SBRR MAHAJANA FIRST GRADE COLLEGE (Autonomous)
POST GRADUATE WING
(Accredited by NAAC with 'A' grade)

Pooja Bhagavat Memorial Mahajana Education Centre.
Affiliated to University of Mysore.

CBCS Regulations

Master of Computer Application (M.C.A.)

Preamble

Mahajana Post Graduate Centre is an exclusive PG wing of SBRR Mahajana First Grade College (Autonomous). The centre happens to be the largest PG Centre affiliated to University of Mysore.

It was established in July 2003 with the motto "Enter to Learn, Depart to Serve". The Centre is affiliated to University of Mysore and offers Post Graduation programmes in the areas of direct relevance and value to the current generation of students. The Centre offers Post Graduate degree in 12 disciplines and is poised to start new programmes in the years to come.

M.C.A. was started in the year 1999. It is a four semester full-time programme. The course is approved by University Grants Commission and affiliated to the University of Mysore. MCA course is accredited by All India Council for Technical Education (AICTE).

1.   Definitions

Course
Every course offered will have three components associated with the teaching-learning process of the course, namely
(i) Lecture – L (ii) Tutorial- T (iii) Practical - P, where

L stands Lecture session. **T** stands Tutorial session consisting participatory discussion / self study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands Practice session and it consists of Hands on experience / Laboratory Experiments / Field Studies / Case studies that equip students to acquire the much required skill component.

In terms of credits, every one hour session of L amounts to 1 credit per semester and a minimum of two hour session of T or P amounts to 1 credit per semester, over a period of one semester of 16 weeks for teaching-learning process. The total duration of a semester is 20 weeks inclusive of semester-end examination.

A course shall have either or all the three components. That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

The total credits earned by a student at the end of the semester upon successfully completing the course are L + T + P. The credit pattern of the course is indicated as
L: T: P.

If a course is of 4 credits then the different credit distribution patterns in L: T: P format could be

4 : 0 : 0,	1 : 2 : 1,	1 : 1 : 2,	1 : 0 : 3,	1 : 3 : 0,
2 : 1 : 1,	2 : 2 : 0,	2 : 0 : 2,	3 : 1 : 0,	3 : 0 : 1,
0 : 2 : 2,	0 : 4 : 0,	0 : 0 : 4,	0 : 1 : 3,	0 : 3 : 1,

The concerned BoS will choose the convenient credit pattern for every course based on the requirement. However, generally, a course shall be of 3 or 4credits.

Different courses of study are labelled and defined as follows:

Core Course

A course which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main discipline /subject of study or from a sister/related discipline / subject which supports the main discipline / subject. In contrast to the phrase Soft Core, a compulsory core course is called a **Hard Core** Course.

Elective Course

Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline / subject of study or which provides an extended scope or which enables an exposure to some other discipline / subject/domain or nurtures the candidate's proficiency/ skill is called an Elective Course. Elective courses may be offered by the main discipline/ subject of study or by sister / related discipline / subject of study. A Soft Core course may also be considered as an elective.

An elective course chosen generally from an unrelated discipline / subject, with an intention to seek exposure is called an **open elective**.
An elective course designed to acquire a 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 is called a **Self Study.**
A core course offered in a discipline / subject may be treated as an elective by other discipline / subject and vice versa.

Project work/Dissertation work is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A project work up to 4 credits is called Minor Project work. A project work of 6 to 8 credits is called Major Project

Work. Dissertation work can be of 10-12 credits. A Project/Dissertation work may be a hard core or a soft core as decided by the BoS concerned.

2. Eligibility for Admission

Candidates possessing a degree of University of Mysore, or of any other University, equivalent there to and complying with the eligibility criteria:

Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree. **OR** Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).

Admission to MCA course shall be open for candidates who have passed the Bachelor degree examinations with not less than 50% of the marks in the aggregate of all the years of the Degree examinations. However, in the case of candidates from Karnataka belonging to SC/ST and Category-I, the aggregate percentage of marks in the qualifying examinations shall not be less than 45%. Provided that for admission to MCA, the candidate shall have passed Bachelor Degree with not less than 50% of marks with Mathematics / Statistics / Computer Science / Computer Programming / Computer Application / Business Mathematics / Business Statistics as one of the optional or electives at degree level. Provided further that in respect of candidates who have studied and passed one of the subjects specified in the first proviso in the Pre-university course with 50% of marks in that subject shall also be considered for admission.

However, in the case of candidates belonging to SC/ST and Category-I, 45% of marks in that subject shall also be considered for admission.

