DEPARTMENT OF ADVANCED COMPUTING

SUMMARY OF CREDITS OF OPEN ELECTIVES
FOR NEP

Theory	OE 1	Basics of Data Science	45	03	03	60-2Hrs
Theory	OE 2	Python Programming	45	03	03	60-2Hrs
Theory	OE 3	Machine Learning using R programming	45	03	03	60-2Hrs
Theory	OE 4	Digital design using HDL	45	03	03	60-2Hrs
Theory	OE 5	Business and Data Understanding	45	03	03	60-2Hrs
Theory	OE 6	Database Management System	45	03	03	60-2Hrs
Theory	OE 7	Visualization techniques using Tableau	45	03	03	60-2Hrs
Theory	OE 8	Research Methodology	45	03	03	60-2Hrs

Course Outcomes and Course Contents

Semester	I
Paper Code	OE 1
Paper Title	BASICS OF DATA SCIENCE

Number of teaching hrs per week	3 Hrs
Total number of teaching hrs per semester	45
Number of credits	3

COURSE OBJECTIVES:

To make the students learn the process of working with data in large scale. Make the student understand the existence of data with its wilderness and make use of it.

COURSE OUTCOMES:

CO1: Understand the fundamental concepts of data.

CO2: Understand the fundamental concepts of data science process.

CO3: Understand the fundamental concepts of Machine Learning

CO4: Fundamental concepts of large data & Data Visualization

CO5: To implement the aspects of Data Science through case studies.

UNIT 1: PREPARING AND GATHERING DATA AND KNOWLEDGE   9 Hrs.

Philosophies of data science - Data science in a big data world - Benefits and uses of data science and big data - facts of data: Structured data , Unstructured data, Natural Language, Machine generated data, Audio, Image and video streaming data - The Big data Eco system: Distributed file system, Distributed Programming framework, Data Integration frame work, Machine learning Framework, NoSQL Databases, Scheduling tools, Benchmarking Tools, System Deployment, Service programming and Security.

UNIT 2: THE DATA SCIENCE PROCESS   9 Hrs.

Overview of the data science process- Retrieving data –Data Preparation: Cleansing, integrating, and transforming data - Exploratory data analysis – Data Modeling: Model and variable selection, Model execution, Model diagnostic and model comparison - Presentation and automation: Presenting data, Automating data analysis

UNIT 3: MACHINE LEARNING   9 Hrs.

Application for machine learning in data science- Tools used in machine learning- Modeling Process – Training model – Validating model – Predicting new observations –Types of machine learning Algorithm : Supervised learning algorithms, Unsupervised learning algorithms.

UNIT 4: VISUALIZATION   **9 Hrs.**

Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools.

UNIT 5: CASE STUDIES   **9 Hrs.**

Distributing data storage and processing with frameworks - Case study: e.g, Assessing risk when lending money.

TEXT BOOKS:

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman and Mohamed Ali, Manning Publications, 2016.
2. Think Like a Data Scientist, Brian Godsey, Manning Publications, 2017.

SUGGESTED BOOKS:

1. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.
2. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014
3. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013

Code number: **OE 1**

Title of the paper: **BASICS OF DATA SCIENCE**

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions
Unit I	09	20
Unit II	09	20
Unit III	09	20
Unit IV	09	10
Unit V	09	10

TOTAL	45	80
Maximum marks for the paper (Excluding bonus question) = 60		

Semester	II
Paper Code	OE 2
Paper Title	PYTHON PROGRAMMING
Number of teaching hrs per week	3 Hrs
Total number of teaching hrs per semester	45
Number of credits	3

COURSE OBJECTIVES:

The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.

COURSE OUTCOMES:

CO1: To understand the basic concepts in Python programming.

CO2: Learn how to write, debug and execute Python program.

CO3. Understand and demonstrate the use of Branching and Looping Structures.

CO4: To get insight knowledge related to advanced data types such as lists, tuples,

dictionaries.

