

ALAGAPPA UNIVERSITY – AFFILIATED COLLEGES

B. Sc., ARTIFICIAL INTELLIGENCE

SYLLABI

[For the candidates admitted from the Academic Year 2023 – 2024 onwards]



ALAGAPPA UNIVERSITY

(A State University Accredited with “A+” grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC)
Karaikudi -630 003, Tamil Nadu.

ALAGAPPA UNIVERSITY, KARAIKUDI

NEW SYLLABUS UNDER CBCS PATTERN (w.e.f. 2023-24) FOR AFFILIATED COLLEGES

B. Sc (Artificial Intelligence)

| Sem | Part | Course Code | Courses | Title of the paper | T/P | Credits | Hours/Week | Marks | | |
|-----|------|--------------------|---------------------------|---|-----|-----------|------------|------------|------------|------------|
| | | | | | | | | I | E | Total |
| 1 | I | 2311T | T / OL | தமிழ் இலக்கிய வரலாறு-I /Other Languages -I | T | 3 | 6 | 25 | 75 | 100 |
| | II | 2312E | E | General English - I | T | 3 | 6 | 25 | 75 | 100 |
| | III | 23BAI1C1 | CC – I | Programming for Problem Solving | T | 4 | 5 | 25 | 75 | 100 |
| | | 23BAI1P1 | CC – II | Problem Solving using C Lab | P | 4 | 4 | 25 | 75 | 100 |
| | | - | Generic Elective (Allied) | Maths/Electronics/Computer Science/IT/BCA | T | 3 | 3 | 25 | 75 | 100 |
| | | | | Respective Allied Theory Practical | P | 2 | 2 | 25 | 75 | 100 |
| | IV | 23BAI1S1 | SEC – 1 | Fundamentals of Information Technology | T | 2 | 2 | 25 | 75 | 100 |
| | | 23BAI1FC | FC – 1 | Office Automation | T | 2 | 2 | 25 | 75 | 100 |
| | | | | Total | | 23 | 30 | 200 | 600 | 800 |
| 2 | I | 2321T | T / OL | தமிழ் இலக்கிய வரலாறு-2 /Other Languages-II | T | 3 | 6 | 25 | 75 | 100 |
| | II | 2322E | E | General English - II | T | 3 | 6 | 25 | 75 | 100 |
| | III | 23BAI2C1 | CC – III | Python Programming | T | 4 | 5 | 25 | 75 | 100 |
| | | 23BAI2P1 | CC – IV | Python Programming Lab | P | 4 | 4 | 25 | 75 | 100 |
| | | -- | Generic Elective (Allied) | Maths/Electronics/Computer Science/IT/BCA | T | 3 | 3 | 25 | 75 | 100 |
| | | -- | | Respective Allied Theory Practical | P | 2 | 2 | 25 | 75 | 100 |
| | IV | 23BAI2S1 | SEC – 2 | Introduction to HTML | T | 2 | 2 | 25 | 75 | 100 |
| | | 23BAI2S2 | SEC – 3 | Multimedia Systems | T | 2 | 2 | 25 | 75 | 100 |
| | -- | | Naan Mudhalvan Course | | | | | | | |
| | | | | Total | | 23 | 30 | 200 | 600 | 800 |
| 3 | I | 2331T | T / OL | தமிழக வரலாறும் பண்பாடும் /Other Languages-III | T | 3 | 6 | 25 | 75 | 100 |
| | II | 2332E | E | General English - III | T | 3 | 6 | 25 | 75 | 100 |
| | III | 23BAI3C1 | CC – V | Object Oriented Programming (Theory & Practical) | T/P | 4 | 5 | 25 | 75 | 100 |
| | | 23BAI3C2 | CC – VI | Data Structures and Algorithms (Theory & Practical) | T/P | 4 | 4 | 25 | 75 | 100 |
| | | -- | Generic Elective (Allied) | Maths/Electronics/Computer Science/IT/BCA | T | 3 | 3 | 25 | 75 | 100 |
| | | -- | | Respective Allied Theory Practical | P | 2 | 2 | 25 | 75 | 100 |
| | IV | 23BAI3S1 | SEC – 4 | Web Designing | T | 2 | 2 | 25 | 75 | 100 |
| | | 233AT/ 23BAI3S2 | SEC – 5 | Adipadai Tamil/PHP Programming | T | 2 | 2 | 25 | 75 | 100 |
| | | -- | | Naan Mudhalvan Course | | | | | | |
| | | | | Total | | 23 | 30 | 200 | 600 | 800 |

| | | | | | | | | | | |
|---|-----|-----------------------|---------------------------|--|-----|------------|------------|-------------|-------------|-------------|
| 4 | I | 2341T | T / OL | தமிழும் அறிவியலும் /Other Languages -IV | T | 3 | 6 | 25 | 75 | 100 |
| | II | 2342E | E | General English - IV | T | 3 | 6 | 25 | 75 | 100 |
| | III | 23BAI4C1 | CC – VII | R Programming | T | 4 | 4 | 25 | 75 | 100 |
| | | 23BAI4P1 | CC – VIII | R Programming– Lab | P | 3 | 3 | 25 | 75 | 100 |
| | | -- | Generic Elective (Allied) | Maths/Electronics/Computer Science/IT/BCA | T | 3 | 3 | 25 | 75 | 100 |
| | | -- | | Respective Allied Theory Practical | P | 2 | 2 | 25 | 75 | 100 |
| | IV | 23BAI4S1 | SEC – 6 | Quantitative Aptitude | T | 2 | 2 | 25 | 75 | 100 |
| | | 234AT/ 23BAI4S2 | SEC – 7 | Adipadai Tamil/Introduction to Data Communication and Networking | T | 2 | 2 | 25 | 75 | 100 |
| | | 23BES4 | EVS | Environmental Studies | T | 2 | 2 | 25 | 75 | 100 |
| | | -- | | Naan Mudhalvan Course | | | | | | |
| | | | | Total | | 24 | 30 | 225 | 675 | 900 |
| 5 | III | 23BAI5C1 | CC – IX | Intelligent Systems | T | 4 | 5 | 25 | 75 | 100 |
| | | 23BAI5C2 | CC – X | Introduction to Machine Learning | T | 4 | 5 | 25 | 75 | 100 |
| | | 23BAI5P1 | CC – XI | Machine Learning Lab | P | 4 | 4 | 25 | 75 | 100 |
| | | 23BAI5C3 | CC – XII | Natural Language Processing (Theory & Practical) | T/P | 4 | 6 | 25 | 75 | 100 |
| | | 23BAI5E1/ 23BAI5E2 | DSE – I | Social Network Analysis/ IOT and its Applications | T | 3 | 4 | 25 | 75 | 100 |
| | | 23BAI5E3/ 23BAI5E4 | DSE – II | Software Project Management/ Virtualization and Cloud | T | 3 | 4 | 25 | 75 | 100 |
| | IV | 23BVE5 | | Value Education | T | 2 | 2 | 25 | 75 | 100 |
| | | 23BAI5I | | Internship/Industrial Visit/ Field Visit | T | 2 | -- | 25 | 75 | 100 |
| | | -- | | Naan Mudhalvan Course | | | | | | |
| | | | | Total | | 26 | 30 | 200 | 600 | 800 |
| 6 | III | 23BAI6C1 | CC – XIII | Deep learning (Theory & Practical) | T/P | 4 | 6 | 25 | 75 | 100 |
| | | 23BAI6C2 | CC – XIV | Computer Vision | T | 4 | 4 | 25 | 75 | 100 |
| | | 23BAI6PR | CC – XV | Project with Viva Voce | | 6 | 8 | 25 | 75 | 100 |
| | | 23BAI6E1/ 23BAI6E2 | DSE – III | Robotics and its applications / Virtual Reality Technology | T | 3 | 5 | 25 | 75 | 100 |
| | | 23BAI6E3/ 23BAI6E4 | DSE – IV | Big Data Analytics / Introduction to Data Science | T | 3 | 5 | 25 | 75 | 100 |
| | IV | 23BAI6S1 | | Essential Reasoning and Quantitative Aptitude | T | 2 | 2 | 25 | 75 | 100 |
| | | -- | | Extension Activity | | 1 | -- | -- | -- | -- |
| | | -- | | Naan Mudhalvan Course | | | | | | |
| | | | | Total | | 23 | 30 | 175 | 525 | 600 |
| | | | | Grand Total | | 142 | --- | 1200 | 3600 | 4700 |

- T/OL – Tamil/Other Languages
- E – English
- CC – Core course – Core competency, critical thinking, analytical reasoning, research skill & teamwork
- Elective Course – Generic/Discipline Specific
- SEC – Skill Enhancement Course - Exposure beyond the discipline
(Value Education, Entrepreneurship Course, Computer application for Science, etc.,)
- NME – Non-Major Elective – Exposure beyond the discipline
- DSE – Discipline specific elective
- Extension activity & MOOCs – Voluntary basis

Practical Subjects:

The following list of parameters are considered for the evaluation of practical examination.

Total Marks: 100 (Internal: 25 marks, External: 75 Marks)

For Internal Marks:

| | | |
|------------------|----------|-----------|
| i. Internal test | : | 20 |
| ii. Record Work | : | 5 |
| | | ---- |
| Total | : | 25 |
| | | ---- |

For External Marks:

| | | |
|---|----------|-----------|
| i. Aim, Procedure / Algorithm and Program | : | 15 |
| ii. Coding and Compilation | : | 20 |
| iii. Debugging | : | 20 |
| iv. Results | : | 20 |
| | | ---- |
| Total | : | 75 |
| | | ---- |

FIRST YEAR – SEMESTER – I

CORE COURSE – I

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|----------------|----------|----------|----------|----------|----------|-------------|-----------|---------------------|------------|
| | | | | | | | | | CIA | External | Total |
| 23BAIIC1 | PROGRAMMING FOR PROBLEM SOLVING | Core -I | 5 | 0 | 0 | 1 | 4 | 5 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Recognize the need for programming languages and problem solving techniques | | | | | | | | | | |
| LO2 | Apply memory management concepts and function based modularization | | | | | | | | | | |
| LO3 | Recognize the bugs in the C program | | | | | | | | | | |
| LO4 | Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions. | | | | | | | | | | |
| LO5 | Develop programming skills to solve real time computational problems | | | | | | | | | | |
| | Contents | | | | | | | | | No. of Hours | |
| Unit I | Introduction to Programming: Introduction to computers, Computer characteristics, Hardware vs software, Steps to develop a program, Software development life cycle, Structured programming, Types of programming languages, Introduction to c, Developing a c program, Console input and output functions, Error diagnostics, Debugging techniques. | | | | | | | | | 15 | |
| Unit II | Operators and Expressions: Identifiers and keywords, Data types, Constants, Variables, Declarations, Expressions, Statements, Arithmetic operators, Unary operators, Relational and logical operators, Assignment operators, Conditional operator Branching, if- else statement, switch statement, goto statement, Looping, while statement, do- while statement, for statement, Nested control structures, break statement, continue statement. | | | | | | | | | 15 | |
| Unit III | Arrays and Strings: Defining an array, Processing an array, Multidimensional arrays, Searching algorithm, Linear search, Sorting algorithm, Bubble sort algorithm, Strings, Defining a string, Initialization of strings, Reading and writing a string, Processing the strings. | | | | | | | | | 15 | |
| Unit IV | Functions: Functions, Overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function, Passing arrays to functions, Recursion. | | | | | | | | | 15 | |
| Unit V | Pointers and Structures: Fundamentals, Pointer declarations, Passing pointers to functions, Pointers and one dimensional arrays, Dynamic memory allocation, Operations on pointers, Defining a structure, Processing a structure, Array of structures, Structures and pointers, Self-referential structures. | | | | | | | | | 15 | |
| TOTAL | | | | | | | | | 75 | | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | The student can understand the fundamentals of computer and program development process | | | | | | | | | | |
| CO2 | The student can prepare innovative solution for the problem using branching and looping statements | | | | | | | | | | |

| | |
|------------------------|--|
| CO3 | The student can decompose a problem into functions and synthesize a complete program using divide and conquer approach |
| CO4 | The student will be able to formulate algorithms and programs using arrays, pointers and structures |
| CO5 | The student will be able to create a new application software to solve real world problems |
| Textbooks | |
| 1. | Byron Gottfried, "Schaum's Outline of Programming with C", 3 rd edition, 2016, McGraw Hill Education (India), ISBN: 9780070145900 |
| 2. | Balagurusamy, E "Programming in ANSI C", 7 th edition, McGraw Higher Ed, 2016, ISBN: 9789339219666 |
| Reference Books | |
| 1. | Yashavant Kanetkar, "Let Us C", 15th edition, 2016, Bpb Publications, ISBN:9788183331630 |
| 2. | Herbert Schildit, "The Complete Reference C", 4th edition, 2017, McGraw Hill Education(India), 2017, ISBN:978007041183 |
| 3. | Beulah Christalin Latha, Anuja Beatrice, Carolin Jeeva & Anita Sofia, Fundamentals of Computing and Programming, 1st edition, Pearson, 2018 |
| 4. | Sumitabha Das, "Computer Fundamentals and C Programming", 18th edition, 2018, McGraw Hill Education (India), ISBN:9789387886070 |
| 5. | Stephen G. Kochan, "Programming in C", 4th edition, 2015, ISBN: 9789332554665, |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 2 | 3 |
| Weightage of course contributed to each PSO | 15 | 15 | 10 | 10 | 10 | 15 |

