

Sant Gadge Baba Amravati University Amravati
B.Sc. Data Science and Analytics (Semester-I) NEP

| Sr. No | Type | Subject Code | Subject | Teaching and Learning Scheme | | | | | Duration of Exam Hrs | Examination and Evaluation Scheme | | | | | | | |
|----------------------------|------------------|--------------|-----------------------------------------|------------------------------|--------------------|---|------------|-----------|----------------------|-----------------------------------|----|----------|----|-------------|-----------------------|----------|-------|
| | | | | Teaching Period per week | | | | Credits | | Maximum Marks | | | | Total marks | Minimum passing Marks | | |
| | | | | L | T | P | Total Hrs | | | External | | Internal | | | External | Internal | Total |
| | | | | | | | | | | Th | Pr | Th | Pr | | | | |
| 1 | AEC | N1DA1 | English Composition and Communication | 1 | 1 | - | 02 | 02 | 02 | 30 | - | 20 | - | 50 | 12 | 08 | 20 |
| 2 | Core | N1DA2 | Foundation Mathematics | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 3 | Core | N1DA3 | Problem Solving Using C | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 4 | Core | N1DA4 | Data Structure | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 5 | SEC/LAB | N1DA5 | Data Analysis with Excel-LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 6 | SEC/LAB | N1DA6 | C- Programming LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 7 | SEC/LAB | N1DA7 | Data Structure LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 8 | IKS | N1DA8 | Indian Knowledge System | 2 | - | - | 02 | 02 | 02 | College Level Theory | | | | 50 | - | 20 | 20 |
| 9 | VAC | N1DA9 | Environmental Science | 2 | - | - | 02 | 02 | 02 | College Level Theory | | | | 50 | - | 20 | 20 |
| 10 | OE-I | N1DA10 | *MOOCS/SWYAM/NEPTEL/GOEC Basket Courses | - | - | 1 | 02 | 01 | - | College Assessment | | | | 50 | - | 20 | 20 |
| 11 | Assessment Hours | | | | | | 06 | | | | | | | | | | |
| TOTAL | | | | | | | 35 | 22 | | | | | | 590 | | | |
| Sem -I Total Credit | | 22 | | | Total Marks | | 590 | | | | | | | | | | |

Internal Assessment Guidelines

For 30 Marks Internal (Theory) – Test 1 = 05M , Test 2 = 05M, Assignment/Seminar/Paper-Presentation =10M, Common Test Based on Whole Syllabus = 10M

For 20 Marks Internal (Theory) – Test 1 = 05M , Test 2 = 05M, Common Test Based on Whole Syllabus = 10M

For 25 Marks Internal (Practical) – Mini Project = 10M, Record = 05M, Skill Test=05M, Attendance and Performance=05M

For 50 Marks College Level Theory – Exam =40M, Assignment=10M

OE-I Assessment – Certificate Submission – 20M, Assignment Submission-20M, Viva-Voce-10M if Subject Choose from GOEC Basket then 40marks paper and 10marks Assignment should be conducted on College Level

*Faculty wise basket other than faculty core subject.

Internship will be conducted after Ist semester till Vth semester in vacations for minimum 60 hrs. It's 2 credits will be reflected in final semester credit grade report.

Sant Gadge Baba Amravati University Amravati

B.Sc. Data Science and Analytics (Semester-II) NEP

| Sr. No | Type | Subject Code | Subject | Teaching and Learning Scheme | | | | | Duration of Exam Hrs | Examination and Evaluation Scheme | | | | | | | |
|-----------------------------|------------------|--------------|------------------------------------------|------------------------------|---|---|--------------------|-----------|----------------------|-----------------------------------|----|----------|----|-----------------------|----------|----------|-------|
| | | | | Teaching Period per week | | | | Credits | | Maximum Marks | | | | Minimum passing Marks | | | |
| | | | | L | T | P | Total Hrs | | | External | | Internal | | Total marks | External | Internal | Total |
| | | | | | | | | | | Th | Pr | Th | Pr | | | | |
| 1 | AEC | N2DA1 | Communication Skills | 1 | 1 | - | 02 | 02 | 02 | 30 | - | 20 | - | 50 | 12 | 08 | 20 |
| 2 | Core | N2DA2 | Statistics for Data Science | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 3 | Core | N2DA3 | Database Management System | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 4 | Core | N2DA4 | Python for Data Science | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 5 | SEC/LAB | N2DA5 | DBMS-LAB | - | - | 3 | 06 | 03 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 6 | SEC/LAB | N2DA6 | Python Programming –LAB | - | - | 3 | 06 | 03 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 7 | SEC | N2DA7 | Design Thinking and Innovation | 2 | - | - | 02 | 02 | 02 | 30 | - | 20 | - | 50 | 12 | 08 | 20 |
| 8 | VAC | N2DA8 | Data Science Ethics | 2 | - | - | 02 | 02 | 02 | College Level Theory | | | | 50 | - | 20 | 20 |
| 9 | OE-II | N2DA9 | MOOCS/SWYAM/NEPTEL/ GOEC Basket Courses* | - | - | 1 | 02 | 01 | | College Assessment | | | | 50 | - | 20 | 20 |
| 10 | Assessment Hours | | | | | | 06 | | | | | | | | | | |
| TOTAL | | | | | | | 35 | 22 | | | | | | 540 | | | |
| Sem -II Total Credit | | 22 | | | | | Total Marks | | | 540 | | | | | | | |

Internal Assessment Guidelines

For 30 Marks Internal (Theory) – Test 1 = 05M , Test 2 = 05M, Assignment/Seminar/Paper-Presentation =10M, Common Test Based on Whole Syllabus = 10M

For 20 Marks Internal (Theory) – Test 1 = 05M , Test 2 = 05M, Common Test Based on Whole Syllabus = 10M

For 25 Marks Internal (Practical) – Mini Project = 10M, Record = 05M, Skill Test=05M, Attendance and Performance=05M

For 50 Marks College Level Theory – Exam =40M, Assignment=10M

OE-II Assessment – Certificate Submission – 20M, Assignment Submission-20M, Viva-Voce-10M if Subject Choose from GOEC Basket then 40marks paper and 10marks Assignment should be Conducted on College Level

*Faculty wise basket other than faculty core subject.

Internship will be conducted after Ist semester till Vth semester in vacations for minimum 60 hrs. It's 2 credits will be reflected in final semester credit grade report.

Sant Gadge Baba Amravati University Amravati

B.Sc. Data Science and Analytics (Semester-III) NEP

| Sr. No | Type | Subject Code | Subject | Teaching and Learning Scheme | | | | | Duration of Exam Hrs | Examination and Evaluation Scheme | | | | | | | |
|------------------------------|------------------|--------------|-----------------------------------|------------------------------|---|---|--------------------|-----------|----------------------|-----------------------------------|----|----------|------------|-------------|-----------------------|----------|-------|
| | | | | Teaching Period per week | | | | Credits | | Maximum Marks | | | | Total marks | Minimum passing Marks | | |
| | | | | L | T | P | Total Hrs | | | External | | Internal | | | External | Internal | Total |
| | | | | | | | | | | Th | Pr | Th | Pr | | | | |
| 1 | Core | N3DA1 | Introduction to Data Science | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 2 | Core | N3DA2 | Design and Analysis of Algorithms | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 3 | Core | N3DA3 | Operating Systems | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 4 | DSE | N3DA4 | Professional Elective 1 | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 5 | SEC/LAB | N3DA5 | Elective1- LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 6 | SEC/LAB | N3DA6 | Operating System -LAB | - | - | 3 | 06 | 03 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 7 | SEC/LAB | N3DA7 | DAA-LAB | - | - | 3 | 06 | 03 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 8 | CC | N3DA8 | Co Curricular Courses* | - | - | 2 | 04 | 02 | 02 | | | | | 30 | - | 12 | 12 |
| 9 | Assessment Hours | | | | | | 03 | | | | | | | | | | |
| TOTAL | | | | | | | 35 | 22 | | | | | 520 | | | | |
| Sem -III Total Credit | | 22 | | | | | Total Marks | | 520 | | | | | | | | |

Professional Elective 1: Advance Database Technologies, Cloud Computing for Data Analytics

*Health and Wellness, Yoga Education, Sports, Fitness, Cultural Activities, Paper presentation , Conference, Community Engagement, Field Visit, Avshikar, NSD, NSS/NCC and Fine/Applied/Visual/Performing Arts. Minimum District Level Certificate Required.