CO5: Acquire the basic knowledge of Object-Oriented Programming Concept and Exception

Handling.

UNIT 1: INTRODUCTION   9 Hrs.

Introduction to Python Programming, History of Python, its features, Scope of Python, Downloading and installing Python, Python code execution process, run a simple program on Python interpreter and IDLE.

UNIT 2: DATA TYPES AND OPERATORS   9 Hrs.

The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Illustrative programs.

UNIT 3: BRANCHING AND LOOPING   10 Hrs.

Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. Illustrative programs

UNIT 4: LISTS, TUPLES AND DICTONARIES   10 Hrs.

Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values, Illustrative programs

UNIT 5: OOPS AND EXCEPTION HANDLING   7 Hrs.

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, exception handling, Illustrative programs

TEXTBOOKS:

1. Python in easy steps - Mike McGrath, In Easy Steps Limited, Second Edition

2. "Hello World" - Computer Programming for Kids and other Beginners - Warren and Carter, Manning Publications, 2014

SUGGESSTED BOOKS:
1. Python3 Tutorial – Tutorialspoint
2. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010

Code number: **OE 2**

Title of the paper: **PYTHON PROGRAMMING**

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions
Unit I	09	20
Unit II	09	20
Unit III	10	20
Unit IV	10	10
Unit V	07	10
TOTAL	**45**	80
Maximum marks for the paper (Excluding bonus question) = 60		

Semester	II
Paper Code	OE 3
Paper Title	MACHINE LEARNING USING R PROGRAMMING
Number of teaching hrs per week	3 Hrs
Total number of teaching hrs per semester	45
Number of credits	3

COURSE OBJECTIVES:

To make the students learn the statistics & mathematical concepts, Hypothesis & Dimension Reduction Technique, R Programming Concepts and Machine Learning.

COURSE OUTCOMES:

CO1: Understand the fundamental concepts of Statistics & Mathematics

CO2: Understand Hypothesis & Dimension Reduction Techniques

CO3: Hands on Experience in R Programming

CO4: Understand Machine Learning Concepts using R

CO5: To have basic knowledge of various predictive models.

UNIT 1: STATISTICS & MATHEMATICAL ESSENTIALS　　　　　　**9 Hrs.**

Measure of Central Tendency - Mean, Median, Mode - Dispersion Technique - Range Inter Quartile Range - Variance, Standard Deviation - Mean Square Error & Root Mean Square - Probability Distribution.

UNIT 2: HYPOTHESIS AND DIMENSION REDUCTION TECHNIQUE　　　**9 Hrs.**

Types of Hypothesis - Sample testing - T-test - Z-test - Chi-square test - Anova test -. One Way Anova. Two Way Anova - Principle component analysis - Collinearity and multicollinearity

UNIT 3: R PROGRAMMING CONCEPTS　　　　　　　　　　**9 Hrs.**

The Data types in R & its uses -Build in functions in R- Data Manipulation -   Data import Techniques – Exploratory Data Analysis – Data Visualization.

UNIT 4: MACHINE LEARNING　　　　　　　　　　　　**9 Hrs.**

 ML Fundamental & common use cases - Approach to Machine Learning - Understanding Supervised learning technique - Unsupervised learning technique

UNIT 5: PREDICTIVE MODELLING IN R　　　　　　　　　**9 Hrs.**

Introduction to predictive modeling - Regression Problem - Classification Problem - Linear Regression - Logistic Regression – Clustering - Distance measure types- K means clustering – Decision Tree Classifier – Random Forest Classifier – Support Vector Machine.

TEXTBOOK:

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman and Mohamed Ali, Manning Publications, 2016.
2. Think Like a Data Scientist, Brian Godsey, Manning Publications, 2017.