S-Strong-3 M-Medium-2 L-Low-1

CORE COURSE – II

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|--|---|------------------|---|---|---|---|---------|-------------|--------------|-----------|-------|
| | | | | | | | | | CIA | External | Total |
| 23BA11P1 | PROBLEM SOLVING USING C – PRACTICAL | Core Practical-I | 0 | 0 | 4 | 1 | 4 | 4 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Understand the need for programming to solve computational problems | | | | | | | | | | |
| LO2 | Discover the basic programming constructs to prepare the program | | | | | | | | | | |
| LO3 | Analyze and interpret data using array, functions and pointers | | | | | | | | | | |
| LO4 | Recognize the bugs in the C program | | | | | | | | | | |
| LO5 | Apply problem-solving skills to real-world scenarios | | | | | | | | | | |
| List of Exercises | | | | | | | | | | | |
| <ol style="list-style-type: none"> 1. Implementation of Basic C programs 2. Simple computational problems using arithmetic expressions and operators. 3. Problem solving using branching and logical expressions. 4. Iterative problems using Loops, while and for loops 5. Implementation of linear searching, bubble sort, and Matrix Manipulation using Arrays 6. Implementation of Text Processing using Strings 7. Find Square Root, numerical differentiation, numerical integration using functions and recursion. 8. Implementation of basic file operations | | | | | | | | | | | |
| Software Essentials: Code Block | | | | | | | | | | | |
| | | | | | | | | | TOTAL | 60 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Translate given algorithms to a working and correct program | | | | | | | | | | |
| CO2 | Identify and correct logical errors encountered at run time | | | | | | | | | | |
| CO3 | Create iterative as well as recursive programs. | | | | | | | | | | |
| CO4 | Represent data in arrays, strings and structures and manipulate them through a Program. | | | | | | | | | | |
| CO5 | Declare pointers of different types and use them in defining self-referential structures. | | | | | | | | | | |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 2 | 2 |
| Weightage of course contributed to each PSO | 15 | 11 | 10 | 11 | 11 | 12 |

S-Strong-3 M-Medium-2 L-Low-1

SKILL ENHANCEMENT COURSE – I

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | | |
|----------------------------|--|--------------|----------|----------|----------|----------|----------|-------------|-----------|---------------------|------------|--|
| | | | | | | | | | CIA | External | Total | |
| 23BAIIS1 | FUNDAMENTALS OF INFORMATION TECHNOLOGY | SEC-I | 2 | 0 | 0 | 1 | 2 | 2 | 25 | 75 | 100 | |
| Learning Objectives | | | | | | | | | | | | |
| LO1 | Understand basic concepts and terminology of information technology. | | | | | | | | | | | |
| LO2 | Have a basic understanding of personal computers and their operation | | | | | | | | | | | |
| LO3 | Be able to identify data storage and its usage | | | | | | | | | | | |
| LO4 | Get great knowledge of software and its functionalities | | | | | | | | | | | |
| LO5 | Understand about operating system and their uses | | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | | |
| Unit I | Introduction to Computers: Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer | | | | | | | | | | 6 | |
| Unit II | Basic Computer Organization: Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers. | | | | | | | | | | 6 | |
| Unit III | Storage Fundamentals: Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives | | | | | | | | | | 6 | |
| Unit IV | Software: Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w | | | | | | | | | | 6 | |
| Unit V | Operating System: Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux. | | | | | | | | | | 6 | |
| TOTAL | | | | | | | | | | 30 | | |
| CO | Course Outcomes | | | | | | | | | | | |
| CO1 | Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it. | | | | | | | | | | | |
| CO2 | Develop organizational structure using for the devices present currently under input or output unit | | | | | | | | | | | |
| CO3 | Concept of storing data in computer using two header namely RAM and ROM with | | | | | | | | | | | |

| | |
|------------------------|---|
| | different types of ROM with advancement in storage basis |
| CO4 | Work with different software, Write program in the software and applications of software |
| CO5 | Usage of Operating system in information technology which really acts as a interpreter between software and hardware |
| Textbooks | |
| 1. | Anoop Mathew, S. Kavitha Murugeshan (2009), “ Fundamental of Information Technology”, Majestic Books |
| 2. | Alexis Leon, Mathews Leon,” Fundamental of Information Technology”, 2nd Edition |
| 3. | S. K Bansal, “Fundamental of Information Technology”. |
| Reference books | |
| 1. | Bhardwaj Sushil Puneet Kumar, “Fundamental of Information Technology” |
| 2. | GG WILKINSON, “Fundamentals of Information Technology”, Wiley-Blackwell |
| 3. | A Ravichandran , “Fundamentals of Information Technology”, Khanna Book Publishing |
| Web Resources | |
| 1. | https://testbook.com/learn/computer-fundamentals |
| 2. | https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html |
| 3. | https://www.javatpoint.com/computer-fundamentals-tutorial |
| 4. | https://www.tutorialspoint.com/computer_fundamentals/index.htm |
| 5. | https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 3 |
| Weightage of course contributed to each PSO | 15 | 15 | 14 | 15 | 14 | 14 |

S-Strong-3 M-Medium-2 L-Low-1

FOUNDATION COURSE – I

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | | |
|----------------------------|--|-----------|----------|----------|----------|----------|----------|-------------|-----------|---------------------|------------|--|
| | | | | | | | | | CIA | External | Total | |
| 23BAI1FC | OFFICE AUTOMATION | FC | 2 | 0 | 0 | I | 2 | 2 | 25 | 75 | 100 | |
| Learning Objectives | | | | | | | | | | | | |
| LO1 | Understand the basics of computer systems and its components. | | | | | | | | | | | |
| LO2 | Understand and apply the basic concepts of a word processing package. | | | | | | | | | | | |
| LO3 | Understand and apply the basic concepts of electronic spreadsheet software. | | | | | | | | | | | |
| LO4 | Understand and apply the basic concepts of database management system. | | | | | | | | | | | |
| LO5 | Understand and create a presentation using PowerPoint tool. | | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | | |
| Unit I | Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS– UNIX–Windows. Introduction to Programming Languages. | | | | | | | | | | 6 | |
| Unit II | Word Processing: Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing Preview, options, merge. | | | | | | | | | | 6 | |
| Unit III | Spreadsheets: Excel – opening, entering text and data, formatting, navigating; Formulas– entering, handling and copying; Charts –creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics. | | | | | | | | | | 6 | |
| Unit IV | Database Concepts: The concept of database management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access). | | | | | | | | | | 6 | |
| Unit V | Power point: Introduction to Power point - Features –Understanding slide typecasting & viewing slides – creating slideshows. Applying special object – including objects & pictures –Slide transition–Animation effects, audio inclusion, timers. | | | | | | | | | | 6 | |
| TOTAL | | | | | | | | | | 30 | | |
| CO | Course Outcomes | | | | | | | | | | | |
| CO1 | Possess the knowledge on the basics of computers and its components | | | | | | | | | | | |
| CO2 | Gain knowledge on Creating Documents, spreadsheet and presentation. | | | | | | | | | | | |
| CO3 | Learn the concepts of Database and implement the Query in Database. | | | | | | | | | | | |
| CO4 | Demonstrate the understanding of different automation tools. | | | | | | | | | | | |
| CO5 | Utilize automation tools for documentation, calculation & presentation purpose | | | | | | | | | | | |
| Textbooks | | | | | | | | | | | | |
| 1. | PeterNorton,“IntroductiontoComputers”–TataMcGraw-Hill. | | | | | | | | | | | |

| Textbooks | |
|----------------------|---|
| 1. | Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, “Microsoft 2003”, Tata McGrawHill |
| Web Resources | |
| 1. | https://www.udemy.com/course/office-automation-certificate-course/ |
| 2. | https://www.javatpoint.com/automation-tools |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 3 | 2 |
| CO3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 3 |
| Weightage of course contributed to each PSO | 14 | 14 | 13 | 15 | 14 | 14 |

S-Strong-3 M-Medium-2 L-Low-1

FIRST YEAR – SEMESTER – II

CORE COURSE – III

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|-----------------|---|---|---|---|---------|-------------|-------|---------------------|-------|
| | | | | | | | | | CIA | External | Total |
| 23BAI2C1 | PYTHON PROGRAMMING | Core-III | 5 | 0 | 0 | 2 | 4 | 5 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Learn core Python scripting elements such as data types, expressions | | | | | | | | | | |
| LO2 | Understand various flow control structures. | | | | | | | | | | |
| LO3 | Learn the string and file handling in Python | | | | | | | | | | |
| LO4 | Understand the most important libraries of Python, and its recommended programming styles and idioms. | | | | | | | | | | |
| LO5 | Develop applications using Python. | | | | | | | | | | |
| | Contents | | | | | | | | | No. of Hours | |
| Unit I | Python, Data Types, Expressions: Python Programming - Running Code in the Interactive Shell, Input, Processing and Output, Editing, Saving and Running a Script - Data Types, String Literals, Escape Sequences, String Concatenation, Variables and the Assignment Statement - Numeric Data Types and Character Sets - Integers and Long Integers, Floating-Point Numbers and Character Sets - Expressions - Arithmetic Expressions and Mixed-Mode Arithmetic and Type Conversions. | | | | | | | | | 15 | |
| Unit II | Functions, Modules and Control Statements: Functions and Modules - Calling Functions, The math Module, The Main Module, Program Format and Structure and Running a Script from a Terminal Command Prompt - Iteration - for loop - Selection - Boolean Type, Comparisons, and Boolean Expressions, if-else Statements, One-Way Selection Statements, Multi-way if Statements, Logical Operators and Compound Boolean Expressions, Short-Circuit Evaluation and Testing Selection Statements - Conditional Iteration - while loop. | | | | | | | | | 15 | |
| Unit III | Strings and Text Files: Strings - Accessing Characters and Substrings in Strings, Strings and String Methods - Text Files - Text Files and Their Format, Writing Text to a File, Writing Numbers to a File, Reading Text from a File, Reading Numbers from a File and Accessing and Manipulating Files and Directories on Disk. | | | | | | | | | 15 | |
| Unit IV | Lists and Dictionaries: Lists - List Literals and Basic Operators, Replacing an Element in a List, List Methods for Inserting and Removing Elements, Searching and Sorting a List, Mutator Methods and the Value None, Aliasing and Side Effects, Equality and Tuples - Defining Simple Functions - Syntax, Parameters and Arguments, return Statement, Boolean Functions and main function, DICTIONARIES - Dictionary Literals, Adding Keys and Replacing Values, Accessing Values, Removing Keys and Traversing a Dictionary. | | | | | | | | | 15 | |

| | | |
|------------------------|--|-----------|
| Unit V | Design with Functions and Design with Classes Design with Functions and Design with Classes - Functions as Abstraction Mechanisms, Problem Solving with Top-Down Design, Design with Recursive Functions and Managing a Program's Namespace - DESIGN WITH CLASSES - Objects and Classes, Data Modeling and Structuring Classes with Inheritance and Polymorphism. | 15 |
| TOTAL | | 75 |
| CO | Course Outcomes | |
| CO1 | Describe the datatypes, expressions and type conversions in Python | |
| CO2 | Use functions, control statements, strings, lists and dictionaries in python programming. | |
| CO3 | Demonstrate the concept of object, class inheritance and polymorphism in Python. | |
| CO4 | Write user defined functions, classes in python. | |
| CO5 | Develop programming skills to solve real time computational problems | |
| Textbooks | | |
| 1. | Kenneth A. Lambert, Martin Osborne, "Fundamentals of Python: From First Programs Through Data Structures", Course Technology, Cengage Learning, 2010, ISBN-13: 978-1-4239-0218-8. | |
| 2. | Paul Barry, "Head First Python 2e", O'Reilly, 2nd Revised edition, 2016, ISBN-13: 978-1491919538. | |
| Reference Books | | |
| 1. | Zed A. Shaw, "Learn Python the Hard Way", Addison-Wesley, Third Edition, 2014, ISBN-13: 978-0-321-88491-6. | |
| 2. | Dave Kuhlman, "A Python Book: Beginning Python, Advanced Python, and Python Exercises", 2013, ISBN: 9780984221233. | |
| 3. | Kent D Lee, "Python Programming Fundamentals", Springer-Verlag London Limited, 2011, ISBN 978-1-84996-536-1. | |
| Web Resources | | |
| 1. | http://docs.python.org/3/tutorial/index.html | |
| 2. | http://interactivepython.org/courselib/static/pythonds | |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 1 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 |
| Weightage of course contributed to each PSO | 15 | 12 | 10 | 11 | 12 | 13 |