Internship will be conducted after Ist semester till Vth semester in vacations for minimum 60 hrs. It's 2 credits will be reflected in final semester credit grade report.

Sant Gadge Baba Amravati University Amravati

B.Sc. Data Science and Analytics (Semester-IV) NEP

| Sr. No | Type | Subject Code | Subject | Teaching and Learning Scheme | | | | | Duration of Exam Hrs | Examination and Evaluation Scheme | | | | | | | |
|-----------------------------|------------------|--------------|--------------------------------------------|------------------------------|---|---|--------------------|-----------|----------------------|-----------------------------------|----|----------|----|-------------|-----------------------|----------|-------|
| | | | | Teaching Period per week | | | | Credits | | Maximum Marks | | | | Total marks | Minimum passing Marks | | |
| | | | | L | T | P | Total Hrs | | | External | | Internal | | | External | Internal | Total |
| | | | | | | | | | | Th | Pr | Th | Pr | | | | |
| 1 | Core | N4DA1 | Entrepreneurship and Start-up Ecosystem | 2 | - | - | 02 | 02 | 02 | 30 | - | 20 | - | 50 | 12 | 08 | 20 |
| 2 | Core | N4DA2 | Optimization Techniques | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 3 | Core | N4DA3 | Artificial Intelligence & Machine Learning | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 4 | Core | N4DA4 | Data Mining and Data Warehousing | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 5 | DSE | N4DA5 | Professional Elective 2 | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 6 | SEC/LAB | N4DA6 | Optimization Techniques -LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 7 | SEC/LAB | N4DA7 | Machine Learning- LAB | - | - | 3 | 06 | 03 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 8 | SEC/LAB | N4DA8 | DMDW – LAB | - | - | 3 | 06 | 03 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 9 | Assessment Hours | | | | | | 05 | | | | | | | | | | |
| TOTAL | | | | | | | 35 | 22 | | | | | | 520 | | | |
| Sem -IV Total Credit | | 22 | | | | | Total Marks | | | 520 | | | | | | | |

Professional Elective 2: Digital Marketing Analytics, LLM's and Generative AI

Internship will be conducted after Ist semester till Vth semester in vacations for minimum 60 hrs. It's 2 credits will be reflected in final semester credit grade report.

Sant Gadge Baba Amravati University Amravati
B.Sc. Data Science and Analytics (Semester-V) NEP

| Sr. No | Type | Subject Code | Subject | Teaching and Learning Scheme | | | | | Duration of Exam Hrs | Examination and Evaluation Scheme | | | | | | | |
|----------------------------|------------------|--------------|-------------------------------------|------------------------------|---|---|--------------------|-----------|----------------------|-----------------------------------|----|----------|----|-------------|-----------------------|----------|-------|
| | | | | Teaching Period per week | | | | Credits | | Maximum Marks | | | | Total marks | Minimum passing Marks | | |
| | | | | L | T | P | Total Hrs | | | External | | Internal | | | External | Internal | Total |
| | | | | | | | | | | Th | Pr | Th | Pr | | | | |
| 1 | Core | N5DA1 | Data Handling Visualization | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | 20 | 80 | 20 | 12 | 32 |
| 2 | Core | N5DA2 | Big Data Analytics | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | 20 | 80 | 20 | 12 | 32 |
| 3 | Core | N5DA3 | Predictive Analysis | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | 20 | 80 | 20 | 12 | 32 |
| 4 | DSE | N5DA4 | Professional Elective 3 | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | 20 | 80 | 20 | 12 | 32 |
| 5 | SEC/LAB | N5DA5 | Data Visualization with PowerBI-LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 10 | 50 | 10 | 10 | 20 |
| 6 | SEC/LAB | N5DA6 | Big Data Analytics – LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 10 | 50 | 10 | 10 | 20 |
| 7 | SEC/LAB | N5DA7 | LAB Based on Elective 3 | - | - | 2 | 04 | 02 | - | - | 25 | - | 10 | 50 | 10 | 10 | 20 |
| 8 | SEC | N5DA8 | Seminar | - | - | 1 | 02 | 01 | - | - | - | - | - | 50 | - | 20 | 20 |
| 9 | SEC | N5DA9 | Project Phase I | - | - | 2 | 04 | 02 | - | - | - | - | - | 50 | - | 20 | 20 |
| 10 | Assessment Hours | | | | | | 05 | | | | | | | | | | |
| TOTAL | | | | | | | 35 | 21 | | | | | | 570 | | | |
| Sem -V Total Credit | | 21 | | | | | Total Marks | | 570 | | | | | | | | |

Professional Elective 3: Social Network Analysis, Text Analytics, Exploratory Data Analytics

Internship will be conducted after Ist semester till Vth semester in vacations for minimum 60 hrs. It's 2 credits will be reflected in final semester credit grade report.

Sant Gadge Baba Amravati University Amravati

B.Sc. Data Science and Analytics (Semester-VI) NEP

| Sr. No | Type | Subject Code | Subject | Teaching and Learning Scheme | | | | | Duration of Exam Hrs | Examination and Evaluation Scheme | | | | | | | |
|-----------------------------|---------|--------------|-----------------------------------------|------------------------------|---|---|--------------------|-----------|----------------------|-----------------------------------|----|----------|------------|-------------|-----------------------|----------|-------|
| | | | | Teaching Period per week | | | | Credits | | Maximum Marks | | | | Total marks | Minimum passing Marks | | |
| | | | | L | T | P | Total Hrs | | | External | | Internal | | | External | Internal | Total |
| | | | | | | | | | | Th | Pr | Th | Pr | | | | |
| 1 | Core | N6DA1 | Business Analytics and Intelligence | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 2 | Core | N6DA2 | Data Security and Privacy | 3 | - | - | 03 | 03 | 03 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 3 | Core | N6DA3 | Advance Data Analytics | 3 | - | - | 03 | 03 | 02 | 50 | - | 30 | - | 80 | 20 | 12 | 32 |
| 4 | SEC/LAB | N6DA4 | Business Analytics and Intelligence-LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 5 | SEC/LAB | N6DA5 | Data Security and Privacy-LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 6 | SEC/LAB | N6DA6 | Advance Data Analytics-LAB | - | - | 2 | 04 | 02 | - | - | 25 | - | 25 | 50 | 10 | 10 | 20 |
| 7 | SEC | N6DA7 | Internship | - | - | - | - | 02 | - | | | | | - | - | - | |
| 8 | SEC | N6DA8 | Project Phase II | - | - | 4 | 08 | 04 | - | - | 50 | - | 50 | 100 | 20 | 20 | 40 |
| Assessment Hours | | | | | | | 06 | | | | | | | | | | |
| TOTAL | | | | | | | 35 | 21 | | | | | 490 | | | | |
| Sem -VI Total Credit | | 21 | | | | | Total Marks | | 490 | | | | | | | | |

Internship will be conducted after Ist semester till Vth semester in vacations for minimum 60 hrs. It's 2 credits will be reflected in final semester credit grade report.

