**UG Syllabus under CBCS**

**Data Science Management (DSM) (2020)**

**Scheme of UG DSM under Choice Based Credit System (CBCS) Courses for Honours Students**

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| --- | --- | --- | --- | --- | --- | --- |
| **SEM.** | **COURSE** | **COURSE CODE** | **MARKS** | **CREDITS** | **TITLE** | **REMARKS** |
| **I** | Core | C-1 | 100 | 6 | Digital Logic | Compulsory |
| C-2 | 100 | 6 | Programming using C |
| Generic | GE-1 | 100 | 6 | Organizational Behaviour | Compulsory |
| Elective |
| Ability | AEC-1 | 100 | 4 | Environmental Science | Compulsory |
| Enhancement |
| **II** | Core | C-3 | 100 | 6 | Data Structure | Compulsory |
| C-4 | 100 | 6 | Introduction to Probability and Statistics |
| Generic Elective | GE-2 | 100 | 6 | A. Financial Management | The Department may offer any one of the two |
| B. General Management |
| or both the courses |
| Ability | AEC-2 | 100 | 4 | MIL  (Odia/Hindi/ English) | Compulsory; The students have to choose any one of the courses |
| Enhancement |
| **III** | Core | C-5 | 100 | 6 | Computer Organization | Compulsory |
| C-6 | 100 | 6 | Operating Systems |
| C-7 | 100 | 6 | Database Management |
| Systems |

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| **SEM.** | **COURSE** | **COURSE CODE** | **MARKS** | **CREDITS** | **TITLE** | **REMARKS** |
| Generic | GE-3 | 100 | 6 | Decision Management Systems | Compulsory |
| Elective |
| Skill | SEC-1 | 100 | 4 | Communicative English | Compulsory |
| Enhancement |
| **IV** | Core | C-8 | 100 | 6 | Foundation of Data Science and Analytics | Compulsory |
| C-9 | 100 | 6 | JAVA  Programming |
| C-10 | 100 | 6 | Data Communications & Networking |
| Generic Elective | GE-4 | 100 | 6 | Marketing Analytics | Compulsory |
| Skill Enhancement | SEC-2 | 100 | 4 | Quantitative Aptitude and  Logical Reasoning | Compulsory |

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| **SEM.** | **COURSE** | **COURSE CODE** | **MARKS** | **CREDITS** | **TITLE** | **REMARKS** |
| **V** | Core | C-11 | 100 | 6 | Big Data Analytics | Compulsory |
| C-12 | 100 | 6 | Cloud Computing |
| Discipline Specific | DSE-1 | 100 | 6 | Software Engineering | Compulsory |
| DSE-2 | 100 | 6 | Python Programming | Compulsory |
| Skill Enhancement | SEC-3 | 100 | 4 | R Programming | Compulsory |
| **VI** | Core | C-13 | 100 | 6 | Machine Learning | Compulsory |
| C-14 | 100 | 6 | Internet of Things (IOT) | Compulsory |
| Discipline Specific | DSE-3 | 100 | 6 | Wireless Communications | Compulsory |
| DSE-4 | 100 | 6 | Project | Compulsory |
| Skill Enhancement | SEC-4 | 100 | 4 | Leadership and Personality Development | Compulsory |

### DSM (HONOURS) SEMESTER I

**Core Course**

**C-1: DIGITAL LOGIC (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course Objectives**

Introduce the concept of digital and binary systems. Be able to design and analyze combinational logic circuits. Be able to design and analyze sequential logic circuits. Understand the basic software tools for the design and implementation of digital circuits and systems.

**Course Outcomes: At the end of the course, a student will be able to:**

* Convert different type of codes and number systems which are used in digital communication and computer systems.
* Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.
* Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.
* Design different types of with and without memory element digital electronic circuits for particular operation
* Organization of memory management and its concepts.

**Unit-1**

CharacterCodes,DecimalSystem,BinarySystem,DecimaltoBinaryConversion,Hexadecimal Notation, Boolean Algebra, Basic Logic Functions: Electronic Logic Gates, Synthesis of Logic Functions, Minimization of Logic Expressions, Minimization using Karnaugh Maps, Synthesis with NAND and NOR Gates, Tri-State Buffers

**Unit-2**

Arithmetic: Addition and Subtraction of Signed Numbers, Addition/ Subtraction Logic Unit, Design of Fast Adders: Carry Look ahead Addition, Multiplication of Positive Numbers, Signed- Operand Multiplication: Booth Algorithm, Fast Multiplication: Bit-Pair Recoding Multipliers, Carry-Save Addition of Summands, Integer Division, Floating-Point Numbers and Operations: IEEE Standard for Floating-Point Numbers, Arithmetic Operations on Floating-Point Numbers, Guard Bits and Truncation, Implementing Floating-Point Operations.

**Unit-3**

Flip-Flops, Gated Latches, Master-Slave Flip-Flops, Edge-Triggering, T Flip-Flops, JK Flip- Flops. Registers and Shift Registers, Counters, Decoders, Multiplexers, Programmable Logic Devices (PLDs), Programmable Array Logic (PAL), Complex Programmable Logic Devices (CPLDs), Field-Programmable Gate Array (FPGA), Sequential Circuits, UP/ DOWN Counters, Timing Diagrams, The Finite State Machine Model, Synthesis of Finite State Machines.

**Unit-4**

MemorySystem:SemiconductorRAMMemories,InternalOrganizationofMemoryChips,Static Memories, Asynchronous DRAMS, Synchronous DRAMS, Structure of Large Memories, Memory System Considerations, RAMBUS Memory. Read-Only Memories: ROM, PROM, EPROM, EEPROM, Flash Memory, Speed, Size, and Cost of Memory. Secondary Storage: Magnetic Hard Disks, Optical Disks, Magnetic Tape Systems.

**Text Books**:

1. Carl Hamacher, Z. Vranesic, S. Zaky: Computer Organization, 5/e (TMH)

**Reference Books:**

1. M. Morris Mano: Digital Logic and Computer Design, Pearson

**CORE–1 Practical: Digital Logic Lab**

1. Introduction to Xilinx software(VHDL)

**Write the VHDL code for**

1. Realizing all logic gates.
2. Combination Circuit.
3. ADDER.
4. SUBTRACTOR.
5. MUX.
6. DE-MUX.
7. Encoder.
8. Decoder.
9. PAL.
10. PLA.

**Write the VHDL program for the following Sequential Logic Circuits**

1. Flip Flops.
2. Shift Registers.
3. Counters.
4. Memory Elements.

### DSM (HONOURS) SEMESTER I

**Core Course**

**C-2: PROGRAMMING USING C (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**COURSE OBJECTIVE:-**

The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

**COURSE OUTCOME:-**

After learning this paper, students should be able to know :-

* Introduction of C language, various elements of C ,data types ,operators, expressions, decision making and branching & implementation in programs.
* Students will learn loops and their types and will write programs, they will understand array concepts ,programs also pointer uses in programs.
* Students will understand various storage classes, concept of function their types, program using functions, String concepts and string programs, dynamic memory allocation.
  + - * Students will understand structure and union, programs based on structure and union. Students also learn file management in C, various operations in files, programs in file handling.

**Unit-1**

**Introduction**:IntroductiontoProgrammingLanguage,IntroductiontoCProgramming, Keywords & Identifiers, Constants, Variables, Input and Output Operations, Compilation and pre-processing, **Data types**: Different data types, Data types qualifier, modifiers, Memory representation, size and range, **Operators:** Operators (Arithmetic, Relational, Logical, Bitwise, Assignment & compound assignment, Increment & Decrement, Conditional),Operator types(unary, binary, ternary). Expressions, Order of expression (Precedence and associativity)

**Control structures**: Decision Making and Branching(Simple IF Statement, IF…ELSE statement, Nesting IF…ELSE Statement, ELSE IF Ladder), Selection control structure (Switch Statement).

**Unit-2**

**Loops:** The WHILE Statement, The DO…WHILE Statement, The FOR Statement, Jumps in Loops, **Array:** Concept of Array, Array Declaration, types of array (one and multiple dimension), Character Arrays and Strings, Subscript and pointer representation of array, Array of Pointers, Limitation of array, **Pointers**: Concept of Pointer (null pointer, wild pointer, dangling pointer, generic pointer), Pointer Expressions, Accessing the Address of a Variable, Declaring Pointer Variables, Initializations of Pointer Variable, Accessing a Variable through its Pointer, Pointer arithmetic.

**Unit-3**

**Class**: Types (auto, register, static, extern), scope rules, declaration and definition. **Function**: Function & types (User defined function, library function) Function Definition, Declaration, Function Calls, Header file and library, Function Arguments, string handling function (strlen, strcmp, strcpy, strncpy, strcat, strstr),Function recursion, Functions Returning Pointers, Pointers to Functions, Command line arguments, Application of pointer(dynamic memory allocation).

**Unit-4**

**Structure and Union:** Defining, Declaring, Accessing, Initialization Structure, nested structure, self-referential structure, bit-field, Arrays of Structures, Structures and Functions, Unions, difference between structure and union, active data member, structure within union, Self-referential Structure.

**File**: File Management in C, Defining and Opening a File, File opening modes(read, write, append), Closing a File, File operations, file and stream, Error Handling During I/O Operations, sequential and random access file, low level and high level file.

**Text Books**:

* 1. E. Balagurusamy, “Programming in ANSI C”,4/e,(TMH)

**Reference Books:**

1. B. Kernighan & Dennis Ritchie, “The C Programming Language”, 2/ePHI
2. Paul Deitel, Harvey Deitel, “C: How to Program”, 8/e, PrenticeHall.
3. P.C. Sethi, P.K. Behera, “Programming using C”, Kalyani Publisher,Ludhiana

**Practical/Tutorial: Programming Fundamentals using C Lab**

1. Write a Program to find greatest among three numbers.
2. Write a Program to all arithmetic operation using switch case.
3. Write a Program to print the sum and product of digits of an integer.
4. Write a Program to reverse a number.
5. Write a Program to compute the sum of the first n terms of the following series

S = 1+1/2+1/3+1/4+……

1. Write a Program to compute the sum of the first n terms of the following series

S =1-2+3-4+5…………….

1. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
2. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than100.
3. Write a Program to compute the factors of a given number.
4. Write a program to swap two numbers using macro.
5. Write a Program to print a triangle of stars as follows (take number of lines from user):

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1. Write a Program to perform following actions on an array entered by the user:
   1. Print the even valued elements
   2. Print the odd valued elements
   3. Calculate and print the sum and average of the elements of array
   4. Print the maximum and minimum element of array
   5. Remove the duplicates from the array
   6. Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

1. Write a Program that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
2. Write a program that swaps two numbers using pointers.
3. Write a program in which a function is passed address of two variables and then alter its contents.
4. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main()function.
5. Write a program to find sum and average of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc( ) functions.
6. Write a menu driven program to perform following operations on strings:
   1. Show address of each character in string 2
   2. Concatenate two strings without using strcat function.
   3. Concatenate two strings using strcat function.
   4. Compare two strings
   5. Calculate length of the string (use pointers)
   6. Convert all lowercase characters to upper case
   7. Convert all uppercase characters to lower case
   8. Calculate number of vowels
   9. Reverse the string
7. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.
8. Write a program to copy the content of one file to another.

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### ITM (HONOURS) SEMESTER I

**General Elective Course**

**GE-1: ORGANIZATIONAL BEHAVIOUR (Theory: 4 Credits; Practical: 2Credits) Theory Full marks: 75 (Mid-Sem: 15; End-Sem:60)**

**Practical Full marks: 25 (End semester evaluation)**

**Course Objectives:**

The objective of this course is to learn the modern trends, theories and changes in organizational behaviour. This course covers the explanations about the human behavior in the organizational context. It details the impact of individual, group and organizational factors on human behavior. The course also focuses on understanding the behavior of the employees working in the organization. It highlights the significance of Challenges and Opportunities of OB, perception, attribution, learning, organizational change, organizational culture, motivation, leadership and conflict management.

**Course Outcomes:**

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

* Understand the behaviour of people in the organization.
* Analyze the complexities associated with management of individual behaviour in the organization.
* Understand the motivation (why) behind behaviour of people in the organization.
* Cover the explanations about human behavior in the organizational context.
* Impact of individual, group and organizational factors on human behavior.
* Understand the concepts of personality, learning and attitude.

**Unit-1**

**Organizational Behaviour -** Meaning, Definition and importance, Foundations of OB, OB Models, and Challenges to OB.

### Unit-2

**Individual Behaviour**

Perception: Definition &Concept; Personality: Concept, Determinants and Personality Types (Type A and Type B, Big Five Model, MBTI Model); Learning: Concept and Theories (Classical and Operant Conditioning); Attitude: Components & Formation

**Unit-3**

**Group Behaviour**

Group Dynamics: Meaning, Formation and Types of Groups (Formal & Informal Groups), Stages of Group Development, Individual vs. Group decision making. Group vs Team. Types of Team.

**Group Communication**

Communication Types, Communication Process, Barriers to communication; Effective Communication Methods.

**Unit-4**

**Motivation -** Meaning, Nature &Importance. Motivational Theories (Maslow’s Need Hierarchy Theory, Herzberg’s two factor Theory, McClelland’s Need Theory, Vroom’s Expectancy Theory, Equity Theory); Motivational Challenges.

**Leadership -** Leadership: Nature and Importance; Leadership Styles; Leadership Theories (Trait Theory, Behaviour Theory, Contingency Theory)

**Textbooks:**

1. Organisational Behaviour: L.M.Prasad
2. Organisational Behaviour: Rao &Narayana
3. Organizational Behaviour: Gupta and Joshi(KP)

**Reference books:**

1. Organisational Behaviour: K Aswathappa(HPH)
2. Organisational Behaviour: Stephen Robbins(PHI)

#### GE-1 Practical/Tutorial: Oraganizational Behaviour

* 1. Organisation’s adaptability towards artificialintelligence.
  2. Leadership Challenges and transformation usingAI.
  3. Social media and group behaviour.
  4. People analytics in organizational behaviour.
  5. Technology enabled work practices in organisations.
  6. Converging technologies and employee perception.
  7. Industry4.0
  8. Case Study Need Hierarchical theory in Teambuilding.
  9. Expectancy Theory towards Technological Adaptation
  10. Practice of Telecommuting and remote working in IT /ITES.
  11. Team building Exercises.
  12. Personality Types.

### DSM (HONOURS) SEMESTER I

**Ability Enhancement Compulsory Course**

**AEC-1: ENVIRONMENTAL SCIENCE (4 Credits)**

**Full marks -100 (Mid-Sem: 20; End-Sem: 80)**

**Unit-1**

The Environment: The Atmosphere, Hydrosphere, Lithosphere, Biosphere, Ecology, Ecosystem, Biogeochemical Cycle (Carbon Cycle, Nitrogen Cycle), Environment Pollution: Air Pollution, Water Pollution, Soil Pollution, Radiation Pollution.

**Unit-2**

Population Ecology: Individuals, Species, Pollution, Community, Control Methods of Population, Urbanization and its effects on Society, Communicable Diseases and its Transmission, Non-Communicable Diseases.

**Unit-3**

Environmental Movements in India: Grassroot Environmental movements in India, Role of women, Environmental Movements in Odisha, State Pollution Control Board, Central Pollution Control Board.