S-Strong-3 M-Medium-2 L-Low-1

CORE COURSE – IV

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|--|---------------------------|----------|----------|----------|----------|----------|-------------|-----------|--------------|------------|
| | | | | | | | | | CIA | External | Total |
| 23BAI2P1 | PYTHON PROGRAMMING LAB | Core Practi cal-II | 0 | 0 | 4 | 2 | 4 | 4 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Understand the basics of python programming concepts. | | | | | | | | | | |
| LO2 | Understand the high-performance programs designed to build up the real proficiency | | | | | | | | | | |
| List of Exercises | | | | | | | | | | | |
| 1. Control Statements 2. Operators 3. Lists and List comprehensions 4. Set 5. Dictionary 6. Function 7. String 8. File 9. Polymorphism 10. Inheritance | | | | | | | | | | | |
| Software Essentials: Code Block | | | | | | | | | | | |
| | | | | | | | | | | TOTAL | 60 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Describe the Control statement, String, List, and Dictionaries in Python. | | | | | | | | | | |
| CO2 | Use functions and represent Compound data using Lists, Tuples and Dictionaries | | | | | | | | | | |
| CO3 | Implement Conditionals and Loops for Python Programs | | | | | | | | | | |
| CO4 | Understand and summarize different types of function and File handling operations. | | | | | | | | | | |
| CO5 | Interpret Object programming in Python | | | | | | | | | | |

| MAPPING TABLE | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 2 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 2 |
| Weightage of course contributed to each PSO | 15 | 14 | 11 | 15 | 15 | 10 |

S-Strong-3 M-Medium-2 L-Low-1

SKILL ENHANCEMENT COURSE – II

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|----------|---|---|---|---|---------|-------------|-------|----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BAI2S1 | INTRODUCTION TO HTML | SEC-II | 2 | 0 | 0 | 2 | 2 | 2 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Insert a graphic within a web page | | | | | | | | | | |
| LO2 | Create a link within a web page | | | | | | | | | | |
| LO3 | Create a table within a web page. | | | | | | | | | | |
| LO4 | Insert heading levels within a web page | | | | | | | | | | |
| LO5 | Insert ordered and unordered lists within a web page. Create a web page. | | | | | | | | | | |
| Contents | | | | | | | | | | | No. of Hours |
| Unit I | Introduction : Web Basics : What is Internet – Web browsers –What is Webpage – HTML Basics : Understanding tags | | | | | | | | | | 6 |
| Unit II | Tags for Document structure (HTML, Head, Body Tag). Block level text elements : Headings paragraph (<p> tag)–Font style elements : (bold, italic, font, small, strong, strike, big tags) | | | | | | | | | | 6 |
| Unit III | Lists: Types of lists : Ordered, Unordered – Nesting Lists –Other tags : Marquee, HR, BR – Using Images – Creating Hyperlinks. | | | | | | | | | | 6 |
| Unit IV | Tables: Creating basic Table, Table elements, Caption –Table and cell alignment – Rowspan, Colspan–Cell padding. | | | | | | | | | | 6 |
| Unit V | Frames: Frameset–Targeted Links–Noframe–Forms: Input, Textarea, Select, Option. | | | | | | | | | | 6 |
| TOTAL | | | | | | | | | | | 30 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Knows the basic concept in HTML Concept of resources in HTML | | | | | | | | | | |
| CO2 | Knows Design concept. Concept of Meta Data Understand the concept of save the files | | | | | | | | | | |
| CO3 | Understand the page formatting. Concept of list | | | | | | | | | | |
| CO4 | Creating Links. Know the concept of creating link to email address | | | | | | | | | | |
| CO5 | Concept of adding images Understand the table creation | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | “Mastering HTML5 and CSS3 Made Easy”, TeachUComp Inc., 2014. | | | | | | | | | | |
| 2. | Thomas Michaud, “Foundations of Web Design: Introduction to HTML & CSS” | | | | | | | | | | |
| Web Resources | | | | | | | | | | | |
| 1. | https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf | | | | | | | | | | |
| 2. | https://www.w3schools.com/html/default.asp | | | | | | | | | | |

| MAPPING TABLE | | | | | | |
|---------------|-------|-------|-------|-------|-------|-------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| | | | | | | |

| | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 3 |
| Weightage of course contributed to each PSO | 14 | 15 | 14 | 14 | 15 | 15 |

S-Strong-3 M-Medium-2 L-Low-1

SKILL ENHANCEMENT COURSE – III

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|----------|---|---|---|---|---------|-------------|-------|---------------------|-------|
| | | | | | | | | | CIA | External | Total |
| 23BA12S2 | MULTIMEDIA SYSTEMS | SEC-III | 2 | 0 | 0 | 2 | 2 | 2 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Understand the definition of Multimedia | | | | | | | | | | |
| LO2 | To study about the Image File Formats, Sounds Audio File Formats | | | | | | | | | | |
| LO3 | Understand the concepts of Animation and Digital Video Containers | | | | | | | | | | |
| LO4 | To study about the Stage of Multimedia Project | | | | | | | | | | |
| LO5 | Understand the concept of Ownership of Content Created for Project Acquiring Talent | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | |
| Unit I | Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text: About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext. | | | | | | | | | | 6 |
| Unit II | Images: Plan Approach - Organize Tools - Configure Computer Workspace - Making Still Images - Color - Image File Formats. Sound: The Power of Sound - Digital Audio-MidiAudio-Midivs. | | | | | | | | | 6 | |
| Unit III | DigitalAudio-Multimedia System Sounds Audio File Formats -Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project. | | | | | | | | | 6 | |
| Unit IV | Animation: The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays-Digital Video Containers-Obtaining Video Clips -Shooting and Editing Video. | | | | | | | | | 6 | |
| Unit V | Making Multimedia: The Stage of Multimedia Project - The Intangible Needs - The Hardware Needs - The Software Needs - An Authoring System's Needs-Multimedia Production Team. | | | | | | | | | 6 | |
| TOTAL | | | | | | | | | | 30 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Understand the concepts, importance, application and the process of developing multimedia | | | | | | | | | | |
| CO2 | To have basic knowledge and understanding about image related processing | | | | | | | | | | |
| CO3 | To understand the framework of frames and bit images to animations | | | | | | | | | | |
| CO4 | Speaks about the multimedia projects and stages of requirement in phases of project. | | | | | | | | | | |
| CO5 | Understanding the concept of cost involved in multimedia planning, designing, and producing | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | TayVaughan,"Multimedia:MakingItWork",8thEdition,Osborne/McGraw-Hill,2001. | | | | | | | | | | |
| Reference books | | | | | | | | | | | |
| 1. | RalfSteinmetz&KlaraNahrstedt"MultimediaComputing,Communication&Applications",Pears onEducation,2012. | | | | | | | | | | |
| Web Resources | | | | | | | | | | | |

| | |
|----|---|
| 1. | https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/ |
|----|---|

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 2 | 2 | 3 | 3 | 3 | 2 |
| CO2 | 2 | 3 | 2 | 3 | 2 | 1 |
| CO3 | 1 | 2 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 2 | 1 | 2 |
| CO5 | 2 | 3 | 1 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 10 | 12 | 11 | 14 | 12 | 10 |

S-Strong-3 M-Medium-2 L-Low-1

SECOND YEAR – SEMESTER – III

CORE COURSE – V

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|----------------|---|---|---|---|---------|-------------|-------|---------------------|-------|
| | | | | | | | | | CIA | External | Total |
| 23BA13C1 | OBJECT ORIENTED PROGRAMMING (THEORY & PRACTICAL) | CORE -V | 3 | 0 | 2 | 3 | 4 | 5 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Understand the basic concepts of Java | | | | | | | | | | |
| LO2 | Develop high quality, internally documented, well-structured object oriented program. | | | | | | | | | | |
| LO3 | Adapt object oriented principles such as abstraction and information hiding in software development. | | | | | | | | | | |
| | Contents | | | | | | | | | No. of Hours | |
| Unit I | Programming Basic, Decision Making and Functions Using JAVA Basic program construction, Data types, Arrays, Operators, Control statements, Simple functions, Passing arguments to functions, Returning values from functions, Reference arguments, Recursion, Inline functions, Scope and storage class. | | | | | | | | | 9 | |
| Unit II | Introduction to Java Programming, Classes and Objects Features of Java, JDK, JRE and JVM, Structure of java program, Class fundamentals, Declaring objects, Constructors, Garbage collection, Overloading methods, Nested and inner classes. Member access and inheritance, Using super, Method overriding, Dynamic method dispatch, Defining a package, Access protection, Importing packages, Defining an interface and implementing interfaces. | | | | | | | | | 9 | |
| Unit III | Exception Handling, Multithreading and Wrapper Classes Exception-handling fundamentals, Exception types, Uncaught exceptions, Using try and catch, throw, throws, finally, Built-in exceptions, Creating user-defined exceptions, Java thread model, Creating threads, Boxing and unboxing. | | | | | | | | | 9 | |
| Unit IV | Input Output Handling, File Handling, Collection and Generics Input output basics, Reading console input, Writing console output, Reading and writing files, ArrayList, Generic class, Bounded types, Creating a generic method. | | | | | | | | | 9 | |
| Unit V | Design Patterns, Graphical Programming and Software Development Process Introduction to design patterns, Iterator pattern and model-view-controller pattern, Simple swing application, Event handling, Painting in swing, Swing user interface elements, Software development process. | | | | | | | | | 9 | |
| List of Exercises | | | | | | | | | | | |
| | <ol style="list-style-type: none"> 1. Control Statements 2. Array 3. Class and Objects 4. Inheritance 5. Packages | | | | | | | | | 30 | |

| | | |
|------------------------|---|-----------|
| 6. | Interface | |
| 7. | Exception Handling | |
| 8. | String Handling | |
| 9. | File Handling | |
| 10. | GUI using Swing | |
| TOTAL | | 75 |
| CO | Course Outcomes | |
| CO1 | Define the object-oriented programming concepts. | |
| CO2 | Select the relevant object oriented concepts to implement a real time application with design patterns. | |
| CO3 | Demonstrate the application of polymorphism in various ways. | |
| CO4 | Illustrate the use of inheritance, exceptions, generics and collection. | |
| CO5 | Develop applications with event-driven graphical user interface and file management . | |
| Textbooks | | |
| 1. | Herbert Schildt, “Java: The Complete Reference”, 10th edition, McGraw Hill Education, 2017, ISBN-10: 1259589331 | |
| Reference books | | |
| 1. | Harvey M. Dietel, “Java How to Program”, 7th edition, Prentice Hall, 2007. ISBN:978-0132222204. | |
| 2. | Elisabeth Freeman, “Head First Design Patterns”, O’Reilly, 1st edition, 2004, ISBN-10: 0596007124. | |
| 3. | Kathy Sierra, Bert Bates, “Head First Java”, 2nd edition, O’Reilly Media, 2005. ISBN: 10-0596004656, ISBN-13:9780596004651. | |
| Web Resources | | |
| 1. | https://www.javatpoint.com/java-tutorial | |
| 2. | https://www.w3schools.com/java/ | |
| 3. | https://www.tutorialspoint.com/java/index.htm | |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 15 | 14 | 14 | 15 | 15 | 15 |

S-Strong-3 M-Medium-2 L-Low-1

Note :

External exam will be conducted in two components.

Practical Component : 75 Marks

Theory Component : 75 Marks

Practical Exam : 3 Hrs. (Max Marks 75 should be converted to 30 i.e. 40% of total mark)

Theory Exam : 3 Hrs. (Max Marks 75 should be converted to 45 i.e. 60% of total mark)

Exam fees may be fixed accordingly.

CORE COURSE – VI

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|---|-----------------|----------|----------|----------|----------|----------|-------------|-----------|-----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BA13C2 | DATA STRUCTURES AND ALGORITHMS (THEORY & PRACTICAL) | CORE -VI | 3 | 0 | 1 | 3 | 4 | 4 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Understand the concepts of linear data structures and algorithms. | | | | | | | | | | |
| LO2 | Demonstrate the different searching and sorting techniques. | | | | | | | | | | |
| LO3 | Relate the different non-linear data structures such as trees and graphs. | | | | | | | | | | |
| | Contents | | | | | | | | | | No. of Hours |
| Unit I | Abstract Data Type Data Abstraction - Abstract Data Type (ADT) - Algorithms - Fundamentals of Algorithmic Problem-solving - Analysis of Algorithms - Asymptotic Notations - Time-Space Trade-off | | | | | | | | | | 9 |
| Unit II | Array based Linear Data Structures Arrays - Stack ADT - Applications of Stack: Expression evaluation and conversion - Recursion - Queue ADT - Circular Queue - Applications of Queue | | | | | | | | | | 9 |
| Unit III | Linked List based Linear Data Structures & Sorting Singly linked lists - Linked Stacks and Queues - Doubly linked lists - Circular linked lists – Applications. Sequential search - Bubble Sort - Selection Sort - Insertion Sort - Radix Sort - Merge Sort - Quick Sort. | | | | | | | | | | 9 |
| Unit IV | Non-linear Data Structures, Trees Introduction to Trees - Binary Tree - Representation - Traversals of Binary Tree and Implementation - Binary Search Trees - Priority Queues - Binary Heap and Applications - AVL Trees - B-trees. | | | | | | | | | | 9 |
| Unit V | Graphs Mathematical background- Graph Representation and Traversals - Depth First Search, Breadth First Search | | | | | | | | | | 9 |
| List of Exercises | | | | | | | | | | | |
| | <ol style="list-style-type: none"> 1. Array Implementation of Stack and Queue ADTs 2. Application of Recursion 3. Linked list Implementation 4. Implementation of Doubly Linked List 5. Implementation of Circular Linked List 6. Implementation of Sorting & Search Algorithms 7. Implementation of Binary Tree Traversal | | | | | | | | | | 15 |
| TOTAL | | | | | | | | | | | 60 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Understand the basics of abstract data type and algorithm analysis. | | | | | | | | | | |
| CO2 | Illustrate the use of array to implement stack and queue. | | | | | | | | | | |

| | |
|------------------------|---|
| CO3 | Apply linked list to design stack and queue data structures. |
| CO4 | Understand the different types of tree data structures and demonstrate the methods for traversing trees. |
| CO5 | Differentiate the graph representations and traversals. |
| Textbooks | |
| 1. | Herbert Schildt, “Java: The Complete Reference”, 10th edition, McGraw Hill Education, 2017, ISBN-10: 1259589331 |
| 2. | Mark Allen Weiss, “Data Structures and Problem Solving using Java”, 4th Edition, Addison-Wesley, 2006 |
| 3. | AnanyLevitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Education, 2011. ISBN13: 978-013231681 |
| Reference books | |
| 1. | V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, First Edition Reprint 2003.Fourth impression,2009, ISBN 978-81-7758-8262 |
| 2. | S. Tanenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and C++, Second Edition, PHI/Pearson Education, 1996. ISBN 978-81-203-1177-0. |
| 3. | Ellis Horowitz, SartajShani, SanguthuvarRajasekaran, “Fundamentals of computer Algorithms”, Second Edition, 2008. ISBN- 978-81-7371-612-6 |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 15 | 15 | 15 | 15 | 15 | 15 |

S-Strong-3 M-Medium-2 L-Low-1

Note :

External exam will be conducted in two components.