SUGGESTED BOOK:

1. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.
2. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014
3. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013

Code number: **OE 3**
Title of the paper: **MACHINE LEARNING USING R PROGRAMMING**

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions
Unit I	09	20
Unit II	09	20
Unit III	09	20
Unit IV	09	10
Unit V	09	10
TOTAL	**45**	80
Maximum marks for the paper (Excluding bonus question) = 60		

Semester	II
Paper Code	OE 4
Paper Title	DIGITAL DESIGN USING HDL

Number of teaching hrs per week	3 Hrs
Total number of teaching hrs per semester	45
Number of credits	3

COURSE OBJECTIVES:

1. Learn different Verilog HDL constructs.
2. Familiarize the different levels of abstraction in Verilog.
3. Understand Verilog Tasks and Directives.
4. Understand timing and delay Simulation.

COURSE OUTCOMES:

CO1: Design and analyze combinational & sequential circuits
CO2: Understand different design methodologies
CO3: Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
CO4: Write the programs more effectively using Verilog tasks and directives
CO5: To learn and implement the Behavioral Modeling Concepts

UNIT I: DESIGN OF COMBINATIONAL LOGIC & SEQUENTIAL LOGIC   9 Hrs.

Decoders, Encoders, Digital multiplexers, Adders and subtractors, Look ahead carry, Binary comparators. Latches, Flipflops, Counters, Design of sequential counters, state machine & State diagrams.

UNIT II: OVERVIEW OF DIGITAL DESIGN WITH VERILOG HDL   9 Hrs.

Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. Hierarchical Modeling Concepts : Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block.

UNIT III: VERILOG BASIC CONCEPTS & MODULES & PORTS   9 Hrs.

Lexical conventions, data types, system tasks, compiler directives. Module definition, port declaration, connecting ports, hierarchical name referencing.

UNIT IV: GATE LEVEL & DATA FLOW MODELLING   9 Hrs.

Gate-Level Modeling

Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays.

Dataflow Modeling

Continuous assignments, delay specification, expressions, operators, operands, operator types.

UNIT V: BEHAVIORAL MODELING   9 Hrs.

Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, structural modeling.

TEXTBOOK:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition.
2. John M Yarbrough,-Digital Logic Applications and Design, Thomson Learning,2001

SUGGESTED BOOK:

1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.

Code number: **OE 4**

Title of the paper: **DIGITAL DESIGN USING HDL**

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions
Unit I	09	20
Unit II	09	20
Unit III	09	20
Unit IV	09	10

Unit V	09	10
TOTAL	**45**	**80**
Maximum marks for the paper (Excluding bonus question) = 60		

Semester	III
Paper Code	OE 5
Paper Title	BUSINESS AND DATA UNDERSTANDING
Number of teaching hrs per week	3 Hrs
Total number of teaching hrs per semester	45
Number of credits	3

COURSE OBJECTIVES :

The course aims to equip the students with basic understanding of data and business decision making

COURSE OUTCOMES:

CO1: To familiarize the students with business environment   and its problems

CO2: To get an insight into the data generation in business and its analysis

CO3: To familiarize students with different methods for data analysis

CO4: To get an insight into the concepts of probability and distribution

CO5: To get an insight into the decision making framework

UNIT I: BUSINESS ENVIRONMENT   **8 Hrs.**

An Overview of the business environment , how it operates -characteristics of business environment – types of environment – environment analysis- -socio culture environment -political and government environment

UNIT II: DATA UNDERSTANDING   8 Hrs.

Data generation process in business environment - collecting and utilizing data for business solutions - variables selection and sampling process -role of softwares

UNIT III: EXPLORING DATA   12 Hrs.

Describing the distribution of a single variable - descriptive measures for Categorical variable - descriptive measures for Numerical variable - Charts for Numerical Variables - Time series data - Outliers and missing values - Finding relationships among variables - Understanding Time series Data - components of time series data - measures of accuracy - testing for randomness- modeling time series data

UNIT IV: CRISP DECISION MAKING FRAMEWORK   8 Hrs.

Probability and Distributions-Probability essentials - Distribution of single Random variable- summary measures of a Probability Distribution - Binomial -Poisson and Normal distributions and their applications

UNIT V: CRISP DECISION MAKING FRAMEWORK: 4 Hrs.