**Unit-4**

Natural Resources: Conservation of Natural Resources, Management and Conservation of Wildlife, Soil Erosion and Conservation, Environmental Laws: Water Act, 1974, Air Act, 1981, The Wildlife (Protection) Act, 1972, Environment Protection, 1986, Natural Disasters and their Management.

**Suggested Readings:**

Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.

Gadgil,M.,&Guha,R.1993.*ThisFissuredLand:AnEcologicalHistoryofIndia*.Univ. of CaliforniaPress.

Gleeson,B.andLow,N.(eds.)1999.*GlobalEthicsandEnvironment*,London,Routledge. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ.Press*.*

Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.

Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India’s Himalaya dams. *Science,* 339: 36-37.

McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books.

McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.

Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.

**DSM (HONOURS) SEMESTER II**

**Core Course**

**C-3: DATA STRUCTURE (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**COURSE OBJECTIVE:-**

The course is designed to develop skills to design and analyze simple linear and non linear data structures. It strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structures

**COURSE OUTCOME:-**

After learning this paper, students should be able to know :-

* Basic terminology of data structure ,time and space complexity, review of array, structures, pointer concepts, dynamic memory allocation and various operations in linked lists.
* Concept of stack & queue, its representations, operations & applications.
* Concept of Tree, various types of trees, Binary tree, representation, various operations on trees, applications of trees.
* Concept of sorting, various types of sorting algorithms, Searching method, types of searching(Linear, Binary)

**Unit-1**

**Introduction:** Basic Terminology, Data structure, Time and space complexity, Review of Array, Structures, Pointers.

**Linked Lists:** Dynamic memory allocation, representation, Linked list insertion and deletion, Searching, Traversing in a list, Doubly linked list, Sparse matrices.

**Unit-2**

**Stack:** Definition, Representation, Stack operations, Applications (Infix–Prefix–Postfix Conversion & Evaluation, Recursion).

**Queues:** Definition, Representation, Types of queue, Queue operations, Applications.

**Unit-3**

**Trees:** Tree Terminologies, General Tree, Binary Tree, Representations, Traversing,

BST, Operations on BST, Heap tree, AVL Search Trees, M-way search tree, Applications of all trees.

**Unit-4**

**Sorting:** Exchange sorts, Selection Sort, Bubble sort, Insertion Sorts, Merge Sort, Quick Sort, Radix Sort, Heap sort.

**Searching:** Linear search, Binary search.

**Text Books**:

1. Classic Data Structure ,P.Samanta , PHI , 2/ed.

**Reference Books:**

1. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures”, Galgotia Publications, 2000.
2. Sastry C.V., Nayak R, Ch. Rajaramesh, Data Structure & Algorithms,I.K.International Publishing House Pvt.Ltd, NewDelhi.

**Practical/Tutorial: Data Structure Lab Write a C/ C++ Program for the followings:**

1. To insert and delete elements from appropriate position in an array.
2. To search an element and print the total time of occurrence in the array.
3. To delete all occurrence of an element in an array.
4. Array implementation of Stack.
5. Array implementation of Linear Queue.
6. Array implementation of Circular Queue.
7. To implement linear linked list and perform different operation such as node insert and delete, search of an item, reverse the list.
8. To implement circular linked list and perform different operation such as node insert and delete.
9. To implement double linked list and perform different operation such as node insert and delete.
10. Linked list implementation of Stack.
11. Linked list implementation of Queue.
12. Polynomial representation using linked list.
13. To implement a Binary Search Tree.
14. To represent a Sparse Matrix.
15. To perform binary search operation.
16. To perform Bubble sort.
17. To perform Selection sort.
18. To perform Insertion sort.
19. To perform Quick sort.
20. To perform Merge sort.

**DSM (HONOURS) SEMESTER II**

**Core Course**

**C-4: INTRODUCTION TO PROBABILITY and STATISTICS (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course Objectives:**

To familiar the students with the concepts which are much useful in research. To expose the students to the basics of probability theory and random processes essential for their subsequent study of different areas in computer science and allied topics.

**Learning Outcomes:**

Students will be able to

* Understand and think of random variables as an intrinsic need for the analysis of random phenomena.
* Characterize probability models and function of random variables based on single & multiples random variables.
* Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
* Understand the concept of confidence interval.
* Understand basic hypothesis testing.

**Unit-1**

Introduction to Statistics: Data Collections and Descriptive Statistics, Inferential Statistics and Probability Models, Populations and Samples.

Descriptive Statistics: Describing and Summarizing Data Sets, Chebyshev’s Inequality, Normal and Paired Data Sets, Sample Correlation Coefficient Problems.

Elements of Probability: Sample Space and Events, Venn Diagrams and Algebra of Events, Axioms of Probability, Sample Spaces Having Equally Likely Outcomes, Conditional Probability, Bayes’ Formula, Independent Events.

**Unit-2**

Random Variables and Expectations: Random Variables, Types of Random Variables, Jointly distributed Random Variables, Expectation, Properties of the expected value, Variance, Covariance and Variance of Sums of Random Variables, Moment Generating Functions. Chebyshev’s Inequality and the Weak Law of Large Numbers Problems.

Special Random Variables: Bernoulli and Binomial Distribution Function, Poisson Random Variables, Hypergeometric Random Variable, Uniform Random Variable, Normal Random Variables, Exponential Random Variables, Poisson Process, Gamma Distribution, Chi-Square Distribution, t-Distribution, f-Distribution, Logistics Distribution.

**Unit-3**

Distributions of Sampling Statistics: The Sample Mean, Central Limit Theorem, Sample Variance, Sampling Distributions from a Normal Population, Sampling from a Finite Population.

Parameter Estimation: Maximum Likelihood Estimators, Internal Estimates, Estimating the difference in Means of Two Normal Populations, Approximate Confidence Interval for the Mean of a Bernoulli Random Variable,

**Unit-4**

Hypothesis Testing: Significance levels, Tests Concerning the Mean of a Normal Population, Testing the Equality of Means of Two Normal Populations, Hypothesis Tests in Bernoulli Populations, Testing the Relationship Between Two Poisson Parameters.

Regression: Introduction, Least Squares Estimators of the Regression Parameters, The Coefficient of Determination and the Sample Correlation Coefficient, Analysis of Residual, Transforming to Linearity, Weighted Least Squares, Polynomial Regression, Multiple Linear Regression,PredictingFutureResponses,LogisticRegressionModelsforBinaryOutputData.

**Text Books:**

* 1. Introduction to Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Elsevier. Chapter1-9.
  2. Introduction to Probability and Statistics Using R by G. JayKerns,

**Practical/Tutorial: Introduction to Probability and Statistics Lab: Using R programming**

**In the Lab students will learn R from the book by G. Jay Kerns and then conduct the following six (6) experiments. The detail experiments given in the Lab.**

Lab 1: Space Vacation Histogram experiment using R function called Space vacation.r

Lab 2: Testing of Chebyshev’s Theorem using R.

Lab 3: Using R to simulate experiments.

Lab 4: Using R to create Binomial Distributions.

Lab 5: Understanding of Normal Distributions and compare theoretical distribution to some real data Lab 6: Using R, empirically study how Central Limit Theorem works.

Laboratory Project 1

**Reminder for Projects:** Every week or so, you will be required to conduct statistical experiment on the computer in the lab and, most importantly, write-up a short report of the results at home. The report should answer ALL the questions asked and will almost always include some graphics created by **R** in the computer lab.

**Tips for doing Projects:** Some simple hints for doing a good job on the Lab Projects.

* READ the entire assignment through, including the Thought Questions before doing any thing.
* THINK about the *’essay’* questions while doing the computer work.

Use a word processor to write-up the results. Neat results and presentation will win you respect and praise from your professors!

*•*

# The Story:

Theyearis2020andinterplanetaryvacationtravelisalltherage.ForyourupcomingJulyvacation, you and your friend Bob have looked through the travel brochures and decided upon two possible planets to visit; either Planet X or Planet Y.

”I don’t like it too hot”, says Bob as you try to decide, ”In fact, I always get very cranky and unreasonable if the temperature is much above 80 degrees.”

You look through the brochures and find out that the average temperature of both Planet X and PlanetY in July is a comfortable 63 degrees. Even better, the very sophisticated brochure for PlanetY indicates that the median temperature there in July is a cool 55 degrees.

”I like PlanetY”, says Bob rather emphatically. ”We should go there.”

You, on the other hand, have taken a statistics class and know a bit about these things. To avoid making a big mistake and vacationing with a hot, cranky and unreasonable Bob, youdecide to download data containing daily July temperature readings for the two planets. You are going to make an INFORMED CHOICE based on statistics.

**Yourtask** is using ideas you’ve learned about descriptive statistics, make a clear and organized presentation to Bob about why you should NOT go to PlanetY on vacation. Remember, besides being a bit heat sensitive, Bob knows nothing about statistics so you will have to explain things clearly.

# TheLaboratory:

To create 600 samples of temperature data for PlanetX and PlanetY, you will need to access an R

function called SpaceVacation() in Prof. Champanerkar’s directory. Type:

* [source(file=url("http://www.math.csi.cuny.edu/~abhijit/113/data/SpaceVacation.r"))](http://www.math.csi.cuny.edu/~abhijit/113/data/SpaceVacation.r)

To create the data and store it in a data frame called Temps,

* Temps =SpaceVacation()

Note, every time you execute the SpaceVacation function, you are actually *creating* new data. Your data will be slightly different than anyone else’s data.

To get at the data, attach it and see how it is named:

* attach(Temps)
* names(Temps)
* length(TempX) # Should return ’600’ for 600 pieces ofdata

# TheHistograms:

Now that you have the data, do some analysis and organization.

* 1. Create and print histogams for temperatures on both planets. Make sure that your name is inthetitleofthehistogram.
  2. Compare the range of July temperatures on the two planets. What is the hottest day you canexpectoneitherplanet?WhatisthecoldestJulydayeverrecordedoneach?Writethese answers on thehistograms.
  3. A check to make sure the brochures weren’t lying. What is the mean and median July temperature on each planet? Write the answers on thehistograms.

# Questions:

Answer the following questions on a separate sheet of paper. Write a sentence or two for each question. To answer some of the questions, you may use R to make your answer more precise.

* 1. Usingyourhistograms,howwouldyouestimatetheprobability(chance)thatthetemperature on a given day will be *less* than 50 degrees? Find this probability for PlanetX andPlanetY.
  2. Again using the histograms, how would you determine the probability (chance) that the temperatureonagivendaywillbe*greater*than80degrees?FindthisprobabilityforPlanetX andPlanetY.
  3. Explain the following statement: ”On an ’average day’, the temperature on PlanetX isabout 64 degrees. On PlanetY, the temperature on an ’average day’ is probably NOT the average temperature.”

# FinalReport

Write a final report to Bob. Your report should be at least half a page long and explain why you should NOT go to PlanetY on vacation. Remember again, besides being a bit heat sensitive, Bob knows nothing about statistics so you will have to explain things clearly.

# To hand in:

* 1. 2histograms(1foreachplanet)withtheanswerstothequestionslistedin(3)
  2. 1pagewiththeanswerstothequestionslistedin(4).
  3. Your finalreport.

Laboratory Project 2

**Tips for doing Projects:** Some simple hints for doing a good job on the Lab Projects.

* READtheentireassignmentthrough,includingtheThoughtQuestionsbeforedoinganything.
* THINKaboutthe*’essay’*questionswhiledoingthecomputerwork.

The report should answer ALL the questions asked and will almost always include some graphics created by **R** in the computer lab.

*•*

Use a word processor to write-up the results. Neat results and presentation will win you respect and praise from your professors!

*•*

# Chebyshev’s Theorem - PartI:

First lets test Chebyshev’s Theorem on some real data, the length of time of eruptions of the Old Faithful Geyser in Yellowstone. In R, load the data:

* data(faithful)
* help(faithful) Shows info on thedata



* attach(faithful) Loads the ’names’ in faithful intoR



* names(faithful)

Lets look at the eruption times now in variable eruptions.

* length(eruptions) How muchdata



* hist(eruptions,20)

To test Chebyshev’s theorem we need to know (1) the mean of the data and (2) the standard deviation. Use R to find these and store them in variables named, for example, emean and esd. Printoutthehistogram(withyournameonit).Onthehistogram,markthemeanand1standard deviation on theaxis.

*±*

One way to see what percentage of the data is within one, two or three standard deviations is to compute the Z-score of the data. Do this using R. Hint: z = (x - mean(x))/sd(x). Make a new variable of the zscores of the eruption data and plot a histogram of this. Print this out (with your name on it) and hand it in later.

Estimate on the Z-Score histogram the percentage of data within:

* + *±*1standarddeviationofthemean
  + *±*2 standard deviations of themean
  + *±*3 standard deviations of themean

Toactuallycalculatetheabovenumbers,usetheRcommandsum.Forexample,ifthestandard deviation of eruptions is stored in esd and the mean in emean, then to count the number of data pointsineruptionswithin*±*1standarddeviationofthemean,

* sum(eruptions>emean-esd &eruptions<emean+esd)

The percentage is easy to get, just divide by the total number of data points. Use this procedure to actually calculate the percentages you previously estimated.

**QUESTIONS:**

* 1. AccordingtoChebyshev’stheorem,whatpercentageofmeasurementsareexpectedtofallin the interval *x ±*1*.*25*s*?
  2. How many measurements actually fall in thisrange?
  3. AccordingtoChebyshev’stheorem,whatpercentageofmeasurementsareexpectedtofallin the interval *x ±*1*.*75*s*?
  4. How many measurements actually fall in thisrange?
  5. AccordingtoChebyshev’stheorem,whatpercentageofmeasurementsareexpectedtofallin the interval *x ±*1*.*00*s*?
  6. How many measurements actually fall in thisrange?
  7. How does this compare with the EmpiricalRule?
  8. Compare the actual results with Chebyshev’s prediction.Comment.

# Chebyshev’s Theorem - PartII:

Chose another data set from R’s library of data. (To list all data sets, type data()). Follow the same procedure as above to test Chebyshev’s theorem and the Empirical Rule.

* Loadthedata,finditslengthandmakeahistogram
* Onthehistogram,pencilinthemeanand*±*1standarddeviation.
* ConvertthedatatoZ-SCORESandmakeahistogram.

From the Z-SCORE histogram, estimate the percentage of data within one, one and a half, one and three-quarters, two and three standard deviations from the mean.

*•*

Calculate these percentages using sumand compare the results to Chebyshev’s Theorem and the Empirical Rule.

*•*

# Introduction to Probability andStatistics

Laboratory Project 3

**Part I: Using R to SIMULATE Experiments**

Although Einstein said that God does not play dice, R can play dice (and cards) rather easily. In this Lab assignment we will learn how to make R roll die and select cards. We can then have R quickly and conveniently play games MANY, MANY times. The output of the games can be analyzedstatistically.

The main R command we will use is sample. For example, suppose we wanted to roll one die

10 times. Since the output of any die roll is a number between 1 and 6, we could try:

* sample(1:6,10,replace=T) Select a number from 1-6, ten timesw/replacement [1] 2 1 5 2 1 6 4 3 36

or we could write a function:

* Roll1Die = function(n)sample(1:6,n,rep=T)
* Roll1Die(20)

[1] 2 3 3 5 4 2 1 3 6 1 4 6 2 1 3 2 1 5 1 4

Now we can ’Roll1Die’ as many times as we want.