Practical Component : 75 Marks

Theory Component : 75 Marks

Practical Exam : 3 Hrs. (Max Marks 75 should be converted to 30 i.e. 40% of total mark)

Theory Exam : 3 Hrs. (Max Marks 75 should be converted to 45 i.e. 60% of total mark)

Exam fees may be fixed accordingly.

SKILL ENHANCEMENT COURSE – IV

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|---|----------|---|---|---|---|---------|-------------|-------|---------------------|-------|
| | | | | | | | | | CIA | External | Total |
| 23BAI3S1 | WEB DESIGNING | SEC-IV | 2 | 0 | 0 | 3 | 2 | 2 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Understand the basics of HTML and its components | | | | | | | | | | |
| LO2 | To study about the Graphics in HTML | | | | | | | | | | |
| LO3 | Understand and apply the concepts of XML and DHTML | | | | | | | | | | |
| LO4 | Understand the concept of JavaScript | | | | | | | | | | |
| LO5 | To identify and understand the goals and objectives of the Ajax | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | |
| Unit I | XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML). | | | | | | | | | | 6 |
| Unit II | Concept of CSS - Creating Style Sheet - CSS Properties - CSS Styling (Background, Text Format, Controlling Fonts) - Working with block elements and objects - Working with Lists and Tables - CSS Id and Class - Box Model (Introduction, Border properties, Padding Properties, Margin - properties) Navigation Bar - CSS Color - Creating page Layout and Site Design | | | | | | | | | 6 | |
| Unit III | Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. | | | | | | | | | 6 | |
| Unit IV | JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition | | | | | | | | | 6 | |
| Unit V | Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations. | | | | | | | | | 6 | |
| TOTAL | | | | | | | | | | 30 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Develop working knowledge of CSS | | | | | | | | | | |
| CO2 | Ability to Develop and publish Web pages using DHTML. | | | | | | | | | | |
| CO3 | Ability to optimize page styles and layout with Cascading Style Sheets (CSS). | | | | | | | | | | |
| CO4 | Ability to develop a java script | | | | | | | | | | |
| CO5 | An ability to develop web application | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | Pankaj Sharma, “Web Technology”, SkKataria& Sons Bangalore 2011. | | | | | | | | | | |
| 2. | Mike Mcgrath, “Java Script”, Dream Tech Press 2006, 1st Edition. | | | | | | | | | | |
| 3. | Achyut S Godbole&AtulKahate, “Web Technologies”, 2002, 2nd Edition. | | | | | | | | | | |
| Reference books | | | | | | | | | | | |

| | |
|----------------------|--|
| 1. | Laura Lemay, RafeColburn , Jennifer Kyrnin, “Mastering HTML, CSS & Javascript Web Publishing”, 2016. |
| 2. | DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2nd Edition. |
| Web Resources | |
| 1. | NPTEL & MOOC courses titled Web Design and Development. |
| 2. | https://www.geeksforgeeks.org |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 1 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 |
| Weightage of course contributed to each PSO | 15 | 12 | 10 | 11 | 12 | 13 |

S-Strong-3 M-Medium-2 L-Low-1

SKILL ENHANCEMENT COURSE – V

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | | |
|----------------------------|---|--------------|----------|----------|----------|----------|----------|-------------|-----------|---------------------|------------|--|
| | | | | | | | | | CIA | External | Total | |
| 23BAI3S2 | PHP PROGRAMMING | SEC-V | 2 | 0 | 0 | 3 | 2 | 2 | 25 | 75 | 100 | |
| Learning Objectives | | | | | | | | | | | | |
| LO1 | To provide the necessary knowledge on basics of PHP. | | | | | | | | | | | |
| LO2 | To design and develop dynamic, database-driven web applications using PHP version. | | | | | | | | | | | |
| LO3 | To get an experience on various web application development techniques. | | | | | | | | | | | |
| LO4 | To learn the necessary concepts for working with the files using PHP. | | | | | | | | | | | |
| LO5 | To get a knowledge on OOPS with PHP. | | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | | |
| Unit I | Introduction to PHP -Basic Knowledge of websites -Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation | | | | | | | | | | 6 | |
| Unit II | PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML - Embedding HTML in PHP. Introduction to PHP Variable -Understanding Data Types -Using Operators - Using Conditional Statements -If(), else if() and else if condition Statement. | | | | | | | | | | 6 | |
| Unit III | Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions. PHP Functions -Creating an Array -Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions. | | | | | | | | | | 6 | |
| Unit IV | PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File. | | | | | | | | | | 6 | |
| Unit V | Managing Sessions and Using Session Variables -Destroying a Session - Storing Data in Cookies -Setting Cookies. | | | | | | | | | | 6 | |
| TOTAL | | | | | | | | | | 30 | | |
| CO | Course Outcomes | | | | | | | | | | | |
| CO1 | Write PHP scripts to handle HTML forms | | | | | | | | | | | |
| CO2 | Write regular expressions including modifiers, operators, and metacharacters. | | | | | | | | | | | |
| CO3 | Create PHP Program using the concept of array. | | | | | | | | | | | |
| CO4 | Create PHP programs that use various PHP library functions | | | | | | | | | | | |
| CO5 | Manipulate files and directories. | | | | | | | | | | | |
| Textbooks | | | | | | | | | | | | |
| 1. | Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison. | | | | | | | | | | | |
| 2. | The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes | | | | | | | | | | | |
| Reference books | | | | | | | | | | | | |

| | |
|----------------------|---|
| 1. | PHP: The Complete Reference-Steven Holzner. |
| 2. | DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2ndEdition. |
| Web Resources | |
| 1. | Opensource digital libraries: PHP Programming |
| 2. | https://www.w3schools.com/php/default.asp |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 1 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 |
| Weightage of course contributed to each PSO | 15 | 12 | 10 | 11 | 12 | 13 |

S-Strong-3 M-Medium-2 L-Low-1

SECOND YEAR – SEMESTER – IV

CORE COURSE – VII

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | | |
|----------------------------|--|-----------|---|---|---|---|---------|-------------|-------|---------------------|-----------|--|
| | | | | | | | | | CIA | External | Total | |
| 23BAI4C1 | R PROGRAMMING | CORE -VII | 4 | 0 | 0 | 4 | 4 | 4 | 25 | 75 | 100 | |
| Learning Objectives | | | | | | | | | | | | |
| LO1 | Understanding and being able to use basic programming concepts | | | | | | | | | | | |
| LO2 | Automate data analysis | | | | | | | | | | | |
| LO3 | Working collaboratively and openly on code | | | | | | | | | | | |
| LO4 | Knowing how to generate dynamic documents | | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | | |
| Unit I | Introduction: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations | | | | | | | | | | 10 | |
| Unit II | Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations | | | | | | | | | | 10 | |
| Unit III | Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations | | | | | | | | | | 10 | |
| Unit IV | FACTORS AND TABLES, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions | | | | | | | | | | 10 | |
| Unit V | OBJECT-ORIENTED PROGRAMMING: S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation. | | | | | | | | | | 10 | |
| TOTAL | | | | | | | | | | 60 | | |
| CO | Course Outcomes | | | | | | | | | | | |
| CO1 | Demonstration and implement of basic R programming framework and data structures | | | | | | | | | | | |
| CO2 | Explain critical R programming language concepts such as control structures and recursion | | | | | | | | | | | |

| | |
|------------------------|---|
| CO3 | Applying mathematical and statistical operations data in R |
| CO4 | Examine data-sets to create testable hypotheses and identify appropriate statistical tests |
| CO5 | Make use of appropriate statistical tests using R and Create and edit visualizations with regression models |
| Textbooks | |
| 1. | R Programming for Data Science by Roger D. Peng |
| 2. | The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning India. |
| Reference books | |
| 1. | Tilman M. Davies, The Book of R: A First Course in Programming and Statistics, 1st edition, 2019. |
| 2. | Andy Field, Discovering Statistics Using R, 1st edition, SAGE Publications Ltd |
| Web Resources | |
| 1. | https://www.w3schools.com/r/ |
| 2. | https://www.javatpoint.com/r-tutorial |
| 3. | https://www.tutorialspoint.com/r/index.htm |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 1 | 2 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 3 | 3 | 1 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 1 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 13 | 11 | 9 | 14 | 14 | 10 |

S-Strong-3 M-Medium-2 L-Low-1

CORE COURSE – VIII

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---------------------------|----------|----------|----------|----------|----------|-------------|--------------|-----------|------------|
| | | | | | | | | | CIA | External | Total |
| 23BAI4P1 | R PROGRAMMING LAB | Core Practi cal-IV | 0 | 0 | 3 | 4 | 3 | 3 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Gain knowledge in developing basic R programs | | | | | | | | | | |
| LO2 | Knowing how to generate dynamic documents | | | | | | | | | | |
| LO3 | Being able to use a continuous test-driven development approach | | | | | | | | | | |
| List of Exercises | | | | | | | | | | | |
| <ol style="list-style-type: none"> 1. Write an R-Program to print Hello World 2. Write an R-Program to take input from user. 3. Write an R-Program to demonstrate working with operators (Arithmetic, Relational, Logical, Assignment operators). 4. Write an R Program to Check if a Number is Odd or Even 5. Write an R Program to check if the given Number is a Prime Number 6. Write an R Program to Find the Factorial of a Number 7. Write an R Program to Find the Factors of a Number 8. Write an R Program to Find the Fibonacci sequence Using Recursive Function 9. Write an R Program to Make a Simple Calculator 10. Write an R Program to Find L.C.M of two numbers 11. Write an R Program to create a Vector and to access elements in a Vector 12. Write an R Program to create a Matrix and access rows and columns using functions colnames() and rownames() . 13. Write an R Program to create a Matrix using cbind() and rbind() functions. 14. Write an R Program to create a Matrix from a Vector using dim() function. 15. Write an R Program to create a List and modify its components. 16. Write an R Program to create a Data Frame. 17. Write an R Program to access a Data Frame like a List. 18. Write an R Program to access a Data Frame like a Matrix. 19. Write an R Program to create a Factor. 20. Write an R Program to Access and Modify Components of a Factor. 21. Write an R Program to create an S3 Class and S3 Objects. 22. Write an R Program to write a own generic function in S3 Class. 23. Write an R Program to create an S4 Class and S4 Objects. 24. Write an R Program to write a own generic function in S4 Class. 25. Write an R Program to create Reference Class and modify its Methods. | | | | | | | | | | | |
| Software Essentials: Code Block | | | | | | | | | TOTAL | 60 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Understand the fundamental concepts in R | | | | | | | | | | |

| | |
|------------|--|
| CO2 | Acquire programming skills in R |
| CO3 | Be able to use R to solve statistical problems |
| CO4 | Be able to implement and describe Monte Carlo the technology |
| CO5 | Be able to minimize and maximize functions using R |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 1 | 2 | 1 | 1 | 2 |
| CO2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO4 | 3 | 2 | 2 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 2 |
| Weightage of course contributed to each PSO | 13 | 10 | 10 | 11 | 10 | 10 |