Faculty: Science and Technology

Syllabus Prescribed for Three Year Six Semester UG Programme

B.Sc. DATA SCIENCE AND ANALYTICS [NEP Pattern]

PROGRAMME EDUCATIONAL OBJECTIVES (PEO):

The Program Educational Objectives (PEOs) of the Computer Applications are listed below:

PEO1. To prepare graduates to be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms.

PEO2. To prepare graduates to achieve peer-recognition, as an individual and as a team player, through demonstration of good analytical, design, implementation and interpersonal skills.

PEO3. To prepare graduates to contribute to society as broadly educated, expressive ethical and responsible citizens with proven expertise

PEO4. To prepare graduates to pursue life-long learning to fulfil their goals.

PROGRAMME OUTCOMES (PO'S):

(To be achieved by the student after every semester/year/and at the time of graduation) At the end of this program, graduates will be able to :

1. Computer knowledge: Apply the knowledge of mathematics, computer Fundamentals to IT applications.

2. Design/Development of solutions: Design solutions for IT applications using latest technologies and develop and implement the solutions using various latest languages.

3. Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex IT applications with an understanding of the limitations.

4. Environment and sustainability: Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

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

6. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PROGRAMME SPECIFIC OUTCOMES (PSO'S):

PSO-1: Apply mathematical, conceptual knowledge of computing and analytical skills to demonstrate data analytics of real-world applications.

PSO-2: Hands-on experience with appropriate data analytics tools to enhance their knowledge in the field of data science.

PSO-3: Equipped with creative and technical skills in various domains of Data Handling, Predictive Modelling and Data Visualization.

EMPLOYABILITY:

1. **Data Analyst:** Data analysts interpret data to help organizations make strategic decisions. They collect, process, and analyze data sets to provide insights and recommendations.
2. **Data Scientist:** Data scientists use advanced statistical and analytical techniques to interpret complex data sets. They develop algorithms and predictive models to extract valuable insights and solve business problems.
3. **Business Intelligence Analyst:** Business intelligence analysts analyze data to help companies improve decision-making processes. They create reports, dashboards, and visualizations to communicate insights to stakeholders.
4. **Machine Learning Engineer:** Machine learning engineers design and implement machine learning algorithms and models. They work on projects such as natural language processing, computer vision, and recommendation systems.
5. **Data Engineer:** Data engineers design, build, and maintain data pipelines and infrastructure. They ensure data availability, reliability, and scalability for analytical and operational needs.
6. **Quantitative Analyst:** Quantitative analysts, or quants, develop mathematical models and algorithms for financial markets and investment strategies. They use statistical techniques to analyze market data and forecast trends.
7. **Research Scientist:** Research scientists conduct scientific research using data analysis techniques. They work in various fields such as healthcare, environmental science, and social science to discover new insights and solve complex problems.
8. **Data Consultant:** Data consultants provide expertise and guidance to organizations on data-related projects. They assess data needs, develop strategies, and implement solutions to improve business processes and outcomes.
9. **Data Journalist:** Data journalists analyze and visualize data to create compelling stories and reports. They use data-driven techniques to uncover trends, patterns, and insights for storytelling in journalism.

SEMESTER-I**Title: ENGLISH COMPOSITION AND COMMUNICATION****Type: AEC****Credits: 02**

| | | | |
|------------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-50 | | Course Code: N1DA1 | (Total Number of Periods) Hrs |
| Theory Exam Marks :30 | Internal Marks:20 | | 30 |

COURSE OUTCOME:

At end of the course students would be able to

:

1. understand communication skills of English language
2. Formulate/ compose his own sentences and able to speak English Language.
3. collaborate with others students in English.
4. communicate properly their ideas and concepts in English.

| Unit | Content |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit 1: | <ul style="list-style-type: none"> ○ Articles ○ Prepositions ○ Tenses ○ Subject – Verb Agreement (6 Hours) |
| Unit 2: | <ul style="list-style-type: none"> ○ Meeting People ○ Exchanging Greetings and Taking Leave ○ Introducing Yourself (6 Hours) |
| Unit 3: Prose | <ul style="list-style-type: none"> ○ The Home Coming – Rabindranath Tagore ○ A Lesson My Father Taught Me – APJ Abdul Kalam ○ How I Became a Public Speaker – George Bernard Shaw (6 Hours) |
| Unit 4: Poetry | <ul style="list-style-type: none"> ○ The quality of Mercy – William Shakespeare ○ The Mountain and the Squirrel – R.W. Emerson ○ Where the Mind is Without Fear – Rabindranath Tagore (6 Hours) |

Skill Enhancement Module: [6 Hours]

Spot Visit and preparing a report – Visit to Super Market, Bus Stand, Railway Station, Bank, Medical Shop, Bakery etc.

Interview of a dignitary and writing a report in dialogue form

TEXT BOOK:

Pathmaker: A Textbook for College Students [ISBN 989354421778] Edited by Board of Editors, SantGadge Baba Amravati University, Amravati. Publisher : Orient BlackSwan Pvt Ltd

Title: FOUNDATION MATHEMATICS**Type: Core****Credits: 03**

| | | | |
|------------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-80 | | Course Code: N1DA2 | (Total Number of Periods) Hrs |
| Theory Exam Marks :50 | Internal Marks:30 | | 45 |

COURSE OUTCOME:

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

1. Interpret the concepts of matrices and calculus in data science.
2. Infer problems in sets and foundations in logic.
3. Solve the relations and functions in sets.
4. Use hypothesis testing for calculating Type I and Type II errors.
5. Relate the concepts of probability in data science.

| UNIT | Content |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNIT 1: SET, RELATION AND FUNCTION | Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, Closures of Relations, Warshall's algorithm. Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions. Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions. (12 Hours) |
| UNIT 2: FOUNDATION IN LOGICS | Complex numbers, Properties of Complex Number, Polar form of Complex number, DE Moivre's theorem and Examples. Proof Methods, statements, Truth Value Table Quantified statements, Indirect argument – Mathematical Induction – Logic – Automated reasoning (11 Hours) |
| UNIT 3: INTRODUCATION TO MATRICES AND CALCULUS: | Introduction to Calculus- Applications of Calculus- Calculus Notation- Linear Functions- Derivative- Exponential & Logarithm Rule- Sine and Cosine Functions-Sigmoid Function- Differentiation- Partial Differentiation- Integration (11 Hours) |
| UNIT 4: MATRIX ALGEBRA | Types of matrices, algebra of matrices–addition, subtraction, and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen values and Eigen vectors, Caley-Hamilton theorem. (11 Hours) |

TEXT BOOKS:-

1. H. Anton, "Elementary Linear Algebra ", John Wiley, 2014.
2. Zealure C Holcomb, "Fundamentals of Descriptive Statistics", Khanna Publishers, 2015.
3. Kandasamy S. Chand, " Numerical Methods", S. Chand publisher, 2008.

REFERENCE BOOKS:-

1. Sheldon Axler, "Linear Algebra Done Right", Springer Nature; 3rd ed. 2015.
2. Peter Goos, David Meintrup, "Statistics with JMP: Graphs, Descriptive Statistics and Probability", Wiley, 2015.