Suppose we want to flip 3 coins and count the number of heads that appear. How would you tell R to flip a coin 15 times? Try

* sample(0:1,15,rep=T) #Pick either 0=Tails or1=Heads) [1] 1 1 0 1 0 1 1 1 0 0 0 1 1 10

or, perhaps more useful, write a function:

* Flip1Coin = function(n)sample(0:1,n,rep=T)
* Flip1Coin(30)

[1] 1 1 1 1 0 0 0 1 0 0 0 0 1 0 0 1 1 0 1 0 0 0 1 0 1 1 1 1 1 1

**To be answered on a separate sheet and handed in:**

1. How many Heads appeared in these 30 experiments? (use R’s sumcommand)
2. Is this number what you would expect?Why?
3. Try flipping 1,000 coins. How many heads occurred? How does this relate to the ’Empirical Definition’ ofprobability?

**Part II: Probability Distributions and Histograms**

We know that a Probability Distribution (or Probability Function) assigns a probability to eachvalueoftheRandomVariable.NowwewanttoinvestigatehowwellaTheoreticalProbability Functionfitswithactualdata.Forexample,supposeourexperimentconsistsofrollingtwodieand adding the results. We can figure out the probability of getting any of the possible outcomes:P(2)

= 1/36, P(3) = 2/36, ...., P(7) = 6/36, P(8) = 5/36 ...

We can also easily *simulate* this experiment using R. One way to get the results from one hundred experiments wouldbe

* TwoDie = Roll1Die(100) +Roll1Die(100)

To look at the results, try a histogram

* hist(TwoDie,breaks=c(1.5:12.5)) #Centers intervalson1,2,. 12

**To be answered on a separate sheet and handed in:**

1. Whatpercentageofthe100experimentsresultedin7?
2. Whatpercentageofthe100experimentsresultedin4?
3. How does this compare with the ProbabilityFunction?

We can easily make an Empirical Probability Function from the data, all we have to do is tell Rtoplottherelativefrequencyinsteadofthefrequencyonthehistogram.

* hist(TwoDie,breaks=c(1.5:12.5),prob=T) #Plot RelativeFrequency

**Do the following and hand in the answers:**

1. UseRtoconducttheexperiment50TIMES.(ieRolltwodicefiftytimes)
2. PlotandprinttheresultingRelativeHistogram.
3. On the histogram, sketch the theoretical Probability Function,P(X).
4. How well do the twocompare?
5. Repeat the process using 500 experiments.Comment.
6. Repeat the process using 5000 experiments.Comment.

**Part III: Mean of a Random Variable**

We know that the Probability Function, *P* (*X*) can be used to calculate the *mean* of a Random Variable. For Discrete Probability Distributions, the mean of a random variable *X* is written as

Σ

*µ*= *XiP* (*Xi*) *.*

For example, compute the mean (or expected value) in the Two Dice experiment

*µ*=2*·*1*/*36+3*·*2*/*36+*...*+12*·*1*/*36=7

**To Do:** Find the experimental (sample) mean for the Two Dice experiment using R. For example, to roll two dice and add up the results 100 times:

* TwoDie = Roll1Die(100) +Roll1Die(100)

The experimental mean value is simply:

* mean(TwoDie) [1]7.32

Your answer might be slightly different, but should be close to 7.

**Your tasks - hand in the answers:**

1. Try this 10 times - Does the experimental mean change? Write down the numbers you obtained.
2. Compare the mean value as computed above to the mean of the simulated data when you take 50, 500, 5000 *realizations* of the experiment in R. Comment on what happens as the number of experimentsincreases.
3. Pick one value of *n*, say *n* = 50 and run 50 experiments 10 or 20 times. Record the value of the sample mean each time. Plot a histogram of these mean values. What is the mean ofthe sample means? Explain this odd statement:

“The sample mean is a Random Variable.”

**Part IV: A coin problem (hand in all answers)**

1. Four fair coins are tossed simultaneously and the number of HEADS is recorded eachtime.
   1. Use your knowledge of Probability to construct the Probability function for this exper- iment. (What is the Random Variable? What is its Range?) Make a chart showing *X* and *P*(*X*).
   2. UseRtosimulateconductingthisexperiment50times.
   3. Compare your theoretical *P* (*X*) to the relative frequency histogram of the simulated experiments.
   4. Use R to simulate 1,000 four-coin experiments. Again, compare the relative frequency histogram you get to *P*(*X*).
   5. Calculate the theoretical mean, *µ*. Compare this to the sample mean when you find whensimulating50,100and1,000realizationsoftheexperiment.

# The Binomial Distribution

Laboratory Project 4

**Part I: Using R to create Binomial Distributions**

TostealProf.Verzani’swords:“Binomialrandomnumbersare*discrete*randomnumbers.They havethedistributionofthenumberofsuccessesin*n*independentBernoullitrialswhereaBernoulli TrialresultsineitheraSuccessoraFailure,withprobabilityofSuccessgivenby*p*.”

R can easily produce binomial random numbers. We can then *simulate* various experiments easily on the computer. For example, lets consider a True/False test with 8 questions. If astudent simply guesses at each question, the number of correct answers on the test will be a Binomial randomnumber.*n*=8isthenumberofBernoullitrials,*p*=1*/*2istheprobabilityofgettinga correct answer for this (dumb!) student. To simulate 5 such (dumb) students taking the test, use the R commandrbinom(number,n,p)

* rbinom(5,8,0.5) [1] 3 4 4 25

Theresultsshowthatthefirststudentgot3correctanswers,thesecondtwogot4correctanswers, the fourth (unlucky) student got only 2 correct answers and the fifth (lucky) student got 5 of the 8 questions correct ... she actually PASSED thetest!

Of course, its absolutely no big deal to simulate 10,000 students taking this test.

* testdat =rbinom(10000,8,0.5)

Try this and look at the relative frequency histogram of testdat. Compare this to the Theoretical BinomialProbabilityDensity.(Remember,theformulafortheprobabilityof*x*successesin*n*trials is

*P* (*x*) = *pxqn−xnCx*

For example, in this 8 question multiple choice test with straight guessing,

*P*(1)=(1*/*2)1(1*/*2)8*−*18*C*1=(1*/*2)8*·*8=8*/*256=0*.*03125

**To Do:**

1. True/FalseTest:
   1. Redo the above simulation changing the value of*p*.
   2. PlotandprinttheresultingRelativeHistogramforBinomialtestdataforsmartstudents (i.e. *p >*0*.*5) and for really dumb students (i.e. *p <*0*.*5) who are more likely to guess wrong than to guesscorrectly.
   3. Explain in words how the shape of the Distribution changes with changing values of*p*.
   4. Forthesevaluesof*p*(includingtheoriginal*p*=1*/*2experiment),computethemean value of the simulated test scores and compare this to the Theoretical mean value for a binomialdistribution.
2. MultipleChoiceTest:Nowconsideramultiplechoiceexamwith20questionsand5possible choices for eachquestion.
   1. Use R’s rbinom function to simulate the number of correct answers for 500 students takingthistestifeverystudentsimplyguessesateachquestion.
   2. Foryoursampleof500students,howmanypassedthetest?(Passingisgettingatleast 13 correctanswers.)
   3. Plotarelativefrequencyhistogramofthesimulateddata.Comparethesimulatedvalue of P(10) to the Theoretical Value ofP(10).
   4. Find the mean of your 500 student sample. Compare this to the Theoretical Mean for the binomial distribution. Are theyclose?
   5. IfaProfessorgivesthetesttoaclassof100studentsandfindsthat75%ofthestudents passed, explain, using statistics and probability, why the Professor can conclude that thestudent’swerenotsimplyguessingattheanswers.
3. ACME Light Bulbs Inc.: A light bulb manufacturer claims that their advanced production facilityonlyproducesonedefectivelightbulbineverybatchof100lightbulbsmade.ACME shipslightbulbsinboxesof20.
   1. Use R to simulate the Probability Distribution of the number of GOOD light bulbs in a box of 20 light bulbs. (What is *n*? What is *p*? Have R simulate 1,000 boxes of20.)
   2. Use the binomial distribution to find the average number of BAD light bulbs in a box. Comparethistotheresultsofthesimulation.
   3. What are the chances of getting a box of ACME light bulbs containing 1 BAD bulb? 4 BAD bulbs? 10 BADbulbs?
   4. Suppose the new production manager turns out to be completely unqualified and the probability of producing a bad bulb rises to 10%. Explain in words and pictures what will happen to the shape of the Distribution Function. Now what are the chances of getting1BADbulbinabox?

Laboratory Project 5

**How *Normal* is a Distribution?**

A large part of statistical analysis is based on the properties of normally distributed random variables. There’s a famous (infamous?) LAW that states that data coming from a large number of independent experiments will produce a Normal Distribution and as such, a lot of statistical models assume ’Normality’.

Inthisexercise, we willtakewhatweknowaboutnormaldistributionsandcomparethetheo- retical distribution to some realdata.

Begin an R session. First, lets clear out any old junk that’s lying around in the workspace. (Warning, this command will delete any work you have done!)

* rm(list=ls()) ## Removes (rm) all variables (good for savingspace)

Next, lets load a data set containing information on the air quality in New York.

* data(airquality)
* attach(airquality) ## To allow us to access the named variables byname.

The data set contains measurements of

* names(airquality)

1. "Ozone" "Solar.R""Wind" "Temp" "Month" "Day"

Ozoneistheprimaryingredientin‘smog’;themoreozoneintheair,theworsetheairquality.Too muchozoneisdangeroustoone’shealthandposesrealhazardsfortheelderlyandthosewithlung ailments. A ‘bad air’ day is one with high ozoneconcentrations.

**PreliminaryQuestion:**Takealookathistogramsofthethreemainmeasurements,Ozone,Wind and Temp. From the histograms, which could best be described by a normal distribution?Why?

Lets concentrate on the Wind measurements. Since we want to compare these measurements to the Standard Normal Distribution, the first thing we’d like to do is normalize the data. This is easy, all we want is the *z-scores* of the Wind data. In R, define a new measurement:

* zwind = (Wind -mean(Wind))/sd(Wind)
* hist(zwind,prob=T)

Nowwecancomparethedistributionof*zwind*totheStandardNormalDistribution.First,we know that 68% of Normally Distributed data lies between 1 standard deviation of the mean. To see if this is true for the Wind data, we need to compute the percentage of data in *zwind* thatlies between *±*1. InR:

*±*

* sum( zwind > -1 & zwind < 1) ## Number of data points in 1 sd ofmean [1]100
* sum( zwind > -1 & zwind<1)/length(zwind) ## Percentage of data in 1sd [1]0.6535948

Pretty close. Using the table of areas for the Standard Normal Distribution, we find that 86.64

% of Normally Distributed data lies within 1*.*5 standard deviations of the mean. Check this for the Winddata:

*±*

* sum(zwind > -1.5 & zwind <1.5)/length(zwind) [1]0.869281

Again, the Normal Distribution prediction is quite close. Is this true for other values of zwind? Is this true for the Temperature and the Ozone Distributions as well? Answers the questions below and hand in your answers.

**Questions:**

* 1. Compare the Wind data distribution to the Standard Normal curve for 5 values of *z*. i.e. Compare the percentages in the Table in the book (for the standard normal distribution) to the percentages found usingR.
  2. Compute the following Probabilities using (a) the Wind Data and (b) the Normal Distribu- tion.
     1. Prob(Wind*>*10mph)
     2. Prob(Wind *>*15mph)
     3. Prob(Wind*>*20mph)
     4. Prob(Wind *<*5mph)
  3. RescaletheOzoneandTemperaturedatatogetzscores.Re-dothecomparisonsinQuestion1 above for these distributions. Which of the three is the ’most normal’? Why? Give numbers tosupportyourconclusion.Whichofthethreeis’least’normal.
  4. A (lazy) statistician decides to build a model for Ozone concentration in New York basedon a normal distribution. Assume ozone concentration is normally distributed with mean and standard deviation given by the data in Ozone. What does this Normal model predict for the chances of finding an Ozone Concentration (1) Greater than 70, (2) Greater than 110 ? Howdothesepredictionscomparetotheactualdata?Explainhowandwhyanormalmodel mightunderpredictthechancesof‘badair’days.

# Introduction to Probability andStatistics

Laboratory Project 6

### Investigating The Central LimitTheorem

Key to understanding Inferential Statistics is the most popular statistical LAW known as the *CentralLimitThoerem*.Inanutshell,thispowerfultheoremstatesthreefactsaboutthestatistics of *samplemeans*.

Given random samples of size *n* selected from some population with mean = *µ* and standard deviation *σ*, the following relationships hold:

* ThemeanofthepopulationandthemeanofthesamplesareEQUAL.

*µx*= *µ*

Thestandarddeviationofthepopulation(*σ*)andthestandarddeviationofthesamplemeans (*σx*) are related by theformula:

*•*

*σ*

*σx*= *√n*

No matter what the distribution of the random variable *x* is, the distribution of the sample means is NORMAL.

*•*

In this exercise, we will use R to take a look at these 3 facts and see, empirically, how the Central Limit Theorem works.

First start up an R session and lets clear out any old junk that might be lying about in the workspace. (Warning, this command will delete any work you have done!! Use with care! )

* rm(list=ls()) ## Removes (rm) all variables (good for savingspace)

Next, lets create a bunch of data. Let’s consider a game like Yahtzee! where you roll 6 dice. We want to keep track of the number of ONES that appear in each roll. Can you figure out what the probability distribution of this random variable (*X* = number of ONES in six rolls) is? Is it binomial?Ifso,whatare*p*,*q*and*n*?

It is a binomial distribution. To get R to roll 6 dice 10,000 times and count the number of ONES in each roll and store it in variable *x*, try

* x =rbinom(10000,6,1/6)
* hist(x,breaks=c(-0.5:6.5),prob=T)

Look at the distribution, you’ve produced. It’s definitely not normal. What should the mean and standard deviation be? Check them using R. Are they close to the theoretical values?

Now we want to try sampling the population data. Suppose we want to take samples ofsize

1. Wecandothis inRwiththe samplecommand.Letsstore onesampleof size40inxsampand look at the sampledistribution.

* xsamp =sample(x,40)
* hist(xsamp,breaks=c(-0.5:6.5),prob=T)

How does this sample compare with the population? What is the sample mean?

We can take a number of different samples reusing the samplecommand, looking at the mean each time.

* xsamp =sample(x,40)
* mean(xsamp) [1]0.975
* xsamp =sample(x,40)
* mean(xsamp) [1]1.025
* xsamp =sample(x,40)
* mean(xsamp) [1]1.225

Notice the **sample mean** is a random variable. It is different for each sample. The Central Limit Theorem is concerned with the statistics of this sample mean.

Supposewewanttolookatthemeanvalueof100differentsamplesof40.Wecaneasilycreate thisrandomvariable(letscallitsampmean)inR,usingaloop.Trythis:

* sampmean=numeric(0) # make a place to store the samplemeans
* for (i in 1:100) sampmean[i] = mean(sample(x,40)) #find mean of 100 samples of40

Now lets investigate the three parts of the Central Limit Theorem. First, the mean of *x* should equal the mean of the sample means. Check it.

* mean(x) [1]1.0126
* mean(sampmean) [1]1.0175

Not perfect but pretty darn close.