S-Strong-3 M-Medium-2 L-Low-1

SKILL ENHANCEMENT COURSE – VI

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|----------|---|---|---|---|---------|-------------|-------|----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BAI4S1 | QUANTITATIVE APTITUDE | SEC-VI | 2 | 0 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | To understand the basic concepts of numbers | | | | | | | | | | |
| LO2 | Understand and apply the concept of percentage, profit & loss | | | | | | | | | | |
| LO3 | To study the basic concepts of time and work, interests | | | | | | | | | | |
| LO4 | To learn the concepts of permutation, probability, discounts | | | | | | | | | | |
| LO5 | To study about the concepts of data representation, graphs | | | | | | | | | | |
| Contents | | | | | | | | | | | No. of Hours |
| Unit I | Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots - Average-problems on Numbers | | | | | | | | | | 6 |
| Unit II | Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain rule. | | | | | | | | | | 6 |
| Unit III | Time and work - pipes and cisterns - Time and Distance - problems on trains - Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surface area -races and Games of skill. | | | | | | | | | | 6 |
| Unit IV | Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Odd man out & Series. | | | | | | | | | | 6 |
| Unit V | Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs-Pie charts-Line graphs. | | | | | | | | | | 6 |
| TOTAL | | | | | | | | | | | 30 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Understand the concepts, application, and the problems of numbers | | | | | | | | | | |
| CO2 | To have basic knowledge and understanding about percentage, profit & loss related processing | | | | | | | | | | |
| CO3 | To understand the concepts of time and work | | | | | | | | | | |
| CO4 | Speaks about the concepts of probability, discount | | | | | | | | | | |
| CO5 | Understanding the concept of problem solving involved in stocks & shares, graphs | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | “Quantitative Aptitude”, R.S. AGGARWAL., S. Chand & Company Ltd., | | | | | | | | | | |
| Web Resources | | | | | | | | | | | |
| 1. | https://www.javatpoint.com/aptitude/quantitative | | | | | | | | | | |
| 2. | https://www.toppr.com/guides/quantitative-aptitude/ | | | | | | | | | | |

| MAPPING TABLE | | | | | | |
|---------------|-------|-------|-------|-------|-------|-------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| | | | | | | |

| | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|
| CO1 | 3 | 2 | 1 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 2 | 2 | 3 |
| CO4 | 2 | 2 | 2 | 2 | 3 | 3 |
| CO5 | 3 | 1 | 2 | 3 | 2 | 3 |
| Weightage of course contributed to each PSO | 11 | 10 | 10 | 13 | 12 | 14 |

S-Strong-3 M-Medium-2 L-Low-1

SKILL ENHANCEMENT COURSE – VII

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|----------------|---|---|---|---|---------|-------------|-------|----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BAI4S2 | INTRODUCTION TO DATA COMMUNICATION AND NETWORKING | SEC-VII | 2 | 0 | 0 | - | 2 | 2 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | To introduce the fundamental network architecture concepts and their core principle issues in the emerging communication / data networks | | | | | | | | | | |
| LO2 | To have a complete picture of the data and computer networks systematically | | | | | | | | | | |
| LO3 | To provide a strong foundation in networking concepts and technology | | | | | | | | | | |
| LO4 | To know the significance of various Flow control and Congestion control Mechanisms | | | | | | | | | | |
| LO5 | To know the Functioning of various Application layer Protocols. | | | | | | | | | | |
| | Contents | | | | | | | | | | No. of Hours |
| Unit I | Data Communications: Introduction– Networks – The Internet – Protocols and Standards- Network Models: OSI model – TCP/IP protocol suite – Transmission Media: Guided media – Unguided Media. | | | | | | | | | | 6 |
| Unit II | Data Link Layer: Error Detection and Correction: Introduction- Block coding – Linear block codes – Cyclic Codes – Checksum - Framing. Flow and Error Control: Protocols –Noiseless Channels: Simple protocol, Stop- and –Wait. Noisy Channel: Stop-and Wait Automatic Repeat Request-Go-Back –N – Piggybacking | | | | | | | | | | 7 |
| Unit III | Medium Access and Network Layer: Multiple Access: Random Access – Controlled access- Channelization. Connecting LANs : Connecting Devices | | | | | | | | | | 5 |
| Unit IV | Network Layer Logical addressing: IPv4 addresses – IPv6 addresses. Network Layer: Delivery, Forwarding, Unicast and Multicast Routing. Transport Layer: Process to Process delivery: UDP – TCP. Congestion Control – Quality of Service | | | | | | | | | | 7 |
| Unit V | Application Layer: Domain Naming System: Name Space - Domain Name Space - Distribution of Name Space - DNS in the INTERNET - Resolution– Remote logging – E-mail – FTP | | | | | | | | | | 5 |
| | TOTAL | | | | | | | | | | 30 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Understand the basics of data communication, networking, internet and their importance | | | | | | | | | | |
| CO2 | Analyze the services and features of various protocol layers in data networks | | | | | | | | | | |
| CO3 | Differentiate wired and wireless computer networks | | | | | | | | | | |
| CO4 | Analyze TCP/IP and their protocols | | | | | | | | | | |
| CO5 | Recognize the different internet devices and their functions | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | Forouzan, A. Behrouz. (2006), Data Communications & Networking, Fourth Edition, Tata McGraw Hill Education | | | | | | | | | | |

| Reference books | |
|-----------------|---|
| 1. | Fred Halsall(1996), Data Communications Computer Networks and Open Systems, Fourth Edition, Addison Wesley |
| Web Resources | |
| 1. | https://www.tutorialspoint.com/data_communication_computer_network/index.htm |
| 2. | https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/ |

| MAPPING TABLE | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 14 | 15 | 15 | 15 | 13 | 14 |

S-Strong-3 M-Medium-2 L-Low-1

THIRD YEAR – SEMESTER – V

CORE COURSE – IX

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|-----------------|----------|----------|----------|----------|----------|-------------|-----------|-----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BA15C1 | INTELLIGENT SYSTEMS | CORE -IX | 5 | 0 | 0 | 5 | 4 | 5 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | To acquire knowledge on various intelligent system techniques and methodologies | | | | | | | | | | |
| LO2 | Learn about Knowledge representation | | | | | | | | | | |
| LO3 | To implement learning methods in solving engineering problems | | | | | | | | | | |
| | Contents | | | | | | | | | | No. of Hours |
| Unit I | Artificial Intelligence: AI problems-AI technique-Problem Search:-Production Systems – Problem Characteristics – Production system characteristics-Heuristic Search techniques: Generate and Test – Hill Climbing – Constraint Satisfaction, Means-end analysis | | | | | | | | | | 15 |
| Unit II | Knowledge representation issues: Representations and mappings – Approaches to Knowledge representations –Frame problem –. Using Predicate Logic: Representing simple facts in logic-Representing Instance and ISA relationships – Computable functions and predicates – Resolution | | | | | | | | | | 15 |
| Unit III | Representing knowledge using rules: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge. Knowledge representation summary: Syntactic and Semantic spectrum of representation-Logic and slot – and-filler structures-Other representational techniques | | | | | | | | | | 15 |
| Unit IV | Rule-based expert systems: Introduction- Rules as a knowledge representation technique- players- Structure- Forward chaining and backward chaining inference techniques- Fuzzy expert systems: Introduction- Fuzzy sets- Linguistic variables and hedges- Operations - Fuzzy rules- - Building a fuzzy expert system | | | | | | | | | | 15 |
| Unit V | Artificial neural networks: Neuron- perceptron- Multilayer neural networks- - The Hopfield network- Robotics: Introduction-Robot hardware-Perception-Moving-Robotic software architecture. | | | | | | | | | | 15 |
| TOTAL | | | | | | | | | | 75 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Outline the applicability, strength and weakness of artificial intelligence in solving computational problems | | | | | | | | | | |
| CO2 | Demonstrate the role of knowledge representation, problem solving and learning in Intelligent-system engineering | | | | | | | | | | |
| CO3 | Identify the characteristics of AI, Knowledge representation, Experts systems and its variants with ANN and robotics | | | | | | | | | | |
| CO4 | Analyze a comprehensive background in both software and hardware to work with the future of robotics and adaptive systems | | | | | | | | | | |
| CO5 | Assess the scientific background through various real time examples | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |

| | |
|------------------------|--|
| 1. | Elaine rich and Kelvin Knight, “Artificial Intelligence “, Tata McGraw hill Publication, 3rdEdition, 2009. [Unit -I,II,III] Unit I : Chapters 1, 2, 3 Unit II : Chapters 4, 5 Unit III : Chapters 6, 11 |
| 2. | Artificial Intelligence: A Guide to Intelligent Systems, 3rd edition, Michael Negnevitsky, Addison Wesley, 2011.[Unit IV-Chapter 1,2,4,V-Chapter6] |
| 3. | Artificial Intelligence a modern Approach “– Stuart Russell & Peter Norvig, 3rd Edition Pearson Education[Unit V-Chapter25-Robotics] |
| Reference books | |
| 1. | “Artificial Intelligence “, George F Luger, 4thEdition , Pearsons Education Publ,2002. |
| 2. | “Foundations of Artificial Intelligent and Expert Systems”, V S Janaki Raman, K. Sarukesi, P Gopalakrishnan, Macmillan India Limited |
| Web Resources | |
| 1. | https://www.techopedia.com/definition/190/artificial-intelligence-ai |
| 2. | https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm |
| 3. | https://data-flair.training/blogs/heuristic-search-ai/ |
| 4. | http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf |
| 5. | http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 3 | 2 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 1 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 3 | 2 |
| Weightage of course contributed to each PSO | 15 | 12 | 10 | 11 | 12 | 13 |

S-Strong-3 M-Medium-2 L-Low-1

CORE COURSE – X

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | | |
|----------------------------|---|----------------|----------|----------|----------|----------|----------|-------------|-----------|---------------------|------------|--|
| | | | | | | | | | CIA | External | Total | |
| 23BA15C2 | INTRODUCTION TO MACHINE LEARNING | CORE -X | 5 | 0 | 0 | 5 | 4 | 5 | 25 | 75 | 100 | |
| Learning Objectives | | | | | | | | | | | | |
| LO1 | Understand the human learning aspects and primitives in learning process by computer | | | | | | | | | | | |
| LO2 | Analyze the nature of problems solved with machine learning techniques | | | | | | | | | | | |
| LO3 | Design and implement suitable machine learning technique for a given application | | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | | |
| Unit I | Introduction Definition - Types of Machine Learning - Examples of Machine Learning Problems - Training versus Testing - Characteristics of Machine learning tasks - Predictive and descriptive tasks - Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types - Feature Construction and Transformation - Feature Selection. | | | | | | | | | | 15 | |
| Unit II | Classification and Concept Learning Classification: Binary Classification- Assessing Classification performance - Class probability Estimation - Multiclass Classification - Regression: Assessing performance of Regression - Error measures - Overfitting- Theory of Generalization: Effective number of hypothesis - Bounding the Growth function. | | | | | | | | | | 15 | |
| Unit III | Linear and Probabilistic Models Least Squares method - Multivariate Linear Regression - Perceptron, Multiple Layer Perceptron - Support Vector Machines - Obtaining probabilities from Linear classifiers - Kernel methods for non-Linearity - Probabilistic models for categorical data – Naïve Bayes Classifier | | | | | | | | | | 15 | |
| Unit IV | Distance Based Models Distance Based Models: Neighbors and Examples - Nearest Neighbors Classification - Distance based clustering – K-Means Algorithm - K-Medoids Algorithm - Hierarchical clustering - Vector Quantization, Self-Organizing Feature Map - Principal Component Analysis. | | | | | | | | | | 15 | |
| Unit V | Rule Based and Tree Based Models Rule Based Models: Rule learning for subgroup discovery - Association rule mining - Tree Based Models: Decision Trees - Ranking and Probability estimation Trees - Regression trees - Classification and Regression Trees (CART), Ensemble Learning, - Bagging and Boosting. | | | | | | | | | | 15 | |
| TOTAL | | | | | | | | | | 75 | | |
| CO | Course Outcomes | | | | | | | | | | | |
| CO1 | Describe the concepts, mathematical background, applicability, limitations of existing machine learning techniques. | | | | | | | | | | | |
| CO2 | Identify the performance evaluation criteria of the model developed | | | | | | | | | | | |
| CO3 | Analyze and design various machine learning based applications with a modern outlook focusing on recent advances. | | | | | | | | | | | |

| | |
|------------------------|---|
| CO4 | Build the learning model for a given task |
| CO5 | Apply some state-of-the-art development frameworks and software libraries for implementation |
| Textbooks | |
| 1. | P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012, ISBN-10: 1107422221, ISBN-13: 978-1107422223. |
| 2. | Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Second Edition (Springer Series in Statistics), 2016, ISBN-10: 0387848576, ISBN-13: 978-0387848570 |
| Reference books | |
| 1. | Christopher Bishop, "Pattern Recognition and Machine Learning (Information Science and Statistics)", Springer, 2007. |
| 2. | Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012, ISBN-10: 0262018020, ISBN-13: 978-0262018029 |
| 3. | Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, "Learning from Data", AMLBook Publishers, 2012 ISBN 13: 978-1600490064. |
| 4. | Tom Mitchell, "Machine Learning", McGraw-Hill, 1997, ISBN-10: 0071154671, ISBN-13: 978-0071154673. |
| Web Resources | |
| 1. | https://www.javatpoint.com/machine-learning |
| 2. | https://www.geeksforgeeks.org/machine-learning/ |
| 3. | https://www.tutorialspoint.com/machine_learning/index.htm |
| 4. | https://www.w3schools.com/python/python_ml_getting_started.asp |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 2 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 1 | 1 | 1 | 2 |
| CO3 | 2 | 3 | 2 | 2 | 2 | 2 |
| CO4 | 2 | 1 | 2 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 2 |
| Weightage of course contributed to each PSO | 12 | 10 | 9 | 10 | 9 | 10 |