Heart of Data Analysis: Modelling, model development and deployment

SELF STUDY   5 Hrs.

SUGGESTED BOOKS:

1. Starling, Grower (1996) The changing Environment of Business Cincimmati, OH, South Western College Publishing

2. S. Christian Albright, Wayne L. Winston, Business Analytics: Data Analysis and Decision Making, Cengage Learning

3. S. Christian Albright & Wayne L. Winston, Business Analytics: Data Analysis and Decision making , Cengage Learning

4. Christian Heuman , Michael Schomaker and Shalabh : Introduction to Statistics and Data Analysis : With Exercises, Solutions and Applications in R,

5. Drew Bentley (2017) , Business Intelligence and Analytics , Library Press

Code number: **OE 5**

Title of the paper: **Business and data understanding**

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions
Unit I	8	10
Unit II	8	20
Unit III	12	20
Unit IV	8	20
Unit IV	4	10
SELF STUDY	5	
TOTAL	**45**	**80**
Maximum marks for the paper (Excluding bonus question) = 60		

Semester	III
Paper Code	OE 6
Paper Title	DATABASE MANAGEMENT SYSTEM
Number of teaching hrs per week	3 Hrs
Total number of teaching hrs per semester	45
Number of credits	3

COURSE DESCRIPTION:

To provide strong foundation for databases, tables, database management system and application area related to it and understand the underlying core concepts.

COURSE OBJECTIVES:

This course concentrates on introduction, principles, design and implementation of DBMS. It introduces about the distributed system and brief about data mining and data warehouse. To provide strong foundation of database concepts and develop skills for the design and implementation of a database application with a brief exposure to advanced database concepts.

COURSE OUTCOMES:

CO1: Understanding the fundamental concepts of Database Management systems
CO2: Understanding the concepts of Database models.
CO3: Understanding the core terms, concepts, and tools of relational database management systems.
CO4: Understanding database design and logic development for database programming.

UNIT 1: Database Management System Introduction   10 Hrs.

Data- Database- Database management system- Characteristics of the database approach- Role of Database administrators- Role of Database Designers- End Users- Advantages of Using a DBMS-Data models, Schema and Instances –Database design - Database Engine – 1 tier architecture – 2 tier architecture- 3 tier architecture – History of Database Management systems- Types of Databases.

UNIT 2: Database Models and Implementation   10 Hrs.

Data Model and Types of Data Model- Relational Data Model- Hierarchical Model- Network Data Model- Object/Relational Model- Object-Oriented Model- Entity-Relationship Model-Modeling using E-R Diagrams- Notation used in E-R Model- Relationships and Relationship Types- Cardinalities.

UNIT 3: Relational Databases   10 Hrs.

Structure of relational databases- Properties of relational databases and Tables –Structure of relational databases – Database Schema – Armstrong Axioms – Functional Dependency-Anomalies in a Database- Properties of Normalized Relations- First Normalization- Second Normal Form Relation- Third Normal Form.

UNIT 4: SQL and Additional Concepts   10 Hrs.

Categories of SQL Commands; Data Definition; Data Manipulation Statements, SELECT - The Basic Form, Subqueries, Functions, GROUP BY Feature, Updating the Database, Data Definition Facilities.

SELF STUDY   5 Hrs.

Text Books And Reference Books:

1. Elmasri Ramez and Navathe Shamkant B, Fundamentals of Database Systems, Addison-Wesley, 6th Edition, 2010.

Essential Reading / Recommended Reading

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 5 Edition, McGraw Hill, 2006.
2. O`neil Patricand, O`neil Elizabeth, Database Principles, Programming and Performance, 2nd Edition, Margon Kaufmann Publishers Inc, 2008.