Title: PROBLEM SOLVING USING C**Type: Core****Credits: 03**

| | | | |
|------------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-80 | | Course Code: N1DA3 | (Total Number of Periods) Hrs |
| Theory Exam Marks :50 | Internal Marks:30 | | 45 |

COURSE OUTCOME:

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

1. Describe the basics of digital computer and programming languages.
2. Demonstrate problem solving techniques using flowchart, algorithm/pseudo code to solve the given problem.
3. Design and Implement C program using Control Statements and Functions.
4. Design and Implement C program using Pointers and File operations.
5. Identify the need for embedded C in real-time applications.
- 6.
- 7.

| UNIT | Content |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNIT 1:- PROGRAMMING LANGUAGES AND PROBLEM SOLVING TECHNIQUES | Introduction – Fundamentals of digital computers - Programming languages - Programming Paradigms – Types of Programming Languages – Language Translators – Problem Solving Techniques: Algorithm – Flow Chart - Pseudo code. (11 Hours) |
| UNIT 2:- FUNDAMENTALS OF C | Evolution of C -Why C language - Applications of C language - Data Types in C – Operators and Expressions – Input and Output statements in C – Decision Statements – Loop Control Statements (12 Hours) |
| UNIT 3:- FUNCTIONS ,ARRAYS AND STRINGS | Functions – Storage Class – Arrays – Strings and standard functions - Pre-processor Statements. (11 Hours) |
| UNIT 4:- POINTERS, STRUCTURES AND UNION | Pointers – Dynamic Memory allocation – Structure and Union – Files. (11 Hours) |

TEXT BOOKS:-

- 1.Jeyapoovan T, “Fundamentals of Computing and Programming in C”, Vikas Publishing house, 2015.
- 2.Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.

REFERENCE BOOKS:-

1. Ashok Kamthane, “Computer Programming”, Pearson Education, 7th Edition, Inc 2017.
2. Yashavant Kanetkar, “Let us C”, 15th edition, BPP publication, 2016.

Title: DATA STRUCTURE**Type: Core****Credits: 03**

| | | | |
|------------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-80 | | Course Code: N1DA4 | (Total Number of Periods) Hrs |
| Theory Exam Marks :50 | Internal Marks:30 | | 45 |

COURSE OUTCOME:

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

1. Understand the fundamental concepts of Data Structures and their applications.
2. Develop problem-solving skills using Data Structures.
3. Implement Data Structures using C programming language.

| UNIT | Content |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNIT1: | Introduction and Overview: Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Tradeoff. Arrays: Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Representation of Two Dimensional Arrays in Memory Operations on Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging. Searching: Linear Search and Binary Search, Comparison of Methods. Sorting: Bubble Sort, Selection Sort, and Insertion Sort. Two-Dimensional Arrays (12 Hours) |
| UNIT2: | Linked Lists: Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. Applications of Linked Lists: Addition of Polynomials. Hashing and Collision: Hashing, Hash Tables, Types of Hash Functions, Collision, Collision Resolution with Open Addressing and Chaining. (11 Hours) |
| UNIT3: | Stacks: Definition, Representation of Stacks using Arrays and Linked List, Operations on Stacks using Arrays and Linked List, Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of Postfix Expression. Recursion: Definition, Recursive Notation, Runtime Stack, Applications of Recursion: Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi. Queues: Definition, Representation of Queues using Array and Linked List, Types of Queue: Simple Queue, Circular Queue, Double-Ended queue, Priority Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues. (12 Hours) |
| UNIT4 | Graphs: Definition, Terminology, Representation, Traversal. Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree, Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL Tree. (10 Hours) |

TEXT BOOKS:-

1. R.B. Patel, "Expert Data Structures with C", Khanna Book Publishing Company, 2023.
2. Seymour Lipschutz, "Data Structures with C", Schaum's Outlines, Tata McGraw-Hill, 2011.
3. Yashavant Kanetkar, "Data Structures Through C", 4th Edition, BPB Publications, 2022.

REFERENCE BOOKS:-

1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2014.
2. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2007.

Title: DATA ANALYSIS WITH EXCEL-LAB**Type: SEC/LAB****Credits: 02**

| | | | |
|---------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-50 | | Course Code: N1DA5 | (Total Number of Periods) Hrs |
| External Marks :25 | Internal Marks:25 | | 60 |

NOTE:

The list suggests the program set. Hence, the concerned staff may modify the list as needed (minimum 15).

COURSE OUTCOME:

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

1. Implement the fundamental concepts of Data Analytics and work with MS Excel. Infer various data visualization tool.
2. Demonstrate various Data driven technique and perform predictive analysis.
3. Perform various advanced data analysis like Cognos Analytics.
4. Create and execute several Forecasting methods using Excel.

LIST OF PROGRAMS:

1. Perform basic spreadsheet tasks including navigation, data entry, and using formulas.
2. Employ data quality techniques to import and clean data in Excel.
3. Create basic charts and pivot charts in Excel.
4. Construct advanced charts and visualizations.
5. Create a CGPA Calculator using Excel and Analyse the result.
6. Perform Data visualization for a Class result and create various Charts.
7. Perform market survey from sample market data from Kaggle and demonstrate the prediction.
8. Analyze data in spreadsheets by using filtering, sorting, look-up functions, and pivot tables.
9. Build dashboards using Excel and Cognos Analytics.
10. Standard Normal Probability Distribution in Excel

TEXT BOOKS:

1. Manisha Nigam, "Advanced Analytics with Excel 2019", BPB 2019.
2. Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications,2014.

REFERENCE BOOKS :

1. Wanyne. L. Winston, 2014 "Market Analytics Data Driven Technique with Microsoft Excel"
2. David Whigham, 2019, "Business Data Analysis Using Excel", Oxford Publications.

Title: C PROGRAMMING - LAB**Type: SEC/LAB****Credits: 02**

| | | | |
|---------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-50 | | Course Code: N1DA6 | (Total Number of Periods) Hrs |
| External Marks :25 | Internal Marks:25 | | 60 |

NOTE:

The list suggests the program set. Hence, the concerned staff may modify the list as needed (minimum 15).

LIST OF PROGRAMS:

1. Drawing Flowcharts using E- Chart & Writing pseudo code for the following problems

- (i) Greatest of three numbers
- (ii) Sum of N numbers
- (iii) Computation of nCr

2. Fundamentals of C

- (i) Program to illustrate arithmetic and logical operators
- (ii) Program to read and print data of different types
- (iii) Program to calculate area and volume of various geometrical shapes
- (iv) Program to compute biggest of three numbers

3. Function, Arrays and Strings

- (i) Program to compute Factorial, Fibonacci series and sum of n numbers using recursion
- (ii) Program to compute sum and average of N Numbers stored in an array
- (iii) Program to sort the given n numbers stored in an array
- (iv) Program to search for the given element in an array

4. Pointers, Structures and Union

- (i) Program to compute sum of integers stored in a 1-D array using pointers and dynamic memory allocation
- (ii) Program to read and print records of a student/payroll database using structures
- (iii) Program to simulate file copy
- (iv) Program to illustrate sequential access file
- (v) Program to illustrate random access file

Title: DATA STRUCTURE - LAB**Type: SEC/LAB****Credits: 02**

| | | | |
|---------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-50 | | Course Code: N1DA7 | (Total Number of Periods) Hrs |
| External Marks :25 | Internal Marks:25 | | 60 |

NOTE:

- Based on N1DA4.
- The list suggests the program set. Hence, the concerned staff may modify the list as needed (minimum 15).

LIST OF PRACTICALS :

1. Implementing basic operations on arrays: insertion, deletion, searching.
2. Implementing linked lists: singly linked list, doubly linked list.
3. Implementing stack and queue using arrays and linked lists.
4. Implementing tree traversal algorithms: preorder, inorder, postorder.
5. Implementing binary search trees (BST) and operations: insertion, deletion, searching.