Second, the standard deviation of the sample means and the population are related by *σx*=

√

*σ/* (*n*). In R, we compare

* sd(sampmean) #$\sigma{\overline{x}}$ [1]0.1375462

√

to the population standard deviationdevidedby (*n*)

* sd(x)/sqrt(40) [1]0.1445272

Ok, not perfect, but still pretty close.

The last thing the Central Limit Theorem says is that, no matter what the distribution of *x*, the sample means should be Normally Distributed. Is this the case here? Look at

* hist(sampmean)

Is it ’normal looking’?

**TO DO:**

* 1. Redo the above analysis for samples of size 50, 100 and 500. Comment on thefollowing:
     1. How do the histograms of samp mean change as the sample size is increased? Does the standard deviation increase or decrease? Is the sample mean looking’ normal’?
     2. Howdothefirsttwopredictionsofthecentrallimittheoremcomparetotheactualdata asthesamplesizeisincreased?Does*µx*approach*µ*?Howaboutthesecondpartofthe Central Limit Theorem?
  2. Redo the analyis for a different population distribution with sample sizes 50, 100 and 500. You may want to create data using a different binomial distribution or you may try out the Rcommandsrexp(10000,.1)(exponential,long-tails)orrpois(1000,4)(PoissonDistribu- tion,non-normal).Whateveryouchoseasthepopulation,examinewhathappenstovarious sized sample means.Check each part of the Central Limit Theorem.

SpaceVacation <- function(n=100)

{T1 = 90 + rnorm(2\*n)\*rexp(2\*n,0.5) T2 = 50 + rnorm(4\*n,0,8)

TempY = c(T1,T2)

TempX =rnorm(6\*n,63.5,7)

Vacation = data.frame(TempX,TempY) return(Vacation)}

### DSM (HONOURS) SEMESTER II

**Generic Elective Course**

**GE-2: FINANCIAL MANAGEMENT (6 Credits)**

**Full marks -100 (Mid-Sem: 20; End-Sem: 80)**

**Course Objectives:**

To help the students to develop cognizance of the importance of Financial Management in corporate valuation.To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control Debt Equity incurrence and improve results. To know about the various financial institutions.

**Learning Outcomes:**

* Course Outcomes On completion of this course, the students will be able to Demonstrate the applicability of the concept of Financial Management to understand the managerial Decisions and Corporate Capital Structure.
* Understand about the different sources of finance. Analyse the complexities associated with management of cost of funds Knowledge on the different financial institutions.
* The main goal of this course is to develop a foundation of financial management concepts.
* This will enable the student to understand how corporations make important investment and financing decisions, and how they establish working capital policies.
* The course also lays a foundation for more complex financial topics that arise in additional elective courses in finance.
* This course in financial management describes the corporation and its operating environment; it will help any future manager to understand how the finances of a company work, and how they will be interfacing with finance.

**Unit-1**

**Introduction & Basic Concepts:** Important functions of Financial Management, Objectives of the firm: Profit maximization vs. Value maximization, Role of Chief Financial Officer. Financial environment in which a firm has to operate, Concepts of Annuity and Perpetuity, Risk-return relationship (concepts only)

**Unit-2**

**Basic Theoretical Framework:** The financial system and its technology; The factors affecting the stability of the financial system; Development finance vs. universal banking; Financial intermediaries and Financial Innovation; RBI-Central Banking.

**Unit-3**

**Financial Institutions:** A brief historical perspective. An update on the performance of IDBI, ICICI, IFCI and SFCs, LIC &GIC, Banking Institutions: Commercial banks - the public and the private sectors - structure and comparative performance, problems of competition; interest rates, spreads, and NPAs. Bank capital - adequacy norms and capital market support.

**Non-banking financial institutions:** Evolution, control by RBI and SEBI. A perspective on future role, Unit Trust of India and Mutual Funds, Reserve bank of India Framework for/Regulation of Bank Credit .

**Unit-4**

**Sources of Finance and Cost of Capital/ Financing Decisions:** Different sources of finance; long term and short term sources, Cost of capital: concept, relevance of cost of capital, Implicit and Explicit cost, specific costs and weighted average cost, rationale of after tax weighted average cost of capital, marginal cost of capital. (Concepts only).

**Text Books:**

1. Fundamentals of Financial Management, VanHorne,Pearson
2. Essentials of Financial Management, IM Pandey,Vikas
3. Financial Management, Khan & Jain, McGrawHill,
4. Financial Management, Srivastav & Misra,Oxford.

**Reference Books:**

1. Financial Management, G Sudarsan Reddy,HPH
2. Financial Management – Tulsian (SChand)
3. Fundamentals of Financial Management, Brigham,Cengage
4. Financial Management by PrasannaChandra , Tata McGrawHill
5. Financial Management, Rustogi, GalgotiaPublishing.

**DSM (HONOURS) SEMESTER II**

**General Elective Course**

**GE-2: GENERAL MANAGEMENT (6 Credits)**

**Theory Full marks: 100 (Mid-Sem: 20; End-Sem: 80)**

**Course Objectives:**

Objectives to provide adequate basic understanding about Management Education among the students.To develop and implement functional and general management skills to make strategic decisions in the real – era. To assess leadership styles from the perspectives of the role of the leader and leadership effectiveness in organizations that are managed by function, by matrix, and by projects. To describe the effective management skills needed to maximize individual and organizational productivity related to the internal and external environment and issues of ethics and social responsibility;

**Learning Outcomes:**

* Course Outcomes On completion of this course, the students will be able to: Evaluate emerging business models and its complexities, manage change, and optimize business performance in a dynamic environment.
* Assess leadership styles from the perspectives of the role of the leader and leadership effectiveness in organizations that are managed by function, by matrix, and by projects.
* Students will understand the management process and able to control the work process of the organization
* In this course student will learn different strategies of organization development planning.
* Relevance of strategic management and benefits of it.

**Unit-1**

**Nature of Management:** Meaning, Definition, it's nature purpose, importance & Functions,ManagementasArt,Science&Profession-ManagementassocialSystem Concepts ofmanagement-Administration-Organization.

**Evolution of Management Thought**: Contribution of F.W.Taylor, Henri Fayol

,Elton Mayo, Chester Barhard& Peter Drucker to the management thought. Various approachestomanagement(i.e.Schoolsofmanagementthought)IndianManagement Thought.

**Unit-2**

**Functions of Management (Part-I)**

**Planning** - Meaning - Need & Importance, types levels– advantages & limitations, Forecasting - Need & Techniques, Decision making - Types - Process of rational decision making & techniques of decision making, **Organizing** - Elements of organizing & processes: Types of organizations, Delegation of authority - Need, difficulties in delegation –Decentralization,

**Unit-3**

**Functions of Management (Part-II)**

**Staffing** - Meaning & Importance, Direction - Nature – Principles, Communication - Types & Importance, Motivation - Importance – theories, Leadership - Meaning - styles, qualities & functions of leaders **Controlling**-Need, Nature, importance, Process & Techniques, Coordination -Need, Importance.

**Unit-4**

**Strategic Management**

Definition, Classes of Decisions, Levels of Decision, Strategy, Role of different Strategist, Relevance of Strategic Management and its Benefits, Strategic Management in India.

**Text Books:**

* 1. Horold Koontz and IteinzWeibrich, Essential of Management, McGraw Hills International
  2. K.Aswathapa, Essential of Business Administration, Himalaya PublishingHouse

**Reference Books:**

1. L.M.Parasad Principles & practice of management - Sultan Chand & Sons - New Delhi
2. Tripathi, Reddy, Principles of Management, Tata McGrawHill

**DSM (HONOURS) SEMESTER II**

**Ability Enhancement Compulsory Course AEC-2: MIL (English/Odia/Hindi) (4 Credits)**

**Full marks -100 (Mid-Sem: 20; End-Sem: 80)**

**English**

**Unit 1: Short Story**

1. Jim Corbett – The Fight betweenLeopards
2. Dash Benhur – TheBicycle
3. Dinanath Pathy – George V HighSchool
4. Alexander Baron – The Man Who knew toomuch
5. Will F Jenkins – UneasyHomecoming

**Unit 2: Prose**

1. Mahatma Gandhi – The way to EqualDistribution
2. S Radhakrishnan – A Call toYouth
3. C. V. Raman – Water- The Elixir ofLife
4. Harold Nicolson – An EducatedPerson
5. Claire Needell Hollander – No Learning WithoutFeeling

**Unit 3:**

1. Comprehension of a passage and answering thequestions

**Unit 4:**

1. Language exercises-test of vocabulary andgrammar

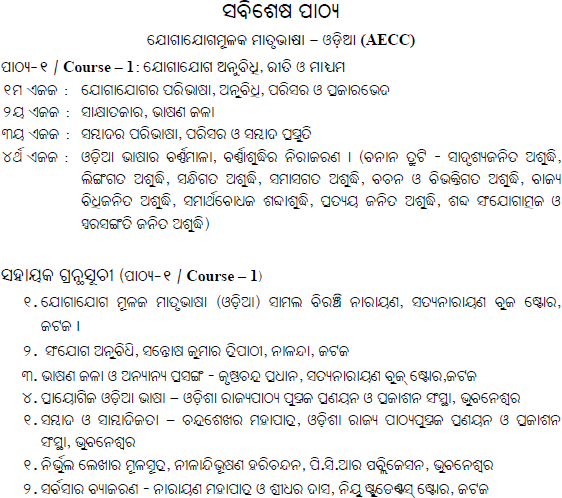
**Text Books:**

All Stories and Prose pieces

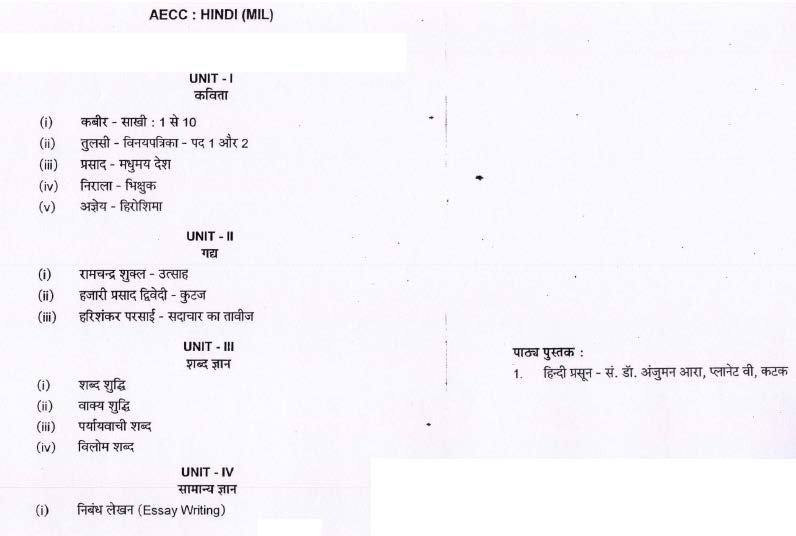
**Reference Books:**

1. The Widening Arc: A Selection of Prose and Stories, Ed. A R Parhi, S Deepika, P Jani,Kitab Bhavan, Bhubaneswar.
2. A Communicative Grammar of English, GeoffreyLeech.
3. A University Grammar of English, Randolph Quirk and SidneyGreenbaum
4. Developing Reading Skills. F. Grellet. Cambridge: Cambridge University Press,1981

**Odia**



**Hindi**



### DSM (HONOURS) SEMESTER III

**Core Course**

**C-5: COMPUTER ORGANIZATION (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course Objectives:**

This course is intended to provide basics involved in data representation and manipulation, data transfer techniques, identify types of instructions, architecture of processing of machine instructions and understand the basics of hardwired and micro-programmed control of the CPU, elements of memory hierarchy and hazards.

**Course Outcomes:**

**The student will be able to**

* Define different number systems, binary addition and subtraction, 2’s complement representation and operations with this representation
* Understand computer architecture concepts related to design of modern processors,

memories and I/Os.

* Understand performance of ALU implementation and performance of memories.

Have the knowledge about principle of pipeline and handling of different hazards

**Unit-1**

Basic Structure of Computers: Computer Types, Functional Units, Input Unit, Memory Unit, Arithmetic and Logic Unit, Output Unit, Control Unit, Basic Operational Concepts, Bus Structures, Software. Machine Instructions and Programs: Numbers, Arithmetic Operations, and Characters: Number Representation, Addition of Positive Numbers, Addition and Subtraction of Signed Numbers, Overflow of Integer Arithmetic, Floating-Point Numbers & Operations, Characters,MemoryLocationsandAddresses,ByteAddressability,WordAlignment,Accessing Numbers, Characters, and Character Strings, Memory Operations, Instructions and Instruction Sequencing, Register Transfer Notation, Basic Instruction Types, Instruction Execution and Straight-Line Sequencing, Branching, Condition Codes, Generating Memory Addresses, Addressing Modes, Implementation of Variables and Constants, Indirection and Pointers, Indexing and Arrays, RelativeAddressing.

**Unit-2**

Basic Processing Unit: Register Transfers, Performance on Arithmetic or Logic Operation, fetchingaWordfromMemory,StoringaWordinMemory.ExecutionofaCompleteInstruction, Branch Instruction, Multiple Bus Organization Hardwired Control, A Complete Processor. Micro-programmed Control: Microinstructions, Microprogram Sequencing, Wide- Branch Addressing, Microinstructions with Next-Address Field, Prefetching Microinstructions, Emulation.

**UNIT-3**

Input/ Output Organization: Accessing I/O Devices, Interrupts, Interrupt Hardware, Enabling & Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions. Direct Memory Access, Bus Arbitration, Buses, Synchronous Bus, Asynchronous Bus, Interface Circuits: Parallel Port, Serial Port, Standard I/O Interfaces, Peripheral Component Interconnect (PCI) Bus, SCSI Bus, Universal Serial Bus(USB)

**Unit-4**

Pipelining: Role of Cache Memory, Pipeline Performance, Data Hazards: Operand Forwarding, Handling Data Hazards in Software, Side Effects. Instruction Hazards: Unconditional Branches, Conditional Branches and Branch Prediction. Influence on Instruction Sets: Addressing Modes, Condition Codes, Data path and Control Considerations. Superscalar Operation: Out-of-Order Execution, Execution Completion, Dispatch Operation, RISC & CISC Processors.

**Text Books**

1. Carl Hamacher, Z. Vranesic, S. Zaky: Computer Organization, 5/Ed (TMH)

**Reference Books**

1. William Stallings: Computer Organization and Architecture (Design forPerformance), 9/Ed
2. S. Brown, & Z. Vranesic, “Fundamentals of Digital Logic Design with VHDL”, 2/Ed, McGraw-Hill.

**Practical/Tutorial: Computer Organization Lab**

1. Study of the complete Architecture of 8085 Microprocessor along with its instructionset.
2. Introduction to GNU Simulator 8085, with itsfeatures.
3. Write an Assembly Language Program to add N consecutivenumbers.
4. Write an Assembly Language Program to find the smallest and largest number from a given series.
5. Write an Assembly Language Program for subtraction of two 8-bitnumbers.
6. Write an Assembly Language Program for displaying a Rolling message “Hello123”.
7. Write an Assembly Language Program to perform ASCII to Decimalconversion.
8. Write an Assembly Language Program to add two unsigned binarynumbers.
9. Write an Assembly Language Program to subtraction of two unsigned binarynumbers.