S-Strong-3 M-Medium-2 L-Low-1

CORE COURSE – XI

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | | |
|---|--|--------------------------|----------|----------|----------|----------|----------|-------------|--------------|-----------|------------|--|
| | | | | | | | | | CIA | External | Total | |
| 23BA15P1 | MACHINE LEARNING LAB | Core Practi cal-V | 0 | 0 | 4 | 5 | 4 | 4 | 25 | 75 | 100 | |
| Learning Objectives | | | | | | | | | | | | |
| LO1 | Understand the basic statistical and algorithmic concepts in the field of Machine Learning | | | | | | | | | | | |
| LO2 | Learn to handle the data | | | | | | | | | | | |
| LO3 | Develop data analytics applications especially in the context of current research | | | | | | | | | | | |
| List of Exercises | | | | | | | | | | | | |
| 1. Data Preprocessing 2. Feature Extraction 3. Model Training using Linear/ logistic regression for a recent application 4. Model Training using Decision Tree for a recent application 5. Model Training using Support Vector Machine for a recent application 6. Model Training using Ensemble models for a recent application 7. Bayesian learning 8. Instance based learning 9. Model Evaluation and Improvisation 10. Exporting the model as endpoint | | | | | | | | | | | | |
| | | | | | | | | | TOTAL | 75 | | |
| CO | Course Outcomes | | | | | | | | | | | |
| CO1 | Identify the most relevant features in a dataset | | | | | | | | | | | |
| CO2 | Understand the implementation procedures for the machine learning algorithms | | | | | | | | | | | |
| CO3 | Write Python programs for various Learning algorithms. | | | | | | | | | | | |
| CO4 | Apply appropriate Machine Learning algorithms for the given data sets. | | | | | | | | | | | |
| CO5 | Develop applications using Machine Learning algorithms to solve real world problems | | | | | | | | | | | |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 2 | 2 | 3 | 3 | 3 | 2 |
| CO2 | 1 | 3 | 2 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 2 | 1 | 2 |
| CO5 | 2 | 3 | 1 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 11 | 12 | 11 | 14 | 12 | 10 |

S-Strong-3 M-Medium-2 L-Low-1

CORE COURSE – XII

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|---|------------------|----------|----------|----------|----------|----------|-------------|-----------|-----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BA15C3 | NATURAL LANGUAGE PROCESSING (THEORY & PRACTICAL) | CORE -XII | 4 | 0 | 2 | 6 | 4 | 6 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics. | | | | | | | | | | |
| | Contents | | | | | | | | | | No. of Hours |
| Unit I | Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches | | | | | | | | | | 12 |
| Unit II | Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues | | | | | | | | | | 12 |
| Unit III | Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software | | | | | | | | | | 12 |
| Unit IV | Predicate-Argument Structure, Meaning Representation Systems, Software | | | | | | | | | | 12 |
| Unit V | Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling | | | | | | | | | | 12 |
| List of Exercises | | | | | | | | | | | |
| | <ol style="list-style-type: none"> 1. Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming) 2. Morphological Analysis 3. N-gram model 4. POS tagging 5. Chunking 6. Named Entity Recognition 7. Virtual Lab on Word Generator | | | | | | | | | | 30 |
| TOTAL | | | | | | | | | | 90 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Show sensitivity to linguistic phenomena and an ability to model them with formal grammars | | | | | | | | | | |
| CO2 | Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems | | | | | | | | | | |
| CO3 | Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods | | | | | | | | | | |
| CO4 | Able to design, implement, and analyze NLP algorithms | | | | | | | | | | |
| CO5 | Able to design different language modeling Techniques | | | | | | | | | | |

| Textbooks | |
|-----------------|---|
| 1. | Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication |
| 2. | Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary |
| Reference books | |
| 1. | Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications |
| Web Resources | |
| 1. | https://www.tutorialspoint.com/natural_language_processing/index.htm |
| 2. | https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/ |
| 3. | https://www.javatpoint.com/nlp |

| MAPPING TABLE | | | | | | |
|--|-----------|-----------|-----------|-----------|-----------|-----------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 2 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 3 | 2 | 2 | 3 | 1 |
| CO4 | 1 | 2 | 2 | 1 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 1 | 3 | 3 |
| Weightage of course contributed to each PSO | 10 | 12 | 10 | 10 | 13 | 10 |

S-Strong-3 M-Medium-2 L-Low-1

Note :

External exam will be conducted in two components.

Practical Component : 75 Marks

Theory Component : 75 Marks

Practical Exam : 3 Hrs. (Max Marks 75 should be converted to 30 i.e. 40% of total mark)

Theory Exam : 3 Hrs. (Max Marks 75 should be converted to 45 i.e. 60% of total mark)

Exam fees may be fixed accordingly.

DISCIPLINE SPECIFIC ELECTIVE – I

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|---------------|----------|----------|----------|----------|----------|-------------|-----------|-----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BA15E1 | SOCIAL NETWORK ANALYSIS | DSE-IA | 4 | 0 | 0 | 5 | 3 | 4 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Learn the core aspects of collecting, visualizing, analyzing, and interpreting social network data | | | | | | | | | | |
| LO2 | Understand the concepts of research designs and measures of network analysis | | | | | | | | | | |
| LO3 | Design, collect and analyze social network data using relevant techniques and tools to address the real-world problems | | | | | | | | | | |
| Contents | | | | | | | | | | | No. of Hours |
| Unit I | Introduction : Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models. | | | | | | | | | | 12 |
| Unit II | Word level and Syntactic Analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing. | | | | | | | | | | 12 |
| Unit III | Semantic analysis and Discourse Processing: Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure. | | | | | | | | | | 12 |
| Unit IV | Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages. | | | | | | | | | | 12 |
| Unit V | Information retrieval and lexical resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame NetStemmers- POS Tagger- Research Corpora SSAS. | | | | | | | | | | 12 |
| TOTAL | | | | | | | | | | | 60 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Describe the core concepts of social network analysis and the underlying mathematics | | | | | | | | | | |
| CO2 | Summarize the research design methods and different options for collection and management of network data | | | | | | | | | | |
| CO3 | Distinguish between the whole network and egocentric research designs | | | | | | | | | | |
| CO4 | Apply suitable multivariate and statistical techniques for testing hypotheses with network data | | | | | | | | | | |
| CO5 | Analyze the node’s position and structural similarities of network using suitable measures | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | Stephen P Borgatti, Martin G. Everett, Jeffrey C. Johnson, “Analyzing Social Networks”, | | | | | | | | | | |

| | |
|------------------------|---|
| | SAGE Publications, 2018, ISBN-10: 1526404109, ISBN-13: 978-1526404107 |
| Reference books | |
| 1. | Albert-László Barabási, Márton Pósfai, “Network Science” 1st Edition, Cambridge University Press, 1st edition 2016, ISBN:978-1107076266 |
| 2. | Przemyslaw Kazienko, Nitesh Chawla, “Applications of Social Media and Social Network Analysis”, Springer, 2015 |
| 3. | Charu C. Aggarwal, “Social Network Data Analytics”, Springer, 2011, ISBN: 9781441984616 |
| 4. | Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2010, ISBN-10: 1848822286, ISBN-13: 978-1848822283 |
| Web Resources | |
| 1. | https://www.tutorialride.com/big-data-analytics/social-network-analysis.htm |
| 2. | https://towardsdatascience.com/social-network-analysis-from-theory-to-applications-with-python-d12e9a34c2c7 |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 14 | 14 | 15 | 15 | 13 | 15 |

S-Strong-3 M-Medium-2 L-Low-1

DISCIPLINE SPECIFIC ELECTIVE – I

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | | |
|----------------------------|---|----------------|----------|----------|----------|----------|----------|-------------|-----------|---------------------|------------|--|
| | | | | | | | | | CIA | External | Total | |
| 23BA15E2 | IOT AND ITS APPLICATIONS | DSE-I B | 4 | 0 | 0 | 5 | 3 | 4 | 25 | 75 | 100 | |
| Learning Objectives | | | | | | | | | | | | |
| LO1 | To use of Devices, Gateways and Data Management in IoT. | | | | | | | | | | | |
| LO2 | To design IoT applications in different domain and be able to analyze their performance | | | | | | | | | | | |
| LO3 | To implement basic IoT applications on embedded platform | | | | | | | | | | | |
| LO4 | To gain knowledge on Industry Internet of Things | | | | | | | | | | | |
| LO5 | To Learn about the privacy and Security issues in IoT | | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | | |
| Unit I | IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics | | | | | | | | | | 12 | |
| Unit II | M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. | | | | | | | | | | 12 | |
| Unit III | IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views | | | | | | | | | | 12 | |
| Unit IV | IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management | | | | | | | | | | 12 | |
| Unit V | Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security | | | | | | | | | | 12 | |
| TOTAL | | | | | | | | | | 60 | | |
| CO | Course Outcomes | | | | | | | | | | | |
| CO1 | Use of Devices, Gateways and Data Management in IoT. | | | | | | | | | | | |

| | |
|------------------------|--|
| CO2 | Design IoT applications in different domain and be able to analyze their performance |
| CO3 | Implement basic IoT applications on embedded platform |
| CO4 | Gain knowledge on Industry Internet of Things |
| CO5 | Learn about the privacy and Security issues in IoT |
| Textbooks | |
| 1. | Vijay Madiseti and Arshdeep Bahga, “Internet of Things: (A Hands-on Approach)”, Universities Press (INDIA) Private Limited 2014, 1st Edition |
| Reference books | |
| 1. | Michael Miller, “The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World”, kindle version |
| 2. | Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, Apress Publications 2013, 1st Edition, |
| 3. | WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, “Getting Started with the Internet of Things”, O’Reilly Media 2011 |
| Web Resources | |
| 1. | https://www.simplilearn.com |
| 2. | https://www.javatpoint.com |
| 3. | https://www.w3schools.com |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 2 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 1 | 2 | 2 | 1 | 3 | 2 |
| CO5 | 2 | 2 | 3 | 1 | 3 | 3 |
| Weightage of course contributed to each PSO | 10 | 12 | 13 | 10 | 14 | 11 |

S-Strong-3 M-Medium-2 L-Low-1

DISCIPLINE SPECIFIC ELECTIVE – II

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|---|-----------------|----------|----------|----------|----------|----------|-------------|-----------|-----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BA15E3 | SOFTWARE PROJECT MANAGEMENT | DSE-II A | 4 | 0 | 0 | 5 | 3 | 4 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | To define and highlight importance of software project management | | | | | | | | | | |
| LO2 | To formulate and define the software management metrics & strategy in managing projects | | | | | | | | | | |
| LO3 | Understand to apply software testing techniques in commercial environment | | | | | | | | | | |
| | Contents | | | | | | | | | | No. of Hours |
| Unit I | Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization | | | | | | | | | | 12 |
| Unit II | Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software | | | | | | | | | | 12 |
| Unit III | Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed. | | | | | | | | | | 12 |
| Unit IV | Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling | | | | | | | | | | 12 |
| Unit V | Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study | | | | | | | | | | 12 |
| TOTAL | | | | | | | | | | 60 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Understand the principles and concepts of project management | | | | | | | | | | |
| CO2 | Knowledge gained to train software project managers | | | | | | | | | | |
| CO3 | Apply software project management methodologies | | | | | | | | | | |
| CO4 | Able to create comprehensive project plans | | | | | | | | | | |
| CO5 | Evaluate and mitigate risks associated with software development process | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project Management”, Pearson Education Asia 2002. | | | | | | | | | | |
| Reference books | | | | | | | | | | | |

| | |
|----------------------|--|
| 1. | Pankaj Jalote, “Software Project Management in Practice”, Addison Wesley 2002. |
| 2. | Hughes, “Software Project Management”, Tata McGraw Hill 2004, 3rd Edition |
| Web Resources | |
| 1. | NPTEL & MOOC courses titled Software Project Management |
| 2. | www.smartworld.com/notes/software-project-management |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 1 | 2 | 2 | 2 |
| CO2 | 3 | 1 | 3 | 2 | 2 | 2 |
| CO3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 2 |
| CO5 | 2 | 3 | 2 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 13 | 11 | 10 | 13 | 13 | 12 |