6. Implementing sorting algorithms: selection sort, bubble sort, insertion sort.
7. Implementing searching algorithms: linear search, binary search.
8. Implementing graph representation: adjacency matrix, adjacency list.
9. Implementing graph traversal algorithms: depth-first search (DFS), breadth-first search (BFS).
10. Implementing shortest path algorithms: Dijkstra's algorithm, Bellman-Ford algorithm.

Title: INDIAN KNOWLEDGE SYSTEM

Type: IKS

Credits: 02

| | | |
|-----------------------|---------------------------|--------------------------------------|
| Total Marks-50 | Course Code: N1DA8 | (Total Number of Periods) Hrs |
| | Internal Marks:50 | 30 |

COURSE OBJECTIVES:

1. To sensitize the students about context in which they are embedded i.e. Indian culture and civilisation including its Knowledge System and Tradition.
2. To help student to understand the knowledge, art and creative practices, skills and values in ancient Indian system.
3. To help to study the enriched scientific Indian heritage.
4. To introduce the contribution from Ancient Indian system & tradition to modern science & Technology

DETAILED CONTENTS:

Module 1: Introduction to IKS

(Any Ten of total sessions assigned for Literary activity)

Introductory lecture on the any TEN topics below:

1. Indian Knowledge System
2. Indian Culture & Civilization
3. Ancient Indian Chemistry
4. Ancient Indian Metallurgy
5. Ancient Indian Mathematics
6. Ancient Indian Astronomy
7. Indian Astronomical Instruments
8. Indian Knowledge System (Upveda: Ayurveda)
9. Indian Knowledge System (Upveda: Gandharveda)
10. Indian Knowledge System (Vedangas: Shiksha, Kalpa, Vyakrana)
11. Indian Knowledge System (Vedangas: Jyotisha, Nirukta, Chandas)
12. Indian Architecture I: Sthapatya-Veda
13. Indian Architecture II: Temples
14. Indian Architecture III: Town & Planning
15. Indian Philosophical System

Module 2: Introduction to Creative Practices

(Twenty Lectures with at least Five different topics of total session under Creative activity)

Introductory lecture on the topics below:

1. Dhatuvada: art of metallurgy
2. Akara jnana: art of mineralogy
3. Vastuvidya: art of engineering
4. Yantramatrika: art of mechanics
5. Takshana: art of carpentry
6. Chalitakayoga: art of practicing as a builder of shrines

7. Raupyaratnapariksha: art of testing silver and jewels
8. Maniraga jnana: art of tinging jewels
9. Sucivayakarma: art of needleworks and weaving
10. Vadya vidya: art of playing on musical instruments
11. Geet vidya : art of singing
12. Nritya vidya: art of dancing
13. Natya vidya: art of theatricals
14. Alekhya vidya: art of painting
15. Viseshakacchedya vidya: art of painting the face and body with color
16. Udakavadya: art of playing on music in water
17. Manasi kavyakriya: art of composing verse
18. Bhushanayojana: art of applying or setting ornaments
19. Citrasakapupabhakshyavikarakriya: art of preparing varieties of delicious food
20. Dasanavasanangaraga: art of applying preparations for cleansing the teeth, cloths and painting the body
21. Utsadana: art of healing or cleaning a person with perfumes
22. Vastragopana: art of concealment of cloths
23. Balakakridanaka: art of using children's toys
24. Tandulakusumabalivikara: art of preparing offerings from rice and flowers
25. Pushpastarana: art of making a covering of flowers for a bed

REFERENCE BOOKS:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru
2. Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. The Cultural Heritage of India. Vol.I. Kolkata:Ramakrishna Mission Publication, 1972.
4. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
5. Dr. R. C. Majumdar, H. C. Raychaudhuri and Kalikinkar Datta: An Advanced History of India (Second Edition) published by Macmillan & Co., Limited, London, 1953.
6. Rao, N. 1970. The Four Values in Indian Philosophy and Culture. Mysore: University of Mysore.
7. Avari, B. 2016. India: The Ancient Past: A History of the Indian Subcontinent from c. 7000 BCE to CE 1200. London: Routledge.

Title: ENVIRONMENTAL SCIENCE

Type: VAC

Credits: 02

| Total Marks-50 | | Course Code: N1DA9 | (Total Number of Periods) Hrs |
|----------------------|-------------------|--------------------|-------------------------------|
| College Level Theory | Internal Marks:50 | | 30 |

COURSE OUTCOME:

1. Explore the basic environmental concepts and issues relevant to the business and management field.
2. Recognize the interdependence between environmental processes and socio-economic dynamics.
3. Determine the role of business decisions, policies, and actions in minimizing environmental degradation.
4. Identify possible solutions to curb environmental problems caused by managerial actions.
5. Develop skills to address immediate environmental concerns through changes in business operations, policies, and decisions.

| UNIT | Content |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit 1: Understanding | Fundamental environmental concepts and their relevance to business operations; Components and segments of the environment, the man-environment relationship, and |

| | |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environment, Natural Resources, and Sustainability | historical environmental movements. Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation. Sustainable practices in managing resources, including deforestation, water conservation, energy security, and food security issues. (8 Hours) |
| Unit 2: Ecosystems, Biodiversity, and Sustainable Practices | Various natural ecosystems, learning about their structure, functions, and ecological characteristics. The importance of biodiversity, the threats it faces, and the methods used for its conservation. Ecosystem resilience, homeostasis, and carrying capacity, emphasizing the need for sustainable ecosystem management. (7 Hours) |
| Unit 3: Environmental Pollution and Waste Management | Various types of environmental pollution, including air, water, noise, soil, and marine pollution, and their impacts on businesses and communities. Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management; Natural and man-made disasters, their management, and the role of businesses in mitigating disaster impacts. (7 Hours) |
| Unit 4: Social Issues, Legislation, and Practical Applications | Dynamic interactions between society and the environment, with a focus on sustainable development and environmental ethics. Role of businesses in achieving sustainable development goals and promoting responsible consumption. Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Environmental justice, environmental refugees, and the resettlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India. (8 Hours) |

READINGS:

Text Books (Latest Editions):

- Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
- Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.
- Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.
- Rajagopalan, R. Environmental studies: from crisis to cure (4th ed.). Oxford University Press.
- Miller, G.T. & Spoolman S. Living in the Environment. (20th ed.). Cengage.
- Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.
- Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.
- Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.
- Wright, R.T. & Boorse, D.F. Environmental Science: Toward A Sustainable Future (13th ed.). Pearson.

References

Title: MOOCS/SWYAM/NEPTEL/GOEC BASKET COURSES**Type: OE-I****Credits: 01**

| | | | |
|---------------------------|--------------------------|----------------------------|--------------------------------------|
| Total Marks-50 | | Course Code: N1DA10 | (Total Number of Periods) Hrs |
| College Assessment | Internal Marks:50 | | 30 Hrs of Engagement |

Note:

As part of the academic curriculum, students are required to complete **Open Elective (OE)** courses in addition to the core subjects.

Note that the OE must be selected from Faculty wise basket other than faculty of core subject, allowing you the opportunity to explore interdisciplinary topics and broaden your knowledge.

- **MOOCs/NEPTEL:** You can choose relevant courses from platforms like Coursera, edX, or NPTEL that are pre-approved by the university. Ensure that the course content aligns with the credit requirements and is recognized by the academic guidelines.
- **GOEC Basket:** Alternatively, you may choose an OE from the university's available electives, as listed in the GOEC basket.

The completed OE must be submitted for credit within the prescribed time frame as outlined by the university.

For any further details or guidance on selecting appropriate courses, consult the academic coordinator.