**Demonstrate the followings:**

1. Assembling and Dis-assembling ofcomputer.
2. Trouble shooting inComputer.

### DSM (HONOURS) SEMESTER III

**Core Course**

**C-6: OPERATING SYSTEMS (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**COURSE OBJECTIVES**

This course has two components: a theory component to teach you the concepts and principles that underlie modern operating systems, and a practice component to relate theoretical principles with operating system implementation. In the theory component, you will learn about processes and processor management, concurrency and synchronization, memory management schemes, file system and secondary storage management, security and protection, etc.

**COURSE OUTCOMES**

* Understands the different services provided by Operating System at different level.
* They learn real life applications of Operating System in every field.
* Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock.
* They will learn different memory management techniques like paging, segmentation and demand paging etc.

**Unit–1**

Introduction to Operating System, System Structures: Operating system services, system calls, system programs, Operating system design and implementation, Operating system structure.

**Unit–2**

Process Management: Process Concept, Operations on processes, Process scheduling and algorithms, Inter-process Communication, Concepts on Thread and Process, Deadlocks: Deadlock detection, deadlock prevention, and deadlock avoidance fundamentals.

**Unit-3**

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual Memory Management: Concepts, implementation (Demand Paging), Page Replacement, Thrashing.

**Unit–4**

Storage Management: File System concept, Access Methods, File System Mounting, File Sharing and File Protection, Implementing File Systems, Kernel I/O Systems.

**Text book:**

* 1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, Eighth Edition, Wiley Student Edition2009.

**Reference book:**

1. Modern Operating System, Tanenbaum,Pearson, 4/Ed.2014
2. Richard F Ashley, Linux with Operating System Concepts, Chapman and Hall/CRC Published August 26,2014
3. Richard Blum, Linux Command Line and Shell Scripting Bible, O’Reilly

**Practical/Tutorial: Operating System Lab**

1. Write a program (using *fork()* and/or *exec()* commands) where parent and childexecute:
   1. same program, samecode.
   2. same program, differentcode.
   3. before terminating, the parent waits for the child to finish itstask.
2. Write a program to report behavior of Linux kernel including kernel version, CPU type and model. (CPUinformation)
3. Write a program to report behavior of Linux kernel including information on configured memory, amount of free and used memory. (memoryinformation)
4. Write a program to print file details including owner access permissions, file accessime,

5.

1. file name is given asargument.
2. Write a program to copy files using systemcalls.
3. Write a programusing C to implement FCFS schedulingalgorithm.
4. Write a program using C to implement Round Robin schedulingalgorithm.
5. Write a program using C to implement SJF schedulingalgorithm.
6. Write a program using C to implement non-preemptive priority based schedulingalgorithm.
7. Write a program using C to implement preemptive priority based scheduling algorithm.
8. Write a program using C to implement SRTF schedulingalgorithm.
9. Write a program using C to implement first-fit, best-fit and worst-fit allocation Strategies.

### DSM (HONOURS) SEMESTER III

**Core Course**

**C-7: DATABASE MANAGEMENT SYSTEMS (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**COURSE OBJECTIVES:**

* To explain basic database concepts, applications, data models, schemas and instances.
* To demonstrate the use of constraints and relational algebra operations. IV. Describe the basics of SQL and construct queries using SQL.
* To emphasize the importance of normalization in databases.
* To facilitate students in Database design
* To familiarize issues of concurrency control and transaction management.

**COURSE OUTCOMES:**

At the end of the course the students are able to:

* Apply the basic concepts of Database Systems and Applications.
* Use the basics of SQL and construct queries using SQL in database creation and interaction.
* Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
* Analyze and Select storage and recovery techniques of database system.

**Unit-1**

Introduction to Database and Database Users, Database System Concepts and Architecture: data Models, schema, and instances, Conceptual Modeling and Database Design: Entity Relationship (ER) Model: Entity Types, Entity Sets, Attributes, Keys, Relationship Types, Relationship Sets, RolesandStructuralConstraints,WeakEntityTypes,ERNamingConventions.EnhancedEntity- Relationship (EER)Model.

**Unit-2**

Database Design Theory and Normalization: Functional Dependencies, Normal Forms based on Primary Keys, Second and third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

**Unit-3**

Relational data Model and SQL: Relational Model Concepts, Basic SQLs, SQL Data Definition and Data types, Constraints in SQL, Retrieval Queries in SQL, INSERT, DELETE, UPDATE Statements in SQL, Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Binary Relation: JOIN and DIVISION.

No SQL: Introduction to NoSQL Database, Types and examples of NoSQL Database Systems, Comparative study of SQL and NoSQL.

**Unit-4**

Introduction to Transaction ProcessingConcepts and Theory: Introduction to Transaction Processing, Transaction and System Concepts, Properties of Transactions, Recoverability, Serializability, Concurrency Control Techniques, Locking techniques for Concurrency Control, Concurrency Control based on Time-Stamp Ordering.

**Text Book:**

1. Fundamentals of Database Systems, 6th edition, RamezElmasri, ShamkantB.Navathe, Pearson Education

**Reference Book:**

1. An Introduction to Database System, Date C.J.- Pearson Education, New Delhi-200

**Practical/Tutorial: Database Systems Labs**

Create and use the following database schema to answer the given queries.

**EMPLOYEE Schema**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Field**  Eno | **Type**  Char(3) | **NULL**  NO | **KEY**  PRI | **DEFAULT**  NIL |
| Ename | Varchar(50) | NO |  | NIL |
| Job\_type | Varchar(50) | NO |  | NIL |
| Manager Hire\_date | Char(3) Date | YesNO | FK | NIL NIL |
| Dno | Integer | YES | FK | NIL |
| Commission | Decimal(10,2) | YES |  | NIL |
| Salary | Decimal(7,2) | NO |  | NIL |

**DEPARTMENT Schema**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field** | **Type** | **NULL KEY** | **DEFAULT** |
| Dno | Integer | No PRI | NULL |
| Dname | Varchar(50) | Yes | NULL |

Location Varchar(50) Yes NewDelhi

**Query List**

* 1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearingfirst.
  2. Query to display unique Jobs from the EmployeeTable.
  3. Query to display the Employee Name concatenated by a Job separated by acomma.
  4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column asTHE\_OUTPUT.
  5. QuerytodisplaytheEmployeeNameandSalaryofalltheemployeesearningmorethan

$2850.

* 1. Query to display Employee Name and Department Number for the Employee No=7900.
  2. Query to display Employee Name and Salary for all employees whose salary is not in the range of $1500 and$2850.
  3. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order byname.
  4. Query to display Name and Hire Date of every Employee who was hired in1981.
  5. Query to display Name and Job of all employees who don’t have a currentManager.
  6. Query to display the Name, Salary and Commission for all the employees who earncommission.
  7. Sort the data in descending order of Salary andCommission.
  8. Query to display Name of all the employees where the third letter of their name is‘A’.
  9. Query to display Name of all employees either have two ‘R’s or have two ‘A’s in their name and are either in Dept No = 30 or their Mangers Employee No = 7788.
  10. Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by5%.
  11. Query to display the CurrentDate.
  12. Query to display Name, Hire Date and Salary Review Date which is the 1stMonday after six months ofemployment.
  13. Query to display Name and calculate the number of months between today and the date each employee washired.
  14. Query to display the following for each employee <E-Name> earns <Salary> monthly but wants <3\*Current Salary>. Label the Column as DreamSalary.
  15. Query to display Name with the 1stletter capitalized and all other letter lower case and length of their name of all the employees whose name starts with ‘J’, ‘A’ and ‘M’.
  16. Query to display Name, Hire Date and Day of the week on which the employeestarted.
  17. Query to display Name, Department Name and Department No for all theemployees.
  18. Query to display Unique Listing of all Jobs that are in Department #30.
  19. Query to display Name, Department Name of all employees who have an ‘A’ in theirname.
  20. Query to display Name, Job, Department No. and Department Name for all the employees working at the Dallaslocation.
  21. Query to display Name and Employee no. Along with their Manger’s Name and the Manager’s employee no; along with the Employees Name who do not have a Manager.
  22. Query to display Name, Department No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.
  23. Query to display Name and Salaries represented by asterisks, where each asterisk (\*) signifies $100.
  24. Query to display the Highest, Lowest, Sum and Average Salaries of all theemployees.
  25. Query to display the number of employees performing the same Job typefunctions.
  26. Query to display the no. of managers without listing theirnames.
  27. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in thatdepartment.
  28. Query to display Name and Hire Date for all employees in the same dept. asBlake.
  29. Query to display the Employee No. And Name for all employees who earn more thanthe averagesalary.
  30. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a‘T’.
  31. Query to display the names and salaries of all employees who report toKing.
  32. Query to display the department no, name and job for all employees in theSale

### DSM (HONOURS) SEMESTER III

**Generic Elective Course**

**GE-3: DECISION MANAGEMENT SYSTEMS (6 Credits)**

**Theory Full marks: 100 (Mid-Sem: 20; End-Sem: 80)**

**Course Objectives:**

To describe the role of information technology and decision management systems in business andrecord the current issues with those of the firm to solve business problems.Tointroduce the fundamental principles of systems analysis anddesign and develop an understanding of the principles and techniques used.To enable students understand the various knowledge representation methods and differentexpert system structures as strategic weapons to counter the threats to business and makebusiness more competitive.

**Learning Outcomes:**

* Relate the basic concepts and technologies used in the field of decision management systems.
* Compare the processes of developing and implementing decision management systems.
* Manager’s will be able to solve problems and can go for better decisions about the areas where insight needed to support selection of decisionalternatives.

**Unit–1**

Introduction Artificial Intelligence, Digital Decisioning, Digital Decisioning principles.

**Unit–2**

Discover and Model Decisions - Characteristics of Suitable Decisions - A Decision Taxonomy - Finding Decisions - Documenting Decisions - Prioritizing Decisions. Design and Implement Decision Services - Build Decision Services - Integrate Decision Services - Best Practices for Decision Services Construction.

**Unit–3**

Monitor and Improve Decisions - What Is Decision Analysis? - Monitor Decisions - Determine the Appropriate Response - Develop New Decision-Making Approaches - Confirm the Impact Is as Expected - Deploy the Change.

**Unit–4**

Enablers for Decision Management Systems: People Enablers, Process Enablers, Technology Enablers.

**Text books:**

1. James Taylor, “Decision Management Systems-A Practical guide to using Business rules and Predictive Analytics”, IBM Press,2012.
2. James Tayler, ``Digital decisioning: Using Decisioning Management to deliver Business Impact on IA, Meghan-Kiffer Press,2019.

**DSM (HONOURS) SEMESTER III**

**Skill Enhancement Course**

**SEC-1: COMMUNICATIVE ENGLISH (4 Credits)**

**Full marks -100 (Mid-Sem: 20; End-Sem: 80)**

**Unit-1: Introduction**

1. What iscommunication?
2. Types of communication (Horizontal, Vertical, Interpersonal,Grapevine),
3. Uses of Communication, Inter-cultural communication, Communication today: (iv)Distinct features of Indianisation, alternative texts of language learning, global English

and English in the print and electronic media in India.

**Unit-2: The Four Skills and Prospect of new material in language learning**

1. Listening-Passive and active, Speaking effective, intelligibility andclarity
2. Methods and techniques of reading such as skimming, scanning and searching for information;Readingtounderstandtheliteral,metaphoricalandsuggestedmeaningof a passage,
3. Identifying the tone (admiring, accusatory, ironical, sympathetic, evasive, indecisive, ambiguous, neutral) of the writer andview-points.
4. Cohesive and Coherentwriting

**Unit-3: Grammatical and Composition Skills**

1. Doing exercises like filling in the blanks, correcting errors, choosing correct forms out of alternative choices, joining clauses, rewriting sentences as directed, and replacing indicated sections with single words / opposites / synonyms, choosing to use correct punctuation marks, getting to understand and use formal and informal styles, learning to understand the usages of officialese, sexism, racism,jargon.
2. Learning to understand information structure of the sentence such as topic-focus relationship; strategies of thematization, postponement, emphasis, structural compression (deletion of redundant parts, nominalization, cleft and pseudo-cleft sentences, elliptical structures etc.), Logical Connectors between sentences, Methods of developing a paragraph, structure of an essay and methods of developing anessay

**Unit-4: Exercises in Written Communication**

1. Préciswriting
2. Note-takingskills
3. Writingreports
4. Guidelines and essentials of official correspondence for making enquiries, complaints and replies
5. Making representations; writing letters of application for jobs; writing CV, writing letters to the editor and social appeals in the form ofletters/pamphlets.

**Text Books:**

1. State Model Syllabus for Under Graduate Couse in Skill Enhancement Course (I), pdf file is available in the internet: <http://dheodisha.gov.in/Higher-Education/Listmodule-> syllabus.aspx

**Reference Books**:

*Ways of Reading: Advanced reading Skills for Students of English Literature*. Martin Montgomery et al. London: Routledge, 2007.

*Applying Communication Theory for Professional Life: A Practical Introduction*. Dainton and Zelley, [http://tsime.uz.ac.zw/claroline/backends/download.php?url=L0ludHJvX3RvX2NvbW11bmljYXRpb25fVGhlb3J5LnBkZg%3D](http://tsime.uz.ac.zw/claroline/backends/download.php?url=L0ludHJvX3RvX2NvbW11bmljYXRpb25fVGhlb3J5LnBkZg%3D%3D&cidReset=true&cidReq=MBA563)

[%3D&cidReset=true&cidReq=MBA563](http://tsime.uz.ac.zw/claroline/backends/download.php?url=L0ludHJvX3RvX2NvbW11bmljYXRpb25fVGhlb3J5LnBkZg%3D%3D&cidReset=true&cidReq=MBA563)

*Literature and the art of Communication*, Cambridge University Press.

*Vistas and Visions*. Orient Black Swan (writing and grammar exercises at the end of lessons are recommended) From *Remapping An Anthology for Degree Classes*, (‘Writing Skills’), Orient Black Swan.

*Indian English through Newspapers (*Chapter 4,5 and 6), Concept, New Delhi,2008*. Contemporary Communicative English,* S Chand

Technical Communication: A Reader Centred Approach. P.V. Anderson. Wadsworth, Cengage.

**DSM (HONOURS) SEMESTER IV**

**Core Course**

**C-8: FOUNDATION OF DATA SCIENCE & ANALYTICS (6 Credits)**

**Theory Full marks: 100 (Mid-Sem: 20; End-Sem: 80)**

**Course Objectives:**

This course is intended to understand data management like data collection, processing, analysis, interpretation and visualization by applying quantitative modelling and data analysis techniques for real world business problems. The course also provides the knowledge of statistical data analysis techniques utilized in business decision making.

**Course Outcomes:**

**The students will be able to**

* Use software tools for data storage, analysis and visualization in big-data analytics.
* Utilize EDA, inference and regression techniques.
* Apply R programming for analyzing statistical data for business decision making.
* Understand different clustering methods for big data sets.

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**Unit–1**

Definition of Big Data, Big data characteristics & considerations, Data Repositories – analyst perspective, Business drivers for analytics, Typical analytical architecture, Business Intelligence Vs Data Science, Drivers of Big Data analytics, Role of data scientist in Big data ecosystem, Application of Big data analytics.