BLUE PRINT

Code number: **OE 6**

Title of the paper**: DATABASE MANAGEMENT SYSTEM**

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions
Unit I	10	20
Unit II	10	20
Unit III	10	20
Unit IV	10	20
SELF STUDY	5	
TOTAL	**45**	**80**
Maximum marks for the paper (Excluding bonus question) = 60		

Semester	IV
Paper Code	OE 7
Paper Title	VISUALIZATION TECHNIQUES USING TABLEAU

Number of teaching hrs per week	3 Hrs
Total number of teaching hrs per semester	45
Number of credits	3

1. Getting started with Tableau
2. Handling data with Tableau
3. Built in visuals(different types of charts, Maps, visualizing Geographical data)

Semester	VII
Paper Code	OE 8
Paper Title	RESEARCH METHODOLOGY
Number of teaching hrs per week	3 Hrs
Total number of teaching hrs per semester	45
Number of credits	3

COURSE OBJECTIVES:

This course will enable students to:

1. understand some basic concepts of research and its methodologies
2. identify appropriate research topics
3. select and define appropriate research problem and parameters
4. prepare a project proposal (to undertake a project)
5. organize and conduct research (advanced project) in a more appropriate manner

6. write a research report and thesis

COURSE OUTCOMES:

CO1: **CO2:** Define the importance of natural language.
CO3: Understand the concepts Text mining.
CO4: Illustrate information retrieval techniques.

UNIT I: INTRODUCTION   9 Hrs.

Meaning of research, Function of Research Meaning of Research - Function of Research – Characteristics of Research – Steps involved in Research – Research in Pure and Applied Sciences - Inter Disciplinary Research. Factors which hinder Research – Significance of Research - Research and scientific methods – Research Process– Criteria of good Research – Problems encountered by Researchers – Literature review.

UNIT II: IDENTIFICATION OF RESEARCH PROBLEM   9 Hrs.

Selecting the Research problem – Necessity of defining the problem – Goals and Criteria for identifying problems for research. Perception of Research problem – Techniques involved in defining the problem – Source of problems – Personal consideration.

UNITIII: RESEARCH DESIGN   9 Hrs.

Formulation of Research design – Need for Research design – Features of a good design – Important concepts related to Research design. Different research designs – Basic principles of experimental designs – Computer and internet in designs.

UNITIV: INTERPRETATION AND REPORT WRITING   9 Hrs.

Meaning and Technique of interpretation – Precautions in interpretation – Significance of report writing – Different steps in writing a report – Layout of a Research report. Types of report – Mechanics of writing a research report – Precautions for writing a research report – Conclusion.

UNIT V: STATISTICAL TECHNIQUES AND TOOLS   9 Hrs.

Introduction of statistics – Functions – Limitations – Measures of central tendency - Arithmetic mean – Median – Mode – Standard deviation – Co-efficient of variation (Discrete serious and continuous serious) – Correlation - Regression – Multiple Regression. Sampling distribution – Standard error – Concept of point and interval estimation – Level of significance – Degree of freedom – Analysis of variance – One way and two way classified data – 'F'-test.

REFERENCE BOOKS:

1. A Hand Book of Methodology of Research, Rajammall, P. Devadoss and K. Kulandaivel, RMM Vidyalaya press, 1976.

2. Research Methodology Methods & Techniques, C.R. Kothari – New Age international Publishers, Reprint 2008.

3. Thesis and Assignment Writing, J. Anderson, Wiley Eastern Ltd., 1997.

4. Research Methodology, Mukul Gupta, Deepa Gupta – PHI Learning Private Ltd., New Delhi, 2011.

5. Fundamentals of Mathematical statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons, New Delhi,1999.

6. Statistical Methods , G.W. Snedecor and W.G. Cochrans, Lowa state University Press,1967. PAPER II : ADVANCED PHYSI

BLUE PRINT

Code number: BCADA 7321
Title of the paper: Research methodology

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions
Unit I	9	10
Unit II	9	20
Unit III	9	20
Unit IV	9	20
Unit V	9	10
TOTAL	**45**	**80**
Maximum marks for the paper (Excluding bonus question)= 60		