SEMESTER II**Title: COMMUNICATION SKILLS****Type: AEC****Credits: 02**

| | | | |
|------------------------------|---------------------------|---------------------------|--------------------------------------|
| Total Marks-50 | | Course Code: N2DA1 | (Total Number of Periods) Hrs |
| Theory Exam Marks :30 | Internal Marks: 20 | | 30 |

COURSE OUTCOME:

At end of the course students would be able to

1. Understand the paragraph, prose, poetry and communication skills .
2. Formulate/ compose his own sentences and able to speak English Language.
3. Collaborate with others students in English.
4. Communicate properly their ideas and concepts in English.

| Unit | Content |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit 1: | 1) Question Tags 2) Synonyms and Antonyms 3) Prefixes, Suffixes, Zero Suffix and Infix (6 Hours) |
| Unit 2: | 1) Making Requests and Responding to Requests 2) Thanking Someone and Responding to Thanks 3) Developing a Thoughts (6 Hours) |
| Unit 3: | 1) On the Rule of the Road – A.G. Gardiner 2) A Simple Philosophy – Seathl 3) The Thief – Ruskin Bond (6 Hours) |
| Unit 4: | 1) The World is Too Much With Us – William Wordsworth 2) Love’s Philosophy – P.B.Shelley 3) Success is Counted Sweetest – Emily Dickinson (6 Hours) |

Skill Enhancement Module:

- 1) Blog Writing 2) Presentation on a topic from prescribed prose/poem **(6 Hours)**

TEXT BOOKS:-

A Textbook for College Students [ISBN 989354421778] Edited by Board of Editors, Sant Gadge Baba Amravati University, Amravati Publisher : Orient BlackSwan Pvt Ltd

Title: STATISTICS FOR DATA SCIENCE**Type: Core****Credits: 03**

| | | | |
|------------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-80 | | Course Code: N2DA2 | (Total Number of Periods) Hrs |
| Theory Exam Marks :50 | Internal Marks:30 | | 45 |

COURSE OUTCOME:

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

1. Deploy concepts of Statistics method to compute averages for statistics data
2. Identify probability value of real-life situation problem by using Probability and distribution concepts
3. Analyze casual relation between two variables by using correlation and regression methods
3. Illustrate significance difference between Null and Alternative Hypothesis for statistical data

| Unit | Content |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit 1: STATISTICAL METHODS | Introduction to statistics and Data collection – Summarizing and presenting statistical Data – Measures of central tendency – Measures of variation – Measures of skewness and kurtosis (11 Hours) |
| Unit 2: PROBABILITY AND DISTRIBUTION | Introduction – Definition of Probability – Basic concepts – Addition law of probability or Theorem of total probability – conditional probability – Bayes’ theorem. Random variable – MGF – Distributions - Binomial - Poisson – Uniform – Normal (12 Hours) |
| Unit 3: CORRELATION AND REGRESSION | Introduction – correlation analysis – simple correlation analysis – Rank correlation –Regression analysis CO-1 BTL-3 MODULE 4: SAMPL (11 Hours) |
| Unit 4: SAMPLING AND LARGE SAMPLE TEST | Introduction – Parameters & Statistics – Statistical Inference – Testing of Hypothesis – Null & alternative Hypothesis – LOS- Test of significance of large and small samples – student’s t-distribution – Chi – square test – F-distribution. (11 Hours) |

TEXT BOOKS:-

1. Richard I. Levin, David S. Rubin, " Statistics for Management ", Seventh Edition, Prentice – Hall of India, 2017.
2. T. Veerarajan," Statistics", Third Edition, McGraw hill, 2008.
3. Dr. B.S.Grewal, "Higher engineering Mathematics", Sixth Edition, Khanna publishers, 2017

REFERENCE BOOKS:-

- 1 Allen B. Downey, “Think Stats: Exploratory Data Analysis 2nd Edition”, O’Reilly publications, 2015.
- 2 Peter Bruce , Andrew Bruce , Peter Gedeck, “Practical Statistics for Data Scientists”, O’Reilly publications, 2020.

Title: DATABASE MANAGEMENT SYSTEM**Type: Core****Credits: 03**

| Total Marks-80 | | Course Code: N2DA3 | (Total Number of Periods) Hrs |
|-----------------------|-------------------|--------------------|-------------------------------|
| Theory Exam Marks :50 | Internal Marks:30 | | 45 |

COURSE OUTCOME:

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

1. Create a normalized database for an organization.
2. Implement and test database queries for any real time data bases.
3. Formulate and design forms and reports for database applications.
4. Apply transactional management and concurrency control for a database transaction.
5. Recognize the features of client server architecture, distributed architecture, directory system and network types

| Unit | Content |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNIT I: Introduction to Databases and Data Models | <p>Introduction to Databases: Data, Database, and DBMS; Database Applications; Advantages and Disadvantages of DBMS; Roles of Database Users and Administrators.</p> <p>Data Models: Overview of Data Models; Types of Data Models (Hierarchical, Network, Relational, Object-Oriented); Importance of Data Models in DBMS.</p> <p>Database Design & Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key; Constraints (Primary Key, Foreign Key, Unique, NOT NULL, CHECK); Introduction to ER Models and Diagrams; Key Constraints and Weak Entity Sets; Extended ER Features.</p> <p>Relational Model: Overview of Relational Model and Relational Schema. (11 Hours)</p> |
| UNIT II: Relational Algebra, SQL, and Normalization | <p>Relational Algebra and Calculus: Relational Algebra Operations (Selection, Projection, Set Operations, Joins, Division); Tuple and Domain Relational Calculus.</p> <p>Structured Query Language (SQL): DDL and DML; Aggregate Functions (Min, Max, Sum, Avg, Count); Logical Operators (AND, OR, NOT); Predicates (Like, Between, Alias, Distinct); SQL Clauses (Group By, Having, Order By, Top/Limit); Joins (Inner, Natural, Outer, Equi Join).</p> <p>Advanced SQL: Analytical, Hierarchical, and Recursive Queries; Views, Cursors, Stored Procedures, Functions, Packages, Triggers, Dynamic SQL.</p> <p>Normalization and Database Design: Functional Dependencies; Armstrong's Axioms, Normal Forms (1NF, 2NF, 3NF, BCNF); Denormalization. (12 Hours)</p> |
| UNIT III: Transaction Management and Database Storage | <p>Transaction Management: ACID Properties; Transactions and Schedules; Lock-Based Concurrency Control; Deadlock Management; Transaction Support in SQL; 2PL, Serializability, and Recoverability.</p> <p>Database Storage and Indexing: File Organizations and Indexing; Index Structures and Performance Tuning; Guidelines for Index Selection. (11 Hours)</p> |
| UNIT IV: NoSQL, Big Data, and Database Security | <p>NoSQL Databases and Big Data: Introduction to NoSQL; Data Models (Document, Key-Value, Column Family, Graph); CAP Theorem, BASE vs ACID; CRUD Operations, MongoDB Operators; Big Data Technologies: Hadoop, MongoDB, Cassandra.</p> <p>Database Security and Advanced Topics: Access Control, Discretionary Access Control; Data Warehousing, OLAP, and Data Mining. (11 Hours)</p> |

TEXT BOOKS:-

1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", third edition, McGraw – Hill, 2018
2. Benjamin Rosenzweig, Elena Rakhimov, "Oracle PL/SQL by Example", fifth edition, Prentice Hall, 2015
3. Brad Dayley, "NoSQL with MongoDB in 24 Hours", 1st edition, Sams Publishing, 2024
4. Silberschatz, H.F. Korth and S. Sudharshan, "Database System Concepts" , Fifth Edition, Tata McGraw Hill, New Delhi, 2006.