**Unit-2**

Need of Data analytic lifecycle, Key roles for successful analytic project, various phases of Data analytic lifecycle: Discovery, Data Preparation, Model Planning, Model Building, Communicating Results, Operationalization.

**Introduction to R:** GUI of R, Getting data into & out of R, Data types in R, Basic operations, Descriptive Statistics.

**Unit–3**

Overview of Clustering, K- means, Association Rules, Apriori Algorithm, Linear Regression, Logistic Regression.

**Unit–4**

Naïve Bayesian Classifier, Decision Tress, Time Series analysis, Text Analysis.

**Text book:**

* 1. David Dietrich, Barry Hiller, “Data Science & Big Data Analytics”, EMC education services, Wiley publications,2012
  2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements ofStatistical Learning", Springer, Second Edition,2011.

**DSM (HONOURS) SEMESTER IV**

**Core Course**

**C-9: JAVA PROGRAMMING (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course Objectives:**

* To understand the basic concepts and fundamentals of platform independent object oriented language.
* To demonstrate skills in writing programs using exception handling techniques and multithreading.
* To understand streams and efficient user interface design techniques.

**Course Outcomes: After successful completion of the course, the students are able to**

* Use the syntax and semantics of java programming language and basic concepts of OOP.
* Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
* Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
* Design event driven GUI and web related applications which mimic the real word scenarios.

**Unit-1**

Introduction to Java: Java History, Architecture and Features, Understanding thesemantic and syntax differences between C++ and Java, Compiling andExecuting a Java Program, Variables, Constants, Keywords (super, this, final, abstract, static, extends, implements, interface) , Data Types, Wrapper class,Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, DoingBasicProgramOutput,DecisionMakingConstructs(conditionalstatementsandloops)and Nesting, Java Methods (Defining, Scope, Passing and ReturningArguments, Type Conversion and Type and Checking, Built-in Java ClassMethods). Input through keyboard using Commandline Argument, the Scanner class, BufferedReaderclass.

**Unit-2**

Object-Oriented Programming Overview: Principles of Object-Oriented Programming, Defining & Using Classes, Class Variables & Methods, Objects, Object reference, Objects as parameters, final classes, Garbage Collection.

Constructor- types of constructor, this keyword, super keyword. Method overloading and Constructor overloading. Aggregation vs Inheritance, Inheritance: extends vs implements, types of Inheritance, Interface, Up-Casting, Down-Casting, Auto-Boxing, Enumerations,Polymorphism, Method Overriding and restrictions. Package: Pre-defined packages and Custom packages.

**Unit-3**

Arrays: Creating & Using Arrays( 1D, 2D, 3D and Jagged Array), Array of Object, Referencing Arrays Dynamically. Strings and I/O: Java Strings: The Java Stringclass, Creating & Using StringObjects,ManipulatingStrings,StringImmutability&Equality,PassingStringsTo&From Methods, StringBuffer Classes and StringBuilder Classes. IO package: Understanding StreamsFile class and its methods, Creating, Reading,Writing using classes: Byte and Character streams,FileOutputStream, FileInputStream, FileWriter, FileReader, InputStreamReader, PrintStream, PrintWriter. Compressing and UncompressingFile.

**Unit-4**

Exception Handling, Threading, Networking and Database Connectivity:Exception types, uncaughtexceptions,throw,built-inexceptions,Creatingyourownexceptions;Multi-threading: The Thread class and Runnable interface,creating single and multiple threads, Thread prioritization, synchronization andcommunication, suspending/resuming threads. Using java.net package,OverviewofTCP/IPandDatagramprogramming.Accessingandmanipulatingdatabases usingJDBC.

**TextBooks:**

1. E. Balagurusamy, “Programming with Java”, TMH, 4/Ed,

**Reference books:**

1. Herbert Schildt, “The Complete Reference to Java”, TMH,10/Ed.

**Practical/Tutorial: Java Programming Lab**

* 1. To find the sum of any number of integers entered as command linearguments.
  2. To find the factorial of a given number.
  3. To convert a decimal to binary number.
  4. To check if a number is prime or not, by taking the number as input from thekeyboard.
  5. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command lineargument
  6. Write a program that show working of different functions of String and StringBufferclasss like setCharAt( ), setLength( ), append( ), insert( ), concat( )and equals().
  7. Write a program to create a – “distance” class with methods where distance is computedintermsoffeetandinches,howtocreateobjectsofaclassandtoseethe use of thispointer
  8. Modify the – “distance” class by creating constructor for assigning values (feetandinches)to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the firstobject.
  9. Write a program to show that during function overloading, if no matching argument is found, then Java will apply automatic type conversions(from lower to higher datatype)
  10. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of finalkeyword.
  11. Write a program to show the use of static functions and to pass variable length arguments in afunction.

1. Write a program to demonstrate the concept of boxing andunboxing.
2. Createamulti-fileprogramwhereinonefileastringmessageistakenasinputfrom the userand the function to display the message on the screen is given in another file (make use of Scanner package in thisprogram).
3. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the samepackage.
4. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or differentpackages
5. Writeaprogram–“DivideByZero”thattakestwonumbersaandbasinput,

computes a/b,and invokes Arithmetic Exception to generate a message when the denominator is zero.

1. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
2. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass ofThrowable).
3. Write a program to demonstrate priorities among multiplethreads.
4. Write a program to demonstrate different mouse handlingeventslike 2

mouseClicked( ), mouseEntered( ), mouseExited( ), mousePressed( ),

mouseReleased( ) &mouseDragged().

1. Write a program to demonstrate different keyboard handlingevents.

3

### ITM (HONOURS) SEMESTER IV

**Core Course**

**C-10: DATA COMMUNICATIONS & NETWORKING**

**(Theory: 4 Credits; Practical: 2 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course Objectives:**

This course is intended to provide an overview of the concepts and fundamentals of data communication and computer networks. It will help the students in understanding of various types of computer networks, different components of computer networks, various protocols, e-mail and communication protocols, network naming and addressing, modern technologies used in networking and their applications.

**Course Outcomes:**

**The student will be able to**

* Understand network communication using the layered concept, Open System Interconnect (OSI) and the Internet Model.
* Understand various types of transmission media, network devices.
* Understand the concept of flow control, error control and LAN protocols.
* Explain the design of and algorithms used in the physical, data link layers.
* Understand the working principles of LAN and the concepts behind physical and logical addressing, subnetting and supernetting.
* Analyze the contents in a given Data Link layer packet, based on the layer concept.
* Determine the various modulation and error detection and correction techniques and their application in communication systems.

**Unit-1**

Introduction to Data Communications and Network Models: Protocols and Standards, Layers in OSI Models, Analog and Digital Signals, Transmission Modes, Transmission Impairment, Data Rate Limits, Performance, Digital Transmission, Network Devices & Drivers: Router, Modem, Repeater, Hub, Switch, Bridge (fundamental concepts only).

**Unit-2**

Signal Conversion: Digital-to-Digital Conversion, Analog-to-Digital Conversion, Digital-to- analog Conversion, Analog-to-analog Conversion.

Transmission Media: Guided Media, Unguided Media, Switching Techniques: Packet Switching, Circuit Switching, Datagram Networks, Virtual-Circuit Networks, and Structure of a Switch.

**Unit-3**

Error Detection and Correction: Checksum, CRC, Data Link Control: Framing, Flow and Error Control, Noiseless Channels, Noisy channels, (Stop and Wait ARQ, Slidding Window Protocol , Go Back N, Selective Repeat) HDLC, Point-to-Point Protocol. Access Control: TDM,CSMA/CD, and Channelization (FDMA, TDMA, and CDMA).

**Unit-4**

Network Layer: Logical Addressing, IPv4 Addresses, IPv6 Addresses, Virtual-Circuit Networks: Frame Relay and ATM, Transport Layer: Process-Process Delivery: UDP, TCP.

Application layers: DNS, SMTP, POP, FTP, HTTP, Basics of WiFi (Fundamental concepts only), Network Security: Authentication, Basics of Public Key and Private Key, Digital Signatures and Certificates (Fundamental concepts only).

**Text Books:**

1. Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan,TMH

**Reference Books:**

Computer Networks, A.S.Tanenbaum, 4th edition, Pearson Education.

**C-14: Practical/Tutorial Computer Networks Lab Use C/C++/ any Network Simulator**

1. Simulate Even Parity generator andchecker.
2. Simulate two dimensional Parity generator andchecker.
3. Simulate checksum generator andchecker.
4. Simulate Hamming codemethod.
5. Simulate Cyclic Redundancy Check (CRC) error detection algorithm for noisy channel.
6. Simulate and implement stop and wait protocol for noisychannel.
7. Simulate and implement go back n sliding windowprotocol.
8. Simulate and implement selective repeat sliding windowprotocol.
9. Simulate and implement distance vector routingalgorithm.

**DSM (HONOURS) SEMESTER IV**

**Generic Elective Course**

**GE-4: MARKETING ANALYTICS (6 Credits)**

**Theory Full marks: 100 (Mid-Sem: 20; End-Sem: 80)**

**Course Objectives:**

To understand the concepts of marketing management To learn about the marketing process for different types of products and services To understand the tools used by marketing managers in decision situations

**Learning Outcomes:**

* To understand the marketing environment Course Outcomes On successfully completing the module students will be able to: -
* Demonstrate knowledge and critical understanding of the role and value of information, performance measurement and customer / competitor insights in marketing.
* Understand the organisational and discursive processes through which data is translated into marketing practices.
* Use IT for marketing applications and to support information retrieval, data analysis and communication.
* Explore the international and ethical dimensions of marketing analytics.
* This course will review contemporary approaches to marketing research design, data collection and analysis.
* Students will also develop an understanding of the importance of effective performance measurement (i.e., making marketing more accountable).
* Students will further develop their appreciation of market information and intelligence and acquire the specialised skills needed to plan, manage and report marketing research studies

**Unit–1**

Marketing Data Summarization: Slicing and Dicing Marketing Data with PivotTables – Using Excel charts to Summarize Marketing Data – Using Excel Functions to Summarize Marketing Data.

**Unit–2**

Forecasting Techniques: Simple Linear Regression and Correlation – Using Multiple Regression to Forecast Sales – Forecasting in the Presence of Special Events – Modeling Trend and Seasonality – Ratio to Moving Average Forecasting Method – Winter’s Method – Using Neural Networks to Forecast Sales.

**Unit-3**

Customer Needs: Conjoint Analysis – Logistic Regression – Discrete Choice Analysis – Customer Value – Introduction to Customer Value, Benefits.

Marketing Segmentation: Cluster Analysis, User-Based Collaborating Filtering – Collaborative Filtering – Using Classification Trees for Segmentation.

**Unit–4**

Retailing and Market Research Tools: Retailing – Introduction to retailing. Market Basket Analysis – Marketing Research Tools – Principal Components Analysis.

**Text book:**

* 1. Marketing Analytics: Data driven Techniques with MS-Excel, by Wayne L. Winston, Wiley,2014
  2. Marketing Analytics: Strategic models and metrics, by Stephan Sorger, CreateSpace Independent Publishing Platform,2013.

### ITM (HONOURS) SEMESTER IV

**Skill Enhancement Course**

**SEC-2: QUANTITATIVE APTITUDE and LOGICAL REASONING (4 Credits)**

**Full marks -100 (Mid-Sem: 20; End-Sem: 80)**

Course Objective:

* Understand relevance & need of quantitative methods for making business decisions
* Demonstrate a sound knowledge of fundamentals of statistics and statistical techniques
* Be able to read and interpret statistical information
* Be able to perform statistical analysis
* Be able to apply quantitative methods to solve a variety of business problems

Course outcome :

* Understand various quantitative & statistical methods
* Understand data and draw inference from data Calculate and interpret statistical values by using statistical tool (correlation & regression) .
* Design various types of graphs.
* Demonstrate an ability to apply various statistical tool to solve business problem
* Become familiar with reasoning problems.
* Able to use logic in mathematics.

**Unit-1**

Whole Numbers, Integers, Rational and irrational numbers, Fractions, Square roots and Cube roots, Surd and Indices, Problems with numbers, Divisibility.

Different formulae of Percentage, Profit and loss, Discount, Simple interest, Ratio and Proportion, Mixture, Mixture

Time and work, Pipes and Cisterns, Basic concepts of Time, Distance and Speed: relationship among them.

**Unit-2**

Concept of Angles, Different Polygons like triangles, rectangular, square, right angled triangle, Pythagorean Theorem, Perimeter and Area of Triangles, Rectangles, Circles

Raw and Grouped Data, Bar Graphs, Pie Chart, Mean, Median, Event and Sample Space, Probability.

**Unit-3**

Analogy basing on kinds of relationships, Simple Analogy: Pattern and Series of Numbers, Letters, Figures. Coding-Decoding of Numbers, Letters, Symbols (Figures), Blood relations.

**Unit-4**

Logical statement: Two premise argument, More than two premise argument using connectivity.

Venn Diagram, Mirror Images, Problems on Cubes and Dices.

**Text Books:**

1. State Model Syllabus for Under Graduate Couse in Skill Enhancement Course (II), pdf file is available in the interne[t: http://dheodisha.gov.in/Higher-](http://dheodisha.gov.in/Higher-) Education/Listmodule-syllabus.aspx

**DSM (HONOURS) SEMESTER V**

**Core Course**

**C-11: BIG DATA ANALYTICS (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course Objectives:**

Understand the Big Data Platform and its Use cases. To study the basic technologies that forms the foundations of big data. To understand the specialized aspects of big data including big data application and big data analytics. To study different types case studies on the current research and applications of big data in industry.

**Learning Outcomes:**

* Having an ability to apply mathematics and science in engineering applications.
* Having a clear understanding of the subject related concepts and of contemporary issues
* Having an ability to be socially intelligent with good SIQ (Social Intelligence Quotient) and EQ (Emotional Quotient)
* Develop a deeper understanding of the linear regression model and its limitations
* Know how to diagnose and apply corrections to some problems with the generalized linear model found in real data.
* Know how to compare relative value of different statistical models and determine which one is the best for the observed data.
* To be able to formalize the problem, to solve it by using neural network.
* To be able to draw conclusion based on extrapolation.

**Unit–1**

**Linear Methods for Regression and Classification:** Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.

**Unit–2**

**Model Assessment and Selection:** Bias, Variance, and model complexity, Bias- variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, conditional or expected test error.

**Additive Models, Trees, and Boosting:** Generalized additive models**,** Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Examples (Spam data, California housing, New Zealand fish, Demographic data).

**Unit-3**

**Neural Networks (NN) , Support Vector Machines (SVM), and K-nearest Neighbour:** Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest –Neighbour classifiers( Image Scene Classification)

**Unsupervised Learning and Random forests:** Association rules, Cluster analysis, Principal Components, Random forests and analysis.

**Unit–4**

**Inferential Statistics and Prescriptive Analytics:** Assessing Performance of a classification Algorithm (t-test, McNemar’s test, Paired t-test, paired f-test), Analysis of Variance, Creating data for analytics through designed experiments.

**Practical: Implementation of following methods using R**

##### Simple and multiple linear regression, Logistic regression, Linear discreminant analysis, Ridge regression, Cross-validation and boot strap, Fitting classification and regression trees, K-nearest neighbours, Principal component analysis, K-means clustering.