S-Strong-3 M-Medium-2 L-Low-1

DISCIPLINE SPECIFIC ELECTIVE – II

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|-----------------|---|---|---|---|---------|-------------|-------|----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BA15E4 | VIRTUALIZATION AND CLOUD | DSE-II B | 4 | 0 | 0 | 5 | 3 | 4 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Recognize the basic concepts of Distributed Systems | | | | | | | | | | |
| LO2 | Understand about Cloud Computing | | | | | | | | | | |
| LO3 | Understand about Virtualization and hypervisors | | | | | | | | | | |
| LO4 | Understand Cloud Types and Cloud Service Deployment Models (IaaS*, PaaS*, SaaS*) | | | | | | | | | | |
| LO5 | Learn to Create Virtual Machines (VM) using vSphere, Data centers and to work with AWS | | | | | | | | | | |
| Contents | | | | | | | | | | | No. of Hours |
| Unit I | Distributed Systems Distribute a system - Distributed algorithm - Distributed Data Stores - Distributed Computing – File Systems - Distributed Messaging - Distributed Applications – Distributed Transaction - Parallel and distributed computing - Applications | | | | | | | | | | 12 |
| Unit II | Cloud Concepts Introduction Cloud Computing - Advantages of Cloud - Public Cloud - five essential characteristics- three service models – Four deployment models - Benefits of Cloud Computing - Cloud Vendors - Traditional Infrastructure setup and Challenges – AWS. | | | | | | | | | | 12 |
| Unit III | Virtualization Introduction to vsphere and the Software - Defined Data Center Creating Virtual Machines – vcenter Server - Configuring and Managing - Virtual Networks Configuring and Managing Virtual Storage – Virtual Machine Management - Resource Management and Monitoring. | | | | | | | | | | 12 |
| Unit IV | Virtual Machines Vsphere HA - vsphere Fault Tolerance - Protecting Data vsphere DRS - Network Scalability -vsphere Update Manager and Host Maintenance - Storage Scalability - Securing Virtual Machines. | | | | | | | | | | 12 |
| Unit V | Datacenter Data center overview -Components - Provisions - Need of Data Center - Data Center Architecture -Different Racks - Data center architecture for cloud computing - role of data center in cloud computing | | | | | | | | | | 12 |
| TOTAL | | | | | | | | | | | 60 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Recognize the basic concepts of Distributed Systems | | | | | | | | | | |
| CO2 | Understand about Cloud Computing | | | | | | | | | | |
| CO3 | Understand about Virtualization and hypervisors | | | | | | | | | | |
| CO4 | Understand Cloud Types and Cloud Service Deployment Models (IaaS*, PaaS*, SaaS*) | | | | | | | | | | |
| CO5 | Learn to Create Virtual Machines (VM) using vSphere, Data centers and to work with AWS | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | Jean Dollimore formerly of Queen Mary, Tim Kindberg, “Distributed Systems Concepts and Design”, 5th Edition Cambridge University, University of London | | | | | | | | | | |
| 2. | Venkata Josyula , Malcolm Orr , Greg Page, “Cloud Computing: Automating the Virtualized | | | | | | | | | | |

| | |
|------------------------|---|
| | Data Center”, 1st Edition. |
| 3. | Brian J.S. Chee, Curtis Franklin Jr., “Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center”, 1st Edition |
| Reference books | |
| 1. | Rajkumar Buyya, Christian Vecchiola, S Tamarai Selvi, (2013), “Mastering Cloud Computing”, First Edition, McGraw Hill publications |
| 2. | Barrie Sosinsky, (2011), “Cloud Computing Bible”, First Edition, Wiley India Private Ltd |
| Web Resources | |
| 1. | https://onlinecourses.nptel.ac.in/noc21_cs14/preview |
| 2. | https://www.w3schools.in/cloud-computing/cloud-computing-architecture/ |
| 3. | https://www.javatpoint.com/virtualization-in-cloud-computing |
| 4. | https://www.kaspersky.co.in/resource-center/definitions/what-is-cloud-security |
| 5. | https://www.tutorialspoint.com/cloud_computing/cloud_computing_applications.htm |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 1 | 2 | 2 | 2 | 3 |
| CO3 | 2 | 3 | 3 | 1 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 12 | 11 | 13 | 11 | 13 | 15 |

S-Strong-3 M-Medium-2 L-Low-1

THIRD YEAR – SEMESTER – VI

CORE COURSE – XIII

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|--|-------------------|----------|----------|----------|----------|----------|-------------|-----------|---------------------|------------|
| | | | | | | | | | CIA | External | Total |
| 23BA16C1 | DEEP LEARNING (THEORY & PRACTICAL) | CORE -XIII | 4 | 0 | 2 | 6 | 4 | 6 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Study the basic concepts of neural networks and deep learning | | | | | | | | | | |
| LO2 | Comprehend deep learning techniques | | | | | | | | | | |
| LO3 | Explore various applications for deep learning techniques | | | | | | | | | | |
| | Contents | | | | | | | | | No. of Hours | |
| Unit I | Neural Networks Introduction to Neural Networks - Training a neural network: loss functions, backpropagation and stochastic gradient descent - Neural networks as universal function approximates | | | | | | | | | 12 | |
| Unit II | Deep Neural Networks Introduction to Deep Learning- A Probabilistic Theory of Deep Learning- Deep Forward Networks - Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks | | | | | | | | | 12 | |
| Unit III | Convolutional Neural Networks Introduction to Convolutional Neural Network - Architectures - AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization | | | | | | | | | 12 | |
| Unit IV | Recurrent Neural Networks and Deep unsupervised Learning Recurrent networks, LSTM, GRU - Architectures, Autoencoders and Variational Autoencoders, Adversarial Generative Networks, DBM - Deep Reinforcement Learning | | | | | | | | | 12 | |
| Unit V | Applications Computer Vision- ImageNet- Detection- Face Recognition- Scene Understanding- Gathering Image Captions - Audio Wave Net - Natural Language Processing Word2Vec - Sentiment Analysis - Recent research | | | | | | | | | 12 | |
| List of Exercises | | | | | | | | | | | |
| <ol style="list-style-type: none"> Basic image processing operations : Histogram equalization, thresholding, edge detection, data augmentation, morphological operations Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network Study the effect of batch normalization and dropout in neural network classifier Familiarization of image labelling tools for object detection, segmentation Image segmentation using Mask RCNN, UNet, SegNet Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.) Image Captioning with Vanilla RNNs Image Captioning with LSTMs Network Visualization: Saliency maps, Class Visualization Generative Adversarial Networks Chatbot using bi-directional LSTMs | | | | | | | | | | 30 | |

| | | |
|--|---|-----------|
| 12. Familiarization of cloud based computing like Google colab | | |
| TOTAL | | 90 |
| CO | Course Outcomes | |
| CO1 | Understand the basics of deep learning | |
| CO2 | Implement various deep learning models | |
| CO3 | Realign high dimensional data using reduction techniques | |
| CO4 | Analyze optimization and generalization in deep learning | |
| CO5 | Explore the deep learning applications | |
| Textbooks | | |
| 1. | Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016. ISBN: 9780262035613 | |
| Reference books | | |
| 1. | Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers, 2013. ISBN: 1601988141, 9781601988140 | |
| 2. | Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015. | |
| Web Resources | | |
| 1. | https://www.javatpoint.com/deep-learning | |
| 2. | https://www.geeksforgeeks.org/deep-learning-tutorial/ | |
| 3. | https://www.simplilearn.com/tutorials/deep-learning-tutorial | |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 1 | 1 | 1 | 2 |
| CO2 | 3 | 1 | 3 | 1 | 1 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 3 | 3 | 2 |
| Weightage of course contributed to each PSO | 15 | 11 | 10 | 11 | 11 | 10 |

S-Strong-3 M-Medium-2 L-Low-1

Note :

External exam will be conducted in two components.

Practical Component : 75 Marks

Theory Component : 75 Marks

Practical Exam : 3 Hrs. (Max Marks 75 should be converted to 30 i.e. 40% of total mark)

Theory Exam : 3 Hrs. (Max Marks 75 should be converted to 45 i.e. 60% of total mark)

Exam fees may be fixed accordingly.

CORE COURSE – XIV

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|-----------|---|---|---|---|---------|-------------|-------|----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BAI6C2 | COMPUTER VISION | CORE -XIV | 4 | 0 | 0 | 6 | 4 | 4 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Describe the concepts of image processing in computer vision | | | | | | | | | | |
| LO2 | Understand the model for application of image analysis to computer vision | | | | | | | | | | |
| LO3 | Apply knowledge in developing applications using computer vision techniques | | | | | | | | | | |
| Contents | | | | | | | | | | | No. of Hours |
| Unit I | Image Formation Models Monocular imaging system - Orthographic and perspective projection - Camera model and camera calibration - Binocular imaging systems – Perspective - Epipolar geometry - Homography estimation – DLT – RANSAC - 3-D reconstruction framework - Auto-calibration. | | | | | | | | | | 12 |
| Unit II | Feature Extraction Image representations (continuous and discrete) - Edge detection - Corner detection - Circle and ellipse detection – Textures - Binary shape analysis - Boundary pattern analysis - Shape from texture, color, motion and edges - Light at surfaces - Phong model - Reflectance map - Albedo estimation - Photometric stereo - Use of surface smoothness constraint. | | | | | | | | | | 12 |
| Unit III | Shape Representation and Segmentation Deformable curves and surfaces - Fourier and wavelet descriptors - Multi-resolution analysis - Region growing - Snakes and active contours - Level set representations - Edge based approaches to segmentation - Mean-shift – MRFs - Graph-cut - Texture segmentation | | | | | | | | | | 12 |
| Unit IV | Motion Detection and Estimation Regularization theory - Optical computation - Stereo vision - Motion estimation - Background subtraction and modelling - Optical flow – KLT - Spatio-Temporal analysis - Dynamic stereo - Motion parameter estimation - Structure from motion - Motion tracking in video. | | | | | | | | | | 12 |
| Unit V | Applications of Computer Vision Automated visual inspection - Inspection of cereal grains – Surveillance - Vehicle vision systems – CBIR – CBVR - Activity recognition - Computational photography – Biometrics - Stitching and document processing. | | | | | | | | | | 12 |
| TOTAL | | | | | | | | | | | 60 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Define image formation models and light effects in computer vision | | | | | | | | | | |
| CO2 | Identify the feature extraction methodology suitable for computer vision applications. | | | | | | | | | | |
| CO3 | Apply the segmentation approaches in image analysis. | | | | | | | | | | |
| CO4 | Analyze the motion detection and estimation techniques. | | | | | | | | | | |
| CO5 | Explain the computer vision techniques used for real time applications | | | | | | | | | | |

| Textbooks | |
|------------------------|---|
| 1. | David A. Forsyth and Jean Ponce, “Computer Vision - A modern approach”, 2nd Edition, Pearson, 2011. ISBN-13: 978-0136085928 |
| 2. | Richard Szeliski, “Computer Vision: Algorithms and Applications”, 1st Edition, Springer-Verlag London Limited, 2011. ISBN-13: 978-1818829343 |
| Reference books | |
| 1. | Linda G. Shapiro, George C. Stockman, “Computer Vision”, 1st Edition, Pearson, 2001. ISBN-13: 978-0130307965 |
| 2. | Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing, 4th Edition, Pearson, 2017. ISBN-13: 978-0133356724 |
| 3. | Dana H. Ballard, Christopher M. Brown, “Computer Vision”, 1st Edition, Prentice Hall, 1982. ISBN-13: 978-0131653160 |
| 4. | B. K. P. Horn, “Robot Vision”, 1st Edition, McGraw-Hill, 1986. ISBN-10: 007-0303495 |
| 5. | Emanuele Trucco, Alessandro Verri, “Introductory Techniques for 3-D Computer Vision”, Prentice Hall, 1998. ISBN-13: 978-0132611084 |
| Web Resources | |
| 1. | https://www.javatpoint.com/computer-vision |
| 2. | https://towardsdatascience.com/computer-vision-for-beginners-part-1-7cca775f58ef |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 1 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 |
| Weightage of course contributed to each PSO | 15 | 12 | 11 | 11 | 12 | 12 |

S-Strong-3 M-Medium-2 L-Low-1

CORE COURSE – XV

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|-------------|----------|----------|-----------|----------|----------|-------------|-----------|------------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BAI6PR | PROJECT | CORE | 0 | 0 | 10 | 6 | 6 | 8 | 50 | 150 | 200 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | To solve real-world problems using Artificial Intelligence and Machine Learning | | | | | | | | | | |
| | Contents | | | | | | | | | | No. of Hours |
| | <ul style="list-style-type: none"> • The students will be allowed to work on any project based on the concepts studied in core/elective courses. • The project work should be compulsorily done in the college only under the supervision of the department staff. • The project shall be undertaken by individual student. • The students will be equally assigned to existing Staff members. • The following list of parameters are considered for the evaluation of Project work and Viva-voce. Parameters: <p align="center"><u>For Internal Marks:</u></p> Two review meetings - $2 \times 10 = 20$ Marks Debugging = 10 Marks Execution = 10 Marks Output = 10 Marks ----- Total = 50 Marks ----- <p align="center"><u>For External Marks:</u></p> Project Report = 50 Marks Project demo & Presentation = 50 Marks Viva-Voce = 50 Marks ----- Total = 150 Marks ----- | | | | | | | | | | |
| TOTAL | | | | | | | | | | 150 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Get expertise in Software Development Lifecycle using real-world problems | | | | | | | | | | |
| CO2 | Able to solve real-world problems using Artificial Intelligence and Machine Learning | | | | | | | | | | |
| CO3 | Explore problem solving using the core / elective course studied | | | | | | | | | | |
| CO4 | Recognize the technological recent trends of computer science. | | | | | | | | | | |
| CO5 | Gain knowledge about technological components | | | | | | | | | | |