REFERENCE BOOKS:-

- 1 J. D. Ullman, "Principles of Database Systems", Galgotia Publishers, Second Edition, New Delhi, 1988
- 2 C.J. Date, An Introduction to Database Systems, Third Edition, Narosa, New Delhi, 1985
- 3 G. V. Post, "Database Management Systems Designing and Building Business Application" ,McGraw Hill International edition, 1999
- 4 R.P. Mahapatra, Govind Verma, "Database Management Systems", Khanna Publishing House, 2025.

Title: PYTHON FOR DATA SCIENCE**Type: Core****Credits: 03**

| | | | |
|------------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-80 | | Course Code: N2DA4 | (Total Number of Periods) Hrs |
| Theory Exam Marks :50 | Internal Marks:30 | | 45 |

COURSE OUTCOME:

1. Identify the need for data science and solve basic problems using Python built-in data types and their methods.
2. Design an application with user-defined modules and packages using OOP Concept.
3. Employ efficient storage and data operations using NumPy arrays.
4. Apply powerful data manipulations using Pandas.
5. Perform data preprocessing and visualization using Pandas

| Unit | Content |
|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit 1:- Introduction To Data Science And Python Programming | Introduction to Data Science and Python: Overview of Data Science; Why Python for Data Science? Essential Python Libraries. Python Programming Basics: Python Features, Identifiers, Reserved Words, Indentation, Comments; Built-in Data Types (Strings, Lists, Tuples, Dictionaries, Sets) and their Methods; Type Conversion; Operators. Control Flow: Decision Making (if, else), Looping (for, while), Loop Control Statements. Functions: User-Defined Functions, Function Arguments and Types.(11 Hours) |
| Unit 2:- File, Exception Handling And OOP | File Handling and Exception Handling: User-Defined Modules and Packages; File Operations (Manipulation, Methods for Files and Directories); Python Exception Handling. Object-Oriented Programming (OOP): Classes and Objects; Constructors, Data Hiding, Abstraction, Inheritance. (10 Hours) |
| Unit 3:- Introduction To Numpy | NumPy Basics: Arrays and Vectorized Computation, The NumPy ndarray, Creating ndarrays, Data Types for ndarrays. Arithmetic with NumPy Arrays: Basic Indexing and Slicing , Boolean Indexing, Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions, Mathematical and Statistical Methods, Sorting, Unique and Other Set Logic(10 Hours) |
| Unit 4:-Data Manipulation, Cleaning, And Visualization With Pandas | Data Structures and Manipulation: Introduction to pandas (Series, DataFrame); Indexing, Selection, Filtering; Function Application, Mapping, Sorting, and Ranking; Summarizing Data (Descriptive Statistics, Unique Values, Value Counts). Data Cleaning and Transformation: Handling Missing Data, Removing Duplicates, Data Transformation (Using Functions, Mapping, Replacing Values), Detecting and Filtering Outliers. String Manipulation: Vectorized String Functions in pandas. Data Visualization: Plotting with pandas (Line, Bar, Histogram, Density, Scatter/Point Plots) (14 Hours) |

TEXT BOOKS:

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

REFERENCE BOOKS:

- 1) Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006.
- 2) Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.

Title: DATABASE MANAGEMENT SYSTEM – LAB**Type: SEC/LAB****Credits: 02**

| | | | | | |
|---------------------------|--|---------------------------|--|--------------------------------------|--|
| Total Marks-50 | | Course Code: N2DA5 | | (Total Number of Periods) Hrs | |
| External Marks :25 | | Internal Marks:25 | | 60 | |

NOTE:

The list suggests the program set. Hence, the concerned staff may modify the list as needed (minimum 15).

LIST OF PROGRAMS:

- 1) To study Basic SQL commands (create table, use, drop, insert) and execute the following queries using these commands:
 - Create a table 'Emp' with attributes 'ename', 'ecity', 'salary', 'enumber', 'eaddress', 'deptname'.
 - Create another table 'Company' with attributes 'cname', 'ccity', 'empnumber' in the database 'Employee'.
- 2) To study the viewing commands (select, update) and execute the following queries using these commands:
 - Find the names of all employees who live in Delhi.
 - Increase the salary of all employees by Rs. 5,000.
 - Find the company names where the number of employees is greater than 10,000.
 - Change the Company City to Gurgaon where the Company name is 'TCS'.
- 3) To study the commands to modify the structure of table (alter, delete) and execute the following queries using these commands:
 - Add an attribute named 'Designation' to the table 'Emp'.
 - Modify the table 'Emp', Change the datatype of 'salary' attribute to float.
 - Drop the attribute 'deptname' from the table 'emp'.
 - Delete the entries from the table 'Company' where the number of employees are less than 500.
- 4) To study the commands that involve compound conditions (and, or, in, not in, between, not between, like, not like) and execute the following queries using these commands:
 - Find the names of all employees who live in 'Gurgaon' and whose salary is between Rs.20,000 and Rs. 30,000.
 - Find the names of all employees whose names begin with either letter 'A' or 'B'.
 - Find the company names where the company city is 'Delhi' and the number of employees is not between 5000 and 10,000.
 - Find the names of all companies that do not end with letter 'A'.

- 5) To study the aggregate functions (sum, count, max, min, average) and execute the following queries using these commands:
 - Find the sum and average of salaries of all employees in computer science department.
 - Find the number of all employees who live in Delhi.
 - Find the maximum and the minimum salary in the HR department.
- 6) To study the grouping commands (group by, order by) and execute the following queries using these commands:
 - List all employee names in descending order.
 - Find number of employees in each department where number of employees is greater than 5.
 - List all the department names where average salary of a department is Rs.10,000.
- 7) To study the commands involving data constraints and execute the following queries using these commands:
 - Alter table 'Emp' and make 'enumber' as the primary key.
 - Alter table 'Company' and add the foreign key constraint.
 - Add a check constraint in the table 'Emp' such that salary has the value between 0 and Rs.1,00,000
 - Alter table 'Company' and add unique constraint to column cname
 - Add a default constraint to column ccity of table company with the value 'Delhi'
- 8) To study the commands for joins (cross join, inner join, outer join) and execute the following queries using these commands:
 - Retrieve the complete record of an employee and its company from both the table using joins.
 - List all the employees working in the company 'TCS'.
- 9) To study the various set operations and execute the following queries using these commands:
 - List the enumber of all employees who live in Delhi and whose company is in Gurgaon or if both conditions are true.
 - List the enumber of all employees who live in Delhi but whose company is not in Gurgaon.
- 10) To study the various scalar functions and string functions (power, square, substring, reverse, upper, lower, concatenation) and execute the following queries using these commands:
 - Reverse the names of all employees.
 - Change the names of company cities to uppercase.
 - Concatenate name and city of the employee.
- 11) To study the commands involving indexes and execute the following queries:
 - Create an index with attribute ename on the table employee.
 - Create a composite index with attributes cname and ccity on table company.
 - Drop all indexes created on table company.
- 12) To study the conditional controls and case statement in PL-SQL and execute the following queries:
 - Calculate the average salary from table 'Emp' and print increase the salary if the average salary is less than 10,000.
 - Display the deptno from the employee table using the case statement if the deptname is 'Technical' then deptno is 1, if the deptname is 'HR' then the deptno is 2 else deptno is 3.
- 13) To study procedures and triggers in PL-SQL and execute the following queries:
 - Create a procedure on table employee to display the details of employee to display the details of employees by providing them value of salaries during execution.
 - Create a trigger on table company for deletion where the whole table is displayed when delete operation is performed.
- 14) Consider the tables given below. The primary keys are made bold and the data types are specified.
PERSON(**driver_id**:string , name:string , address:string)

CAR(regno:string , model:string , year:int)

ACCIDENT(report_number:int , accd_date:date , location:string)

OWNS(driver_id:string , regno:string)

PARTICIPATED(driver_id:string , regno:string , report_number:int ,damage_amount:int)

- Create the above tables by properly specifying the primary keys and foreign keys.
- Enter at least five tuples for each relation.
- Demonstrate how you
- Update the damage amount for the car with specific regno in the accident with report number 12 to 25000.
- Find the total number of people who owned cars that were involved in accidents in the year 2008.
- Find the number of accidents in which cars belonging to a specific model were involved.