**Text books:**

* 1. Trevor Hastie, Robert Tibshirani, Jerome Friedman *, The Elements of Statistical Learning-Data Mining, Inference, and Prediction* ,Second Edition , Springer Verlag,2009.

[ chapters: 2,3(3.1-3.4,3.6),4(4.3-4.5),7(excluding 7.8 and 7.9),9(9.1,9.2),(10.1-10.5,10.8,10.10,10.14),11(11.3-11.6),12(12.1-

12.3),13.3,14(14.1-14.3.8,14.5.1),15]

* 1. E.Alpaydin*, Introduction to Machine Learning*, Prentice Hall Of India,2010,(Chapter-19)
  2. G.James, D.Witten, T.Hastie, R.Tibshirani-*An introduction to statistical learning with applications in R*, Springer,2013.(2.3,3.6.1-3.6.3,4.6.1- 4.6.3,5.3,6.6.1,8.3.1,8.3.2,10.4,10.5.1)

**References:**

## 1.C.M.Bishop –Pattern Recognition and Machine Learning,Springer,2006

2. L.Wasserman-All of statistics

### DSM (HONOURS) SEMESTER V

**Core Course**

**C-12: CLOUD COMPUTING (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**COURSE OBJECTIVE:-**

This course gives students an insight into the basics of cloud computing along with cloud services ,evolution of cloud, virtualization techniques. Cloud computing is one of the fastest growing domain from a while now. It will provide the students about major players in cloud collaborating in cloud along with it various security challenges in cloud.

**COURSE OUTCOME:-**

After learning this paper ,students should be able to know :-

* Concept of cloud , types of cloud, services of cloud, various challenges, business models around cloud, major players in cloud computing.
* students will understand in details various types of services offered in cloud also various service providers in cloud, introduction of map reduce technique ,HDFS & hadoop framework.
* Students will know various collaboration techniques in cloud and storing, sharing files in cloud.
* students will understand need for virtualization , advantages and disadvantages of virtualization ,types of virtualizations, various types of hypervisors. Students acquaint themselves with various cloud security challenges, common standards of cloud, end user access to clouds.

**Unit–1**

Cloud computing definition, Private, public and hybrid cloud, Types of cloud services: IaaS, PaaS, SaaS, Benefits and challenges of cloud computing, Evolution of cloud computing, Usage scenarios and applications, Business models around cloud, Major players in cloud computing, Issues in cloud, Eucalyptus, Nimbus, Open Nebula, CloudSim.

**Unit–2**

Software as a Service, Platform as a Service, Infrastructure as a Service, Database as a Service, Monitoring as a Service, Communication as a Service, Service providers: Google App Engine, Amazon EC2, Microsoft Azure, Sales force, Introduction to MapReduce, GFS, HDFS, Hadoop Framework.

**Unit–4**

Collaborating on Calendars, Schedules and Task Management, Collaborating Event Management,ContactManagement,ProjectManagement,CollaboratingonWordProcessing, Database: Storing and Sharing Files, Collaborating via Web-based communication tools, EvaluatingWebmailService,CollaboratingviaSocialNetworks,CollaboratingviaBlogsand Wikis.

**Unit–4**

Need for Virtualization, Pro and Cons of Virtualization, Types of Virtualization, System VM, Process VM, Virtual Machine Monitor, Virtual Machine Properties, Interpretation and binary Translation, HLL VM, Hypervisors, Xen, KVM, VMWare, Virtual Box, Hyper – V.

Cloud security challenges, Software as a Service Security, Common Standards, The Open Cloud Consortium, The Distributed Management Task Force, Standards for application developers, Standards for Messaging, Standards for Security, End user access to cloud computing, Mobile Internet device and the cloud.

**Practical:** Cloud Computing

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1. Create virtual machines that access different programs on sameplatform.
2. Create virtual machines that access different programs on differentplatforms.
3. Exploring Google cloud for thefollowing
   1. Storage
   2. Sharing ofdata
   3. Manage your calendar, to-dolists
   4. A document editingtool
4. Exploring Microsoftcloud
5. Exploring Amazoncloud
6. Exploring Opencloud

**Text books:**

1. Cloud Computing for Dummies, by J. Hurwitz , R. Bloor, M. Kanfman, and F. Haiper, Wiley India Edition, 2010 (UnitI).
2. Cloud Computing Implementation Management and Security by J. Rittinghouse and J. Ransome, CRC Press, 2010 (UnitII).
3. Cloud Computing: A Practical Approach by A. Velte, T. Velte and R. Elsenpeter, Tata McGraw Hill, 2009 (UnitII).
4. Cloud Computing: Web-based Applications That Change the Way You workand

Collaborate Online by M.. Miller, Que Publishing, August 2008 (Unit III).

1. Virtual Machines by J. E. Smith and R. Nair, Morgan Kaufmann Publishers, 2006 (Unit IV).
2. <http://cloud-standards.org/wiki/index.php?title=Main_Page>(Unit–V).

**Reference Books:**

1. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS), by M. Kavis, Wiley,2014.
2. MasteringInCloudComputingbyR.Buyya,C.VecchiolaandT.Selvi,TataMcgraw- Hill Education,2013.
3. Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and more by K. Jamsa, Jones & Bartlett Learning Company LLC,2013.

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### DSM (HONOURS) SEMESTER V

**Discipline Specific Elective Course**

**DSE-1: SOFTWARE ENGINEERING (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End Semester Evaluation)**

**Course Objectives: The course's main objective is**

Basic knowledge and understanding of the analysis and design of complex systems. To apply software engineering principles and techniques. Ability to develop, maintain and evaluate large-scale software systems. To provide the idea of decomposing the given problem into Analysis, Design, Implementation, Testing and Maintenance phases. To provide an idea of using various process models in the software industry according to given circumstances. To gain the knowledge of how Analysis, Design, Implementation, Testing and Maintenance processes are conducted in a software project. To perform independent research and analysis. Ability to work as an effective member or leader of software engineering teams.

**Learning outcomes: Upon successful completion of this course, students should be able to:**

* A basic understanding of software process models such as waterfall and evolutionary models is required.
* Ability to understand the problem statement and able to describe the Requirement analysis, creating a data model, use cases, computing function point, effort , architectural design and path testing of a software project.
* Software requirements and SRS papers are understood.
* An understanding of project management's responsibilities, which includes planning, scheduling, risk management, and so on.
* Explain the differences between data models, object models, context models, and behavioural models.
* Knowledge of various software architectural styles.
* Familiarity with implementation difficulties like modularity and coding standards.
* Knowledge of verification and validation methods, such as static analysis and reviews.
* Knowledge of software testing methodologies such as unit and integrated testing.
* Describe how to measure software and how to avoid software risks.

**Unit–1**

Introduction to Software Engineering, Software Crises, Overview of software development activities, Process Models, Classical Waterfall Model, Code and Fix model, Iterative waterfall model, Prototyping mode, Spiral model, RAD model, Agile models: Extreme Programming, and Scrum.

Requirement identification, Requirement Gathering and Analysis, Functional and Non- functional requirements, Trawling of Requirements, Software Requirement Specification (SRS), Requirement Traceability, Requirement Validation, Functional Specification.

Introduction to UML and UML Diagrams: Use Case Model, Class Diagram, Object Diagram, State Chart Diagram.

**Unit–2**

Software Project Management; Feasibility Study, Project Planning Activities, Estimation in Project Planning Process: LOC and Function Point, Project Estimation Techniques: COCOMO Model, Halstead’s Software Science, Staff Estimation, Project Scheduling: Activity Networks & CriticalPathMethod,GanttChart,PERTChart,ProjectMonitoring&Control,RiskManagement: Software Risks, Risk Identification and Assessment, Risk Projection and RiskRefinement.

**Unit-3**

Overview of design process: High-level and detailed design, Cohesion and coupling, Modularity and layering, System Modeling: Traditional and Object-oriented Approaches, Traditional approach: Data Flow Diagram (DFD), Entity-Relationship Diagram (ERD), State Transition Diagram (STD) and Decision Table. Structural Analysis using Data Flow Diagrams: Structure Chart. Design Specification, Basic concepts of Object-Oriented Analysis and Design, Design Patterns.

**Unit–4**

V-model of software Development and Testing: Unit, Integration, System, Acceptance and Regression Testing. Differences between fault (bug, defect), error, and failure. Definition of software Testing: Verification and Validation, Black-box and While-box testing. Coding, Code Review: Walk-through, and Inspection, Defect Prevention, Debugging.

Introduction to Software Maintenance: Corrective, Adaptive, Perfective, and Preventive. Lehman’s Laws for Closed Source Software and Open Source Software.

**Text books:**

Fundamentals of Software Engineering, Rajib Mall , PHI, 2014.

**Reference Books:**

Software Engineering, A Practitioner’s Approach, Roger S. Pressman ,TMG Hill. Software Engineering, I. Sommerville, 9th Ed. , Pearson Education. SOFTWARE

**Practical/Tutorial: Software Engineering Lab**

**S. No. Practical Title**

1. ProblemStatement,
   * ProcessModel
2. Requirement Analysis:
   * Creating a DataFlow
   * Data Dictionary, UseCases
3. ProjectManagement:
   * ComputingFP
   * Effort
   * Schedule, Risk Table, Timelinechart
4. DesignEngineering:
   * ArchitecturalDesign
   * Data Design, Component LevelDesign
5. Testing:
   * Basis PathTesting

**Sample Projects:**

1. **Criminal Record Management:** Implement a criminal record managementsystem

forjailers, police officers and CBI officers.

1. **Route Information**: Online information about the bus routes and their frequencyandfares
2. **Car Pooling**: To maintain a web based intranet application that enables the corporateemployees within an organization to avail the facility of carpooling effectively.
3. Patient Appointment and Prescription ManagementSystem
4. Organized Retail Shopping ManagementSoftware
5. Online Hotel Reservation ServiceSystem
6. Examination and Result computationsystem
7. Automatic Internal AssessmentSystem
8. Parking AllocationSystem
9. Wholesale ManagementSystem

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### ITM (HONOURS) SEMESTER V

**Discipline Specific Elective Course**

**DSE-2: PYTHON PROGRAMMING (6 Credits)**

**Full marks - 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course objectives**

* To acquire programming skills in core Python.
* To acquire Object Oriented Skills in Python
* To develop the ability to write database applications in Python

**Course Outcomes**

At the end of the course, the student will be able to

* Explain basic principles of Python programming language
* Implement object oriented concepts
* Implement database and GUI applications

**Unit-1**

**Python:** Features of Python , Installing Python for windows and setting up paths, writing and Executing of a python programs, Python Virtual machine, Frozen binaries, Comparison between C, Java and python , Comments , Docstrings ,How python sees variables, Data types in Python, built in types, sequences in python, sets, literals in Python, user defined data types, identifiers & reserved words, Naming convention in python,

**Unit-2**

various Operators in Python , Input & Output , Control statements, if statements, while loop, for loop, infinite loop, nested loop ,else suit, break, continue, pass ,assert, return statements, command line arguments.

Arrays in python, advantages using arrays, creating arrays, importing the array module, indexing and slicing on arrays, Processing the arrays, Comparing arrays.

Strings in Python, Creating strings, Length of a string, Indexing in strings, Slicing strings, Concatenation and Comparing strings,Finding SubStrings,Replacing a String.

**Unit-3**

FunctionsinPython,Defineafunction,Callingafunction,returnfromfunction,passbyobject Reference, Positional arguments, Default arguments, Recursivefunctions.

Introduction to OOP, features of OOP, creating classes, the self variable, constructor, types of variables, namespaces, types of methods.

**Unit-4**

Inheritance: Define inheritance, types of inheritance, constructors in inheritance, overriding super class constructors & methods, the super() method, MRO

Polymorphism: Duck typing philosophy of Python, operator overloading, method overriding, interfaces in python

Exceptions:Errorsinapythonprogram,Exceptions,Exceptionhandling,TypesofExceptions, The Exception block, the assert statement, user definedexceptions

Python Database Connectivity: DBMS, types of databases used with Python, installation of MySQL database , setting path, verifying MySQL , installing MySQL connector, Working with MySQL database, Using MySQL from python, retrieving rows ,deleting rows, updating rows in a table.

**Text Books**

1. T. Budd, Exploring Python, TMH, 1st Ed,2011.
2. Core Python Programming, Dr. R. Nageswar Rao , DreamtechPress
3. Python Programming for Absolute Beginners, Michael Dawson, CENGAGELearning

**Reference Books**

1. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python , Freely availableonline.2012

**OnlineReferences:**

1. Python Tutorial/Documentation [www.python.or](http://www.python.or/)2015
2. <http://docs.python.org/3/tutorial/index.html>
3. <http://interactivepython.org/courselib/static/pythonds>
4. <http://www.ibiblio.org/g2swap/byteofpython/read/>

**Pratical: Software Lab based on Python Programming:**

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon userschoice.
2. Write a Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the followingcriteria:

Grade A: Percentage >=80

Grade B: Percentage>=70 and <80 Grade C: Percentage>=60 and <70 Grade D: Percentage>=40 and <60 Grade E: Percentage<40

1. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters fromuser.
2. Write a Program to display the first n terms of Fibonacciseries.
3. Write a Program to find factorial of the givennumber.
4. Write a Program to find sum of the following series for n terms: 1 – 2/2! + 3/3! - - - --

n/n!

1. Write a Program to calculate the sum and product of two compatiblematrices.
2. Install MySQL and connector. Write Python programs to retrie, inserting, delete, update rows in atable.

**DSM (HONOURS) SEMESTER V**

**Skill Enhancement Course**

**SEC-3: R PROGRAMMING (4 Credits)**

**Full marks - 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course Objectives:**

The module is designed to make students exercise the fundamentals of statistical analysis in R environment. They would be able to analysis data for the purpose of exploration using Descriptive and Inferential Statistics. Students will understand Probability and Sampling Distributions and learn the creative application of Linear Regression in multivariate context for predictive purpose.

**Learning Outcomes:**

At the end of the module the student will able to learn:-

* The significance of R language.
* Installing, configuring R Studio and Writing, Executing codes in R Studio.
* About Various data types and its usages.
* Reading and Writing data using various control structures and Functions.
* Write simple pseudo code and create simple flow charts.
* Perform various data analysis techniques and statistical operations in R.

**Unit 1:**

Introduction: Overview and History of R, Getting Help, Data Types, Subsetting, Vectorized, Operations.

**Unit 2:**

Reading and Writing Data. Control Structures, Functions, lapply, tapply, split, mapply, apply. Coding Standards.

**Unit 3:**

Scoping Rules. Debugging Tools, Simulation, R Profiler

**Uni 4:**

Data Analysis Using R: Visualization before Analysis, Dirty Data, Visualizing a Single Variables, Examining Multi Variable.

Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II Errors, Power and Sample Size, ANOVA.

**Text Books:**

1. William N. Venables and David M. Smith, An Introduction to R. 2nd Edition. Network Theory Limited.2009.
2. Norman Matloff, The Art of R Programming -A Tour of Statistical Software Design, No Starch Press.2011.

##### Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition (chapter 3only)

**Practical: R Programming**

1. Write a program that prints Hello World' to thescreen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 ton
3. Write a program that prints a multiplication table for numbers up to12.
4. Write a function that returns the largest element in alist.
5. Write a function that computes the running total of alist.
6. Write a function that tests whether a string is apalindrome.
7. Implement the following sorting algorithms: Selection sort, Insertion sort, BubbleSort
8. Implement linearsearch.
9. Implement binarysearch.
10. Implement matrices addition, subtraction andMultiplication.
11. Other programs to visualize single variables and multiple variables such as histogram, density plot, Dotchart, Barplot, Box-and-Whisker Plot, Hexbin Plot, ScatterplotMatrix.
12. Write R code for Student’s *t*-test, Welch’s *t*-test, Wilcoxon Rank-sumTest,

### DSM (HONOURS) SEMESTER VI

**Core Course**

**C-13: MACHINE LEARNING (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**COURSE OBJECTIVE :**

To introduce students to the basic concepts and techniques of Machine Learning. To develop skills of using recent machine learning software for solving practical problems. To gain experience of doing independent study and research.

COURSE OUTCOME:-:-

After learning this paper ,students should be able to know :-

* Students will understand concept of machine learning, the concept of learning task,various types of learning techniques.
* Students will understand artificial neural networks,perceptions ,learning rules,background propagation algorithms.
* Students will understand various supervised learning methods .
* Students will understand various unsupervised learning –k means ,reinforcement learning methods.

**Unit–1**

Introduction – Types of Machine Learning , Designing a Learning System, Issues in Machine Learning; -The Concept Learning Task - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias - Decision Tree Learning - Decision tree learning algorithm, Instance based Learning, Nearest neighbors method.

**Unit–2**

Artificial Neural Networks – Perceptrons, Learning rules, Gradient descent and the Delta rule, Adaline, Madaline Network, Multilayer networks, Derivation of Backpropagation rule- Backpropagation Algorithm- Convergence, Generalization; – Evaluating Hypotheses – Estimating Hypotheses Accuracy, Basics of sampling Theory, Radial basis function networks, Support Vector Machine.

**Unit-3**

Supervised Learning- Linear Regression (Gradient Descent, Normal Equations), Weighted Linear Regression (LWR), Logistic Regression, Generative Models (Gaussian Discriminant Analysis, Naive Bayes), Learning – Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, Tree Ensembles (Decision trees, Random Forests, Boosting and Gradient Boosting).

**Unit–4**

Unsupervised Learning- K-means, Gaussian Mixture Model (GMM), Expectation Maximization (EM), Variational Auto-encoder (VAE), Factor Analysis, Principal Components Analysis (PCA), Independent Components Analysis (ICA), Linear Discriminant Analysis (LDA), Vector Quantization – Self Organizing Feature Map.

Reinforcement learning: Markov decision process (MDP), Hidden Markov Model(HMM), Bellman equations, Value iteration and policy iteration, Linear quadratic regulation, Linear Quadratic Gaussian, Q-learning, Monte Carlo Methods.

**Text books:**

* 1. T. Mitchell, “Machine Learning” Mcgraw HillPublisher.
  2. T. Hastie, R. Tibshirani, J. Friedman “The Element of Statistical Learning” 2e2008
  3. E. Alpaydin, Introduction to Machine Learning. Eastern Economy Edition, Prentice Hall of India.
  4. C. M. Bishop, Pattern recognition and Machine Learning,Springer

## Lab Experiments:

1. Basic operations in Pythonimplementation.
2. Loading data from Training set and testing theModels.
3. Learn to predict values with LinearRegression.
4. Learn to predict states using LogisticRegression.
5. Learn the definition of a Perceptron as a building block for neural networks, and the perceptron algorithm forclassification.
6. Learn the definition of a Neural Network, Learn to train them using Backpropagation network.
7. Train Decision Trees to predict states andclassification.
8. Learn the Bayes rule, and how to apply it to predicting data using the Naive Bayesalgorithm.
9. Learn to train a Support Vector Machine to separate datalinearly.
10. Use Kernel Methods in order to train SVMs on data that is not linearlyseparable.
11. Learn the basics of clustering Data, Cluster data with the K-meansalgorithm.
12. Cluster data with Gaussian MixtureModels.
13. Optimize Gaussian Mixture Models with ExpectationMaximization.
14. Learn to scale features in your data, Learn to select the best features for trainingdata.
15. Reduce the dimensionality of the data using Principal Component Analysis and Independent Component Analysis andLDA
16. Learn how to define Markov Decision Processes to solve real-worldproblems.
17. Learn about policies and value functions, Derive the BellmanEquations.
18. Write your own implementations of iterative policy evaluation, policy improvement, policy Iteration, and valueIteration.
19. Implement classic Monte Carlo prediction and controlmethods.
20. Learn how to tune hyper parameters of anestimator.
21. Plotting of Validation curve and learning curve to evaluate themodel.
22. Evaluating Estimator performance, Crossvalidation

### DSM (HONOURS) SEMESTER VI

**Core Course**

**C-14: INETERNET OF THINGS (6 Credits)**

**Theory Full marks: 75 (Mid-Sem: 15; End-Sem: 60) Practical Full marks: 25 (End semester evaluation)**

**Course description and objectives:**

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

**Course Outcomes:**

• Able to understand the application areas of IOT

• Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

• Able to understand building blocks of Internet of Things and characteristics.

**Unit–1**

Introduction to Internet of Things, Definitions and Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies - Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, EnbeeddedSystems

Textbook 1:1.1–1.5

**Unit–2**

IoTlevels and Development Templates, IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6.

IoT and M2M, Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT

- Software Defined Networking, and Network Function Virtualization, IoT Platform Design Methodology - Introduction, IoT Design Methodology, Step1: Purpose and requirement specification, Step2: Process Specification, Step 3: Domain Model Specification, Step 4: Information Model Specification, Step 5: Service Specification, Step 6: IoT Level Specification, Step 7: Function View Specification, Step 8: Operational View Specification, Step 9: Device and Component Integration, Step 10: Application Development, IoT System Logical Design Using Python

Textbooks 1:3.1-3.4, 5.1-5.4, 6.1-6.11

**Unit-3**

IoT Physical Devices and End Points: What is an IoT Device, Exemplary Device Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry pi interfaces, programming raspberry piwithpython,IoTphysicalserversandcloudofferings-introductiontocloudstoragemodels and communication Networks, wamp-autobahn for IoT, xively cloud for IoT, python web application frame work-django, designing a RESTful webAPI

Textbook 1: 7.1-7.7, 8.1-8.7

**Unit–4**

Data Analytics for IoT; Introduction AppacheHadoop, using HadoopMapReduce for Batch Data Analysis,

Textbook 1: 10.1 -10.8

Ethics:Characterizing the IoT,Privacy, Control,Distributing Control and Crowd Sourcing, Environment,Physical Thing, Electronics,InternetService,Solutions,Internet of Things as Part of Solution, Cautious Optimizing, The Open IoT definition.

Textbook 2: Chapter 11

**Text books:**

1. InternetOfThings-AHandsonApproach,byArshdeepBahgaandVijayMadisetti,University of P[enn,http://www.internet-of-things-book.com/](http://www.internet-of-things-book.com/)
2. Designing the Internet of Things, by Adrian McEwen andHakimCassimally, Wiley Publication.

**References:**

* 1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems.ByOvidiuVermesanandPeterFriess,RiverPublishersSeriesinCommunication.

**List of Experiments:**

1. Define and Explain Eclipse IoTProject.
2. List and summarize few Eclipse IoTProjects.
3. Sketch the architecture of IoT Toolkit and explain each entity inbrief.
4. Demonstrate a smart object API gateway service reference implementation in IoTtoolkit.
5. Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoTtoolkit.
6. Describe gateway-as-a-service deployment in IoTtoolkit.
7. Explain application framework and embedded software agents for IoTtoolkit.
8. Explain working of RaspberryPi.
9. Connect Raspberry Pi with your existing systemcomponents.
10. Give overview ofZetta.

**Design based Problems (DP)/Open Ended Problem:**

1. How do you connect and display your Raspberry Pi on a Monitor OrTV?
2. Create any circuitry project usingArduino.

**Major Equipment:**

Raspberry pi, Arduino

**List of Open Source Software/learning website:**

* https://github.com/connectIOT/iottoolkit
* https://[www.arduino.cc/](http://www.arduino.cc/)
* <http://www.zettajs.org/>
* Contiki (Open source IoT operatingsystem)
* Arduino (open source IoTproject)
* IoT Toolkit (smart object API gateway service referenceimplementation)
* Zetta (Based on Node.js, Zetta can create IoT servers that link to various devices and sensors)

**DSM (HONOURS) SEMESTER VI**

**Discipline Specific Elective Course**

**DSE-3: WIRELESS COMMUNICATIONS (6 Credits)**

**Theory Full marks: 100 (Mid-Sem: 20; End-Sem: 80)**

**COURSE OBJECTIVES:**

To expose the students to understand the fundamentals of mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards.

**COURSE OUTCOMES:**

After successful completion of the course, the students are able to:

* Identify concept of wireless networks , applications & challenges. Various types of multiplexing techniques , modulation techniques, spread spectrum concepts .
* Students will identify motivation behind specialized MAC in wireless communications, various MAC protocols and their benefits. Students will also understand details about GSM network like architecture ,handover, protocols, IP packet delivery, tunneling and encapsulation .
* Students will identify basic concepts of Wireless LAN like IEEE 802.11, system architecture ,medium access control, MAC management schemes.
* Students will gain knowledge about various security issues in wireless systems and their benefits .

**Unit–1**

Introduction to Wireless Networks: Evolution of Wireless Networks, Applications, Challenges,WirelessCommunicationPrinciplesandfundamentals:TheElectromagnetic Spectrum, Transmission Bands and their Characteristics, Spectrum Regulation, Analog and Digital Data Transmission: Voice Coding, Multiplexing (Space Division Multiplexing, Frequency Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing), Modulation Techniques for Wireless Systems: Analog Modulation (AM, FM), DigitalModulation(ASK,FSK,PSK,QAM)

**Unit–2**

MotivationforaspecializedMAC:Hiddenandexposedterminal,Nearandfarterminals. MultipleAccessforWirelessSystems:FDMA,TDMA,CDMA,ALOHA-CarrierSense Multiple Access(CSMA).

GSM: Mobile services, System architecture, Localization and calling, Handover, Security, Mobile IP: Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation Optimizations

**Unit-3**

Wireless LAN: Infra red Vs. radio transmission, Infrastructure and ad-hoc network, IEEE 802.11: System architecture, Protocol architecture, Physical layer (FHSS,DSSS), Medium access control layer (Basic DFWMAC-DCF using CSMA/CA,) MAC frames, MAC management(Registration, Handoff, Power Management).

**Unit–4**

Security Issues in Wireless Systems: The Need for Wireless Network Security, Attacks on Wireless Networks, Security Services, Wired Equivalent Privacy (WEP) Protocol, Mobile IP Weaknesses in the WEP Scheme.

**Text books:**

* 1. Wireless Networks., P. Nicopolitidis, M. S. Obaidat, G. I. Papadimitriou, A. S. Pomportsis, John Wiley & Sons,Ltd.
  2. Mobile Communications, by Dr. JochenSchiller
  3. Principle of Wireless Networks, Kaveh Pahlavan, PrashantKrishnamurthy.

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### Reference Books:

**DSM (HONOURS) SEMESTER VI**

**Discipline Specific ElectiveCourse**

**DSE-4: PROJECT (6Credits)**

**Objective:**

##### An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

**Guidelines:**

As the project work constitutes a major component in most of the professional programs and it is to be carried out with due care and should be executed with seriousness by thecandidates.

**Type of Project**

As majority of the students are expected to work out a real-life project in some industry/research and development laboratories/educational institutions/software companies, it is suggested that the project is to be chosen which should have some direct relevance in day-to-day activities of the candidates in his/her institution. It is not mandatory for a student to work on a real-life project.

The student can formulate a project problem with the help of Guide.

**Project Proposal (Synopsis)**

The project proposal should be prepared in consultation with the guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. The project work should compulsorily include the software development. The project proposal should contain complete details in the following form:

1. Title of theProject
2. Introduction and Objectives of theProject
3. Project Category (RDBMS/OOPS/Networking/Multimedia/Artificial Intelligence/Expert Systemsetc.)
4. Analysis (DFDs at least up to second level, ER Diagrams/ Class Diagrams/ Database Design etc. as per the projectrequirements).
5. A complete structure which includes: Number of modules and their description to provide an estimation of the student’s effort on the project. Data Structures as per the project requirements for all the modules. Process Logic of each module. Testing process to be used. Reportsgeneration
6. Tools / Platform, Hardware and Software Requirementspecifications
7. Future scope and further enhancement of theproject.

**Evaluation of the Project**

Following Scheme shall be followed for evaluation of the project: Background of the Problem: 10 marks

Review of Literature: 20 marks Methodology: 10 marks Observation and Analysis: 20 Viva Voce: 20 marks

Seminar: 20 marks

Total: 100 marks

**DSM (HONOURS) SEMESTER VI**

**Skill Enhancement Course**

**SEC-4: LEADERSHIP & PERSONALITY DEVELOPMENT (4 Credits)**

**Full marks – 100 (Mid-Sem: 20; End-Sem: 80)**

**Course Objectives:**

The object of this course is to make individuals competent to function effectively and manage and influence the employees. It assists in organizing and synthesizing complex ideas into a tapestry of words and images. It also aids in improving the critical skillvisioning process and eventually aiding in analyzing the past, understanding the present and exploring options to craft a clear future vision. This course makes the students groom their personality and prove themselves as good Samaritans of the Society. This course consists of individual or in-group class presentations pertaining to the applications of concepts, Theories or issues in human development.

**Learning Outcomes:**

* Course Objectives to develop leadership and communication skills, goal setting, time management techniques and to collaborate more effectively in teams.
* To use effective strategies for learning and study including personal learning styles and study skills while taking responsibility now and in the future.
* To manage time and resources effectively by setting short and long term goals, make constructive choices and learn everyday by effective self-evaluation.
* Course Outcomes Understand how current technologies can be used to communicate effectively in professional environments.
* Be able to gather, assess, and use information to make informed and well-reasoned decisions. Be able to apply theories of leadership to create an effective team environment in the workplace.
* Have a broad understanding of effective leadership roles and strategies and be able to apply them in a variety of professional, personal, and civic environments.
* Be able to demonstrate the ability to understand and apply communication theory in order to effect appropriate change in a variety of leadership settings.
* Develop personal talents, use specific teamroles in a team, motivate members of the team and create synergy while achieving results

**Unit-1**

Leadership: Definition and meaning, Importance, Leadership and Management, Leader vs Manager, Essential qualities of an effective leader.

Theories of Leadership: Trait theory, Behavioral theories, Contingency theory

**Unit-2**

Types of Leaders, Leadership styles: Traditional, Transactional, Transformational, Inspirational and servant leadership and Emerging issues in leadership: Emotional Intelligence and leadership, Trust as a factor, Gender and Leadership

**Unit-3**

Personality: Concept and Definition, Determinants of personality, Personality traits, Personality characteristics in organizations: Self evaluation, Locus of control, Self-efficacy, Self-esteem, Self-monitoring: Positive and negative Impact.

**Unit-4**

Organizational Context of Leadership and Personality, Contemporary Business Leaders.

**Text Books:**

* 1. Organisational Behaviour, M.Parikh and R.Gupta , TataMcGraw Hill Education PrivateLimited
  2. Organisational Behaviour, D. Nelson, J.C Quick and P. Khandelwal, CengagePublication.