DISCIPLINE SPECIFIC ELECTIVE – III

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|------------------|----------|----------|----------|----------|----------|-------------|-----------|-----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BAI6E1 | ROBOTICS AND ITS APPLICATIONS | DSE-III A | 5 | 0 | 0 | 6 | 3 | 5 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | To understand the robotics fundamentals | | | | | | | | | | |
| LO2 | Understand the sensors and matrix methods | | | | | | | | | | |
| LO3 | Understand the Localization: Self-localizations and mapping | | | | | | | | | | |
| LO4 | To study about the concept of Path Planning, Vision system | | | | | | | | | | |
| LO5 | To learn about the concept of robot artificial intelligence | | | | | | | | | | |
| Contents | | | | | | | | | | | No. of Hours |
| Unit I | Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics. | | | | | | | | | | 12 |
| Unit II | Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot | | | | | | | | | | 12 |
| Unit III | Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems. | | | | | | | | | | 12 |
| Unit IV | Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations | | | | | | | | | | 12 |
| Unit V | Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc. | | | | | | | | | | 12 |
| TOTAL | | | | | | | | | | | 60 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Describe the different physical forms of robot architectures | | | | | | | | | | |
| CO2 | Kinematically model simple manipulator and mobile robots. | | | | | | | | | | |

| | |
|------------------------|---|
| CO3 | Mathematically describe a kinematic robot system |
| CO4 | Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty. |
| CO5 | Program robotics algorithms related to kinematics, control, optimization, and uncertainty |
| Textbooks | |
| 1. | Richard D.Klafter. Thomas Achmielewski and Mickael Negin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001 |
| 2. | Saeed B.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2nd edition 2011 |
| Reference books | |
| 1. | Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008 |
| 2. | Robotics technology and flexible automation by S.R.Deb, THH-2009 |
| Web Resources | |
| 1. | https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm |
| 2. | https://www.geeksforgeeks.org/robotics-introduction/ |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 1 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 1 | 3 | 1 |
| CO4 | 3 | 3 | 3 | 1 | 1 | 2 |
| CO5 | 3 | 3 | 1 | 3 | 2 | 3 |
| Weightage of course contributed to each PSO | 12 | 13 | 13 | 11 | 12 | 12 |

S-Strong-3 M-Medium-2 L-Low-1

DISCIPLINE SPECIFIC ELECTIVE – III

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|--|------------------|----------|----------|----------|----------|----------|-------------|-----------|-----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BA16E2 | VIRTUAL REALITY TECHNOLOGY | DSE-III B | 5 | 0 | 0 | 6 | 3 | 5 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | Understand the fundamental principles of virtual reality | | | | | | | | | | |
| LO2 | Infer the essential information about the hardware and software in virtual environment | | | | | | | | | | |
| LO3 | Design and construct a simple virtual environment | | | | | | | | | | |
| | Contents | | | | | | | | | | No. of Hours |
| Unit I | History of Virtual Reality Commercial VR Technology- Input Devices- Tracker Performance Parameters- Mechanical- Magnetic- Ultrasonic- Optical- Hybrid- Navigation and Manipulation Interfaces- Gesture Interfaces | | | | | | | | | | 12 |
| Unit II | Output Devices Graphic Displays - Sound Displays-The Human Auditory System- The Convolvotron - Haptic Feedback: The Human Haptic System- Tactile- Force-The Graphics Rendering Pipeline- PC Graphics Architecture- Graphics Benchmarks | | | | | | | | | | 12 |
| Unit III | Workstation based Architecture Workstation Based Architectures: The Sun Blade 1000 - The SGI Infinite Reality - Distributed VR -Multi pipeline Synchronization- Collocated Rendering- Distributed Virtual Environments- Geometric - Kinematics Modeling- Physical- Behavior- Model Management | | | | | | | | | | 12 |
| Unit IV | Virtual Reality Programming VR Programming: Toolkits and Scene Graphs- World Tool Kit- Java 3D-General Haptics Open Software Toolkit- People Shop-Usability Engineering Methodology | | | | | | | | | | 12 |
| Unit V | Virtual Reality Applications Engineering - Education - Medicine - Entertainment - Science - Training | | | | | | | | | | 12 |
| TOTAL | | | | | | | | | | 60 | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Recognize the virtual technology and usage of input devices | | | | | | | | | | |
| CO2 | Identify the essential output devices, sound displays, graphics and feedback | | | | | | | | | | |
| CO3 | Demonstrate workstation-based architecture for modelling | | | | | | | | | | |
| CO4 | Analyze the programming tool kits in engineering the virtual reality methods | | | | | | | | | | |
| CO5 | Relate the user performance and multimodality feedbacks | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | Grigore C. Burdea and Philippe Coiffet, “Virtual Reality Technology”, Third Edition, John Wiley and Sons, 2012, ISBN-13: 978-1118014806 | | | | | | | | | | |
| 2. | Gerard Kim, “Designing Virtual Reality Systems: The Structured Approach”, Springer, 2007, ISBN: 1846282306, 9781846282300 | | | | | | | | | | |

| Reference books | |
|------------------------|---|
| 1. | John Vince, "Introduction to Virtual Reality", Springer, 2004, ISBN: 1852337397 |
| 2. | William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann publisher, 2003, ISBN: 1558603530, 9781558603530. |
| 3. | Alan B. Craig, William R. Sherman, Jeffrey D. Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009, ISBN: 0080959083, 9780080959085 |
| Web Resources | |
| 1. | https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-virtual-reality |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 2 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 1 | 2 | 2 | 1 | 3 | 2 |
| CO5 | 2 | 2 | 3 | 1 | 3 | 3 |
| Weightage of course contributed to each PSO | 10 | 12 | 13 | 10 | 14 | 11 |

S-Strong-3 M-Medium-2 L-Low-1

DISCIPLINE SPECIFIC ELECTIVE – IV

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | | |
|----------------------------|---|-----------------|----------|----------|----------|----------|----------|-------------|-----------|---------------------|------------|--|
| | | | | | | | | | CIA | External | Total | |
| 23BAI6E3 | BIG DATA ANALYTICS | DSE-IV A | 5 | 0 | 0 | 6 | 3 | 5 | 25 | 75 | 100 | |
| Learning Objectives | | | | | | | | | | | | |
| LO1 | Understand the Big Data Platform and its Use cases, Map Reduce Jobs | | | | | | | | | | | |
| LO2 | To identify and understand the basics of cluster and decision tree | | | | | | | | | | | |
| LO3 | To study about the Association Rules, Recommendation System | | | | | | | | | | | |
| LO4 | To learn about the concept of stream | | | | | | | | | | | |
| LO5 | Understand the concepts of NoSQL Databases | | | | | | | | | | | |
| Contents | | | | | | | | | | No. of Hours | | |
| Unit I | Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model | | | | | | | | | | 12 | |
| Unit II | Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes? Theorem — Naïve Bayes Classifier. | | | | | | | | | | 12 | |
| Unit III | Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches. | | | | | | | | | | 12 | |
| Unit IV | Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics | | | | | | | | | | 12 | |
| Unit V | NoSQL Databases : Schema-less Models?: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R. | | | | | | | | | | 12 | |
| TOTAL | | | | | | | | | | 60 | | |
| CO | Course Outcomes | | | | | | | | | | | |

| | |
|------------------------|--|
| CO1 | Work with big data tools and its analysis techniques |
| CO2 | Analyze data by utilizing clustering and classification algorithms |
| CO3 | Learn and apply different mining algorithms and recommendation systems for large volumes of data |
| CO4 | Perform analytics on data streams. |
| CO5 | Learn NoSQL databases and management |
| Textbooks | |
| 1. | AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012. |
| Reference books | |
| 1. | David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/El sevier Publishers, 2013 |
| 2. | EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015 |
| Web Resources | |
| 1. | https://www.simplilearn.com |
| 2. | https://www.sas.com/en_us/insights/analytics/big-data-analytics.html |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 1 | 3 | 2 | 3 | 2 | 2 |
| CO2 | 2 | 1 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 13 | 12 | 12 | 14 | 13 | 12 |

S-Strong-3 M-Medium-2 L-Low-1

DISCIPLINE SPECIFIC ELECTIVE – IV

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|----------------------------|---|-----------------|----------|----------|----------|----------|----------|-------------|-----------|-----------|---------------------|
| | | | | | | | | | CIA | External | Total |
| 23BA16E4 | INTRODUCTION TO DATA SCIENCE | DSE-IV B | 5 | 0 | 0 | 6 | 3 | 5 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | To learn about basics of Data Science and Big data | | | | | | | | | | |
| LO2 | To learn about overview and building process of Data Science | | | | | | | | | | |
| LO3 | To learn about various Algorithms in Data Science | | | | | | | | | | |
| LO4 | To learn about Hadoop Framework | | | | | | | | | | |
| LO5 | To learn about case study about Data Science | | | | | | | | | | |
| Contents | | | | | | | | | | | No. of Hours |
| Unit I | Introduction: Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science | | | | | | | | | | 12 |
| Unit II | The Data science process: Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building | | | | | | | | | | 12 |
| Unit III | Algorithms :Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised | | | | | | | | | | 12 |
| Unit IV | Introduction to Hadoop :Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types | | | | | | | | | | 12 |
| Unit V | Case Study: Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation | | | | | | | | | | 12 |
| TOTAL | | | | | | | | | | | 60 |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Understand the basics in Data Science and Big data | | | | | | | | | | |
| CO2 | Understand overview and building process in Data Science | | | | | | | | | | |
| CO3 | Understand various Algorithms in Data Science | | | | | | | | | | |
| CO4 | Understand Hadoop Framework in Data Science | | | | | | | | | | |
| CO5 | Case study in Data Science | | | | | | | | | | |
| Textbooks | | | | | | | | | | | |
| 1. | Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, manning publications 2016 | | | | | | | | | | |
| Reference books | | | | | | | | | | | |
| 1. | Roger Peng, “The Art of Data Science”, lulu.com 2016. | | | | | | | | | | |
| 2. | MurtazaHaider, “Getting Started with Data Science – Making Sense of Data with Analytics”, IBM press, E-book | | | | | | | | | | |
| 3. | Davy Cielen, Arno D.B. Meysman, Mohamed Ali,“Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools”, Dreamtech Press 2016 | | | | | | | | | | |
| 4. | Annalyn Ng, Kenneth Soo, “Numsense! Data Science for the Layman: No Math Added”, | | | | | | | | | | |

| | |
|----------------------|---|
| | 2017, 1st Edition |
| 5. | Cathy O'Neil, Rachel Schutt, "Doing Data Science Straight Talk from the Frontline", O'Reilly Media 2013 |
| 6. | Lillian Pierson, "Data Science for Dummies", 2017 II Edition |
| Web Resources | |
| 1. | https://www.w3schools.com/datascience/ |
| 2. | https://en.wikipedia.org/wiki/Data_science |
| 3. | http://www.cmap.polytechnique.fr/~lepenec/en/post/references/refs/ |

| MAPPING TABLE | | | | | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
| CO1 | 3 | 2 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 1 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 3 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 13 | 12 | 14 | 12 | 13 | 12 |

S-Strong-3 M-Medium-2 L-Low-1

| | | | | | | | |
|---|-----|--|-----|-----------------|---------------------|--------------------|--------------|
| Title of the Course | | ESSENTIAL REASONING AND QUANTITATIVE APTITUDE | | | | | |
| Paper Number | | Professional Competency Skill | | | | | |
| Category | PCS | Year | III | Credits | 2 | Course Code | 23BAI6S 1 |
| | | Semester | VI | | | | |
| Instructional Hours per week | | Lecture | | Tutorial | Lab Practice | Total | |
| | | 1 | | 1 | - | 2 | |
| Objectives of the Course | | <ul style="list-style-type: none"> • Develop Problem solving skills for competitive examinations • Understand the concepts of averages , simple interest , compound interest | | | | | |
| UNIT-I: | | Quantitative Aptitude: Simplifications=averages-Concepts –problem-Problems on numbers-Short cuts- concepts –Problems | | | | | |
| UNIT-II: | | Profit and Loss –short cuts-Concepts –Problems –Time and work - Short –uts -Concepts -Problems. | | | | | |
| UNIT-III: | | Simple interest –compound interest- Concepts- Prolems | | | | | |
| UNIT-IV: | | Verbal Reasoning : Analogy- coding and decoding –Directions and distance –Blood Relation | | | | | |
| UNIT-V: | | Analytical Reasoning : Data sufficiency Non-Verbal Reasoning : Analogy ,Classification and series | | | | | |
| Skills acquired from this course | | Studnets relating the concepts of compound interest and simple interest | | | | | |
| Recommended Text | | 1."Quantitative Aptitude" by R.S aggarwal ,S.Chand & Company Ltd 2007 | | | | | |
| Website and e-Learning Source | | https://nptel.ac.in | | | | | |

| METHODS OF EVALUATION | | |
|------------------------------|--|------------------|
| Internal Evaluation | Continuous Internal Assessment Test | 25 Marks |
| | Assignments / Snap Test / Quiz | |
| | Seminars | |
| | Attendance and Class Participation | |
| External Evaluation | End Semester Examination | 75 Marks |
| Total | | 100 Marks |
| METHODS OF ASSESSMENT | | |
| Remembering (K1) | <ul style="list-style-type: none"> • The lowest level of questions requires students to recall information from the course content. • Knowledge questions usually require students to identify information in the textbook. | |
| Understanding (K2) | <ul style="list-style-type: none"> • Understanding of facts and ideas by comprehending organizing, comparing, translating, interpolating, and interpreting in their own words. • The questions go beyond simple recall and require students to combine data together | |
| Application (K3) | <ul style="list-style-type: none"> • Students must solve problems by using / applying a concept learned in the classroom. • Students must use their knowledge to determine a exact response. | |
| Analyze (K4) | <ul style="list-style-type: none"> • Analyzing the question is one that asks the students to break down something into its component parts. • Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations. | |
| Evaluate (K5) | <ul style="list-style-type: none"> • Evaluation requires an individual to make judgment on something. • Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem – solving. • Evaluation questions do not have single right answers. | |
| Create (K6) | <ul style="list-style-type: none"> • The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem solving skills | |