prepared in consultation with your guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. The project work should compulsorily include the software development.
- Synopsis of the project proposal covering the following aspects may be prepared:
  - Title of the Project
  - Introduction and Objectives of the Project
  - Problem Definition, Requirement Specifications (Detailed functional Requirements and Technical Specifications), Project Planning and Scheduling (Gantt chart/PERT chart)
  - Scope of the solution
  - Analysis (DFDs, ER Diagrams/Class Diagrams etc. as per the project requirements)
  - A complete structure which includes:
    - Number of modules and their description to provide an estimation of the student's effort on the project
    - Data Structures as per the project requirements for all the modules. Process Logic of each module
    - Implementation methodology
    - List of reports that are likely to be generated
  - Overall network architecture (if required for your project)
  - Implementation of security mechanisms at various levels
  - Future scope and further enhancement of the project
  - Bibliography
- Every student, (in a group of maximum three) will be asked to select a particular project listed by the department or by own, on which he/she will have to develop a working module during VI semester.
- Two copies of the original project report in the hard bound form along with the Soft copy (containing the executable file(s) of the project should be shared on given email) is to be submitted to the University.
- Coding standards should be followed meticulously. At the minimum, the code should be self-documented, modular, and should use the meaningful naming convention



## **Criteria of Assessment /Evaluation of Project work**

### **A. College Assessment (CA) criteria**

The College Assessment (CA) of the students for 40 marks is to be done based on following criteria.

| Sr.No | Criteria                                                    | Marks |
|-------|-------------------------------------------------------------|-------|
| 01    | Project Selection & Problem definition                      | 10    |
| 02    | Literature survey and data collection/ Gathering            | 05    |
| 03    | Design / concept of project/ Working - Execution of Project | 10    |
| 04    | Stage wise progress as per Action plan/milestone            | 10    |
| 05    | Quality Report Writing                                      | 05    |

### **B. University Assessment (UA) Criteria**

• The University Assessment (UA) for 60 marks is to be done and based on following criteria. This assessment shall be done by the faculty mentor and External examiner.

| Sr.No | Criteria                                         | Marks |
|-------|--------------------------------------------------|-------|
| 01    | Major Project Completion as per plan             | 10    |
| 02    | Project related Requirement Analysis & Designing | 10    |
| 03    | Developing a Solution with proper justifications | 20    |
| 04    | Project Report Writing                           | 10    |
| 05    | Project Presentation                             | 10    |

### **Typographical instructions/guidelines for Project report writing**

Following is the suggestive format for preparing the Project report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following.

- The PROJECT report shall be computer typed (English- British) and printed on A4 size paper.
- Text Font -Times New Roman (TNR), Size-12 point
- Subsection heading TNR- 12 point bold normal
- Section heading TNR- 14 capital bold
- Chapter Name/ Topic Name – TNR- 16 Capital
- All text should be justified. (Settings in the Paragraph)
- The report must be typed on one side only with 1.5-line space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.
- The report must be Spiralbound / Hardbound with cover page in colour. The title of project, name of the candidate, year of submission, name of the institute, etc shall be printed on the cover.

## **Project Report**

On completion of the project work, every student will submit a project report which should contain the

following:

1. Cover Page
2. Title page
3. Certificate by the Guide
4. Acknowledgment (The candidate may thank all those who helped in the execution of the project.)
5. Abstract (It should be in one page and include the purpose of the study, the methodology used.)
6. Table of Contents (if any)

Detailed description of the project (This should be split in various chapters/sections with each chapter/section describing a project activity in totality).

Chapter–1 Introduction (background of the Industry or User based Problem/Task)

Chapter–2 Literature Survey (to finalize and define the Problem Statement)

Chapter–3 Scope of the project

Chapter–4 Methodology/Approach, if any

Chapter-5 Details of designs, working and processes

Chapter-6 Results and Applications

Chapter-7 Conclusion

8. References

### **NOTE:**

1. Project report must contain only a relevant and short mention – technology or platform or tools used. It must be more focussed on project work and its implementation
2. Students can add/remove/edit chapter names as per the discussion with their guide