Title: PYTHON PROGRAMMING – LAB

Type: SEC/LAB

Credits: 02

| | | | |
|--------------------|-------------------|--------------------|-------------------------------|
| Total Marks-50 | | Course Code: N2DA6 | (Total Number of Periods) Hrs |
| External Marks :25 | Internal Marks:25 | | 60 |

NOTE:

The list suggests the program set. Hence, the concerned staff may modify the list as needed (minimum 15).

Introduction

- Implement basic Python programs for reading input from console.
- Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: Strings, List, Tuples, Dictionary, Set
- Solve problems using decision and looping statements.
- Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem.

File Handling

- Create packages and import modules from packages.
- Perform File manipulations- open, close, read, write, append and copy from one file to another.
- Handle Exceptions using Python Built-in Exceptions
- Solve problems using Class declaration and Object creation.

Numpy

- Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.
- Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
- Computation on NumPy arrays using Universal Functions and Mathematical methods.

Title: DESIGN THINKING AND INNOVATION**Type: SEC****Credits: 02**

| | | | |
|------------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-50 | | Course Code: N2DA7 | (Total Number of Periods) Hrs |
| Theory Exam Marks :30 | Internal Marks:20 | | 30 |

COURSE OUTCOME:

By the end of the course, students will be able to :

1. Propose real-time innovative product designs and Choose appropriate frameworks, strategies, techniques during prototype development.
2. Know wicked problems and how to frame them in a consensus manner that is agreeable to all stakeholders using appropriate frameworks, strategies, techniques during prototype development.
3. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products.

CONTENTS:**Unit 1: Basics of Design Thinking**

1. **Introduction to Innovation:** Understand the concept of innovation and its significance in business.
2. **Creative Thinking & Problem Solving:** Explore creative thinking processes and problem-solving approaches.
3. **Design Thinking Approach:** Learn the Design Thinking approach and its objectives.
4. **Design Thinking & Customer Centricity:**
 - o Real-world examples of customer challenges.
 - o Use of Design Thinking to enhance customer experience.
 - o Parameters of product experience.
 - o Aligning customer expectations with product offerings.
5. **Global Success Stories:** Discuss global success stories of companies like AirBnB, Apple, IDEO, and Netflix.
6. **Four Stages of Design Thinking Process:**
 - o Empathize
 - o Define
 - o Ideate
 - o Prototype
 - o Implement

Unit 2: Learning to Empathize and Define the Problem

1. **Empathy in Innovation:** Understand the importance of empathy in the innovation process and learn how students can develop empathy using design tools.
2. **Observing and Assimilating Information:** Techniques for observing and gathering information for problem-solving.
3. **Individual Differences & Uniqueness:** Group discussions and activities to encourage understanding, acceptance, and appreciation of individual differences.
4. **Wicked Problems:**
 - o What are wicked problems?
 - o Identifying wicked problems around us and understanding their potential impact through solutions.

Unit 3: Ideate, Prototype, and Implement

1. **Ideation Templates:** Learn various ideation templates, including brainstorming and systems thinking.
2. **Brainstorming:** Understanding the concept of brainstorming and how to reach consensus on wicked problems.

3. **Customer Experience Mapping for Ideation:** Learn methods for mapping customer experience during the ideation phase.
4. **Prototyping:**
 - Know the methods of prototyping.
 - Understand the purpose of rapid prototyping.
5. **Implementation:** Steps for implementing design solutions.

Unit 4: Feedback, Re-Design, & Re-Create

1. **Feedback Loop:** Understanding the feedback loop, focusing on user experience, addressing ergonomic challenges, and creating user-focused designs.
2. **Final Concept Testing:** Conduct final testing of the concept with end-users.
3. **Final Presentation:** Solve problems through innovative design concepts and creative solutions, culminating in a final presentation.

TEXT BOOKS:

- 1) **E. Balaguruswamy** (2023), *Developing Thinking Skills (The Way to Success)*, Khanna Book Publishing Company.
- 2) **Tim Brown** (2008), *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, Harvard Business Review.
- 3) **R.T. Krishnan & V. Dabholkar**, *8 Steps to Innovation*, Collins Publishing.

REFERENCE BOOKS:

1. **Nigel Cross**, *Design Thinking*, Bloomsbury.

Title: DATA SCIENCE ETHICS

Type: VAC

Credits: 02

| | | | |
|----------------------|-------------------|--------------------|-------------------------------|
| Total Marks-50 | | Course Code: N2DA8 | (Total Number of Periods) Hrs |
| College level theory | Internal Marks:50 | | 30 |

COURSE OUTCOME:

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

1. Identify ethical considerations and dilemmas in data science projects.
2. Evaluate the ethical implications of data collection, analysis, and decision-making processes.
3. Apply ethical frameworks and principles to address ethical challenges in data science.
4. Communicate effectively about ethical issues in data science to stakeholders.
5. Reflect on the societal impact of data science practices and technologies.

| Unit | Contents |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNIT-1 Introduction to Data Science Ethics | Overview of ethical considerations in data science, Introduction to ethical frameworks and principles, Case studies on ethical issues in data science (7 Hours) |
| UNIT-2 Data Collection and Privacy | Ethical considerations in data collection and storage, Legal and regulatory frameworks for data privacy and confidentiality, Privacy-preserving techniques and technologies (7 Hours) |
| UNIT-3 Bias and Fairness in Data Analysis | Understanding bias in data and algorithms, Fairness considerations in machine learning and decision-making, mitigating bias and ensuring fairness in data analysis (8 Hours) |

| | |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNIT-4 Transparency and Accountability | Importance of transparency and accountability in data science, Ethical considerations in model development and deployment, Strategies for promoting transparency and accountability in data-driven decision-making (8 Hours) |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

TEXT BOOKS:

1. "Ethics of Big Data" by Kord Davis and Doug Patterson
2. "Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy" by Cathy O'Neil

Title: MOOCS/SWYAM/NEPTEL/GOEC BASKET COURSES**Type: OE-II****Credits: 01**

| | | | |
|---------------------------|--------------------------|---------------------------|--------------------------------------|
| Total Marks-50 | | Course Code: N2DA9 | (Total Number of Periods) Hrs |
| College Assessment | Internal Marks:50 | | 30 Hrs of Engagement |

Note:

As part of the academic curriculum, students are required to complete **Open Elective (OE)** courses in addition to the core subjects.

Note that the OE must be selected from Faculty wise basket other than faculty of core subject, allowing you the opportunity to explore interdisciplinary topics and broaden your knowledge.

- **MOOCs/NEPTEL:** You can choose relevant courses from platforms like Coursera, edX, or NPTEL that are pre-approved by the university. Ensure that the course content aligns with the credit requirements and is recognized by the academic guidelines.
- **GOEC Basket:** Alternatively, you may choose an OE from the university's available electives, as listed in the GOEC basket.

The completed OE must be submitted for credit within the prescribed time frame as outlined by the university.

For any further details or guidance on selecting appropriate courses, consult the academic coordinator.