3.   Scheme of Instructions

3.1   A Masters Degree program is of 4 semesters-two year's duration for regular candidates. A regular candidate can avail a maximum of 8 semesters – 4 years (in one stretch) to complete Masters Degree (including blank semesters, if any). Whenever a candidate opts for blank semester(s)/DROP in a course or in courses or is compelled to DROP a course or courses as per the provision of the regulation, he/she has to study the prevailing courses offered by the department as per the prevailing scheme, when he/she continues his/her study.

3.2   A candidate has to earn a minimum of 76 credits, for successful completion of a Master's degree with a distribution of credits for different courses as given in the following table.

Course Type	Credits
Hard Core	40
Soft Core	A minimum of 28, not exceeding 32
Open Elective	A minimum of 4, not exceeding 8

Every course including project work, practical work, field work, seminar, self study elective should be entitled as hard core or soft core or open elective by the BoS concerned.

3.3   A candidate can enrol for a maximum of 24 credits per semester with the approval of the concerned department.

3.4   Only such candidates who register for a minimum of 18 credits per semester in the first two semesters and complete successfully 76 credits in total of the 4 semesters be considered for declaration of ranks, medals and are eligible to apply for student fellowship, scholarship, free ships and hostel facilities.

3.5   In excess to the minimum of 76 credits for masters degree in the concerned discipline / subject of study, a candidate can opt to complete a minimum of 18 extra credits to acquire **add on proficiency diploma** in that particular discipline /subject along with the masters degree. In such of the cases where in, a candidate opts to earn at least 4 extra credits in different discipline / subjects in addition to a minimum of 76 credits at masters level as said above then an **add on proficiency certification** will be issued to the candidate by listing the courses studied and grades earned.

3.6   A candidate admitted to Masters Program can exercise an option to exit with Bachelor Honors Degree / PG diploma after earning 40 credits successfully.

4.   Continuous Assessment, Earning of Credits and Award of Grades

The evaluation of the candidate shall be based on continuous assessment. The Structure for evaluation is as follows:

4.1   Assessment and evaluation processes happen in a continuous mode. However, for reporting purposes, a semester is divided into 3 discrete components identified as C1, C2, and C3.

4.2   The performance of a candidate in a course will be assessed for a maximum of 100 marks as explained below:

4.2.1   The first component (C1), of assessment is for 25 marks. This will be based on test/ assignment/seminar/quiz/group discussions. During the first half of the semester, the first 50% of the syllabus will be completed. This shall be consolidated during the 8th week of the semester. Beyond 8th week, making changes in C1 is not permitted.

4.2.2   The second component (C2), of assessment is for 25 marks. This will be based on test/ assignment/seminar/quiz/group discussions. The continuous assessment and scores of second half of the semester will be consolidated during the 16th week of the semester. During the second half of the semester the remaining units in the course will be completed.

4.2.3   The outline for continuous assessment activities for Component-I (C1) and Component-II (C2) will be proposed by the teacher(s) concerned before the commencement of the semester and will be discussed and decided in the respective Departmental Council. The students should be informed about the modalities well in advance. The evaluated courses/assignments during component I (C1) and component II (C2) of assessment are immediately returned to the candidates after obtaining acknowledgement in the register maintained by the concern teacher for this purpose.

4.2.4   During the 18th -20th week of the semester, a semester-end examination of 2 hours duration shall be conducted for each course. This forms the third/final component of assessment (C3) and the maximum marks for the final component will be 50.

4.2.5   In case of a course with only practical component a practical examination will be conducted with two examiners (one internal and one external).
A candidate will be assessed on the basis of:
a) Knowledge of relevant processes
b) Skills and operations involved
c) Results / products including calculation and reporting.
If external examiner does not turn up then both the examiners will be internal examiners. The duration for semester-end practical examination shall be decided by the departmental council.

4.2.6   **Scheme of Valuation for Practical Examination:**
The student is evaluated for 50 marks in C3 as per the following scheme:
There will be two questions. A candidate has to prepare procedure for both the questions and execute any one of examiner's choice:

Procedure Development	:	10 x 2=20 Marks
Implementation	:	15 x 1=15 Marks
Viva	:	10 Marks
Record	:	05 Marks
Total	**:**	**50 Marks**

*For change of question = 5 Marks will be deducted per question.

4.2.7   If **X** is the marks scored by the candidate out of 50 in C3 in theory examination, if **Y** is the marks scored by the candidate out of 50 in C3 in Practical examination, and if **Z** is the marks scored by the candidate out of 50 in C3 for a course of (L=0):T:(P=0)type that is entirely tutorial based course, then the final marks (M) in C3 is decided as per the following table.

L.T.P distribution	Find mark M in C3
L:T:P	$\dfrac{[(L+T)*X]+[(T+P)*Y]}{L+2T+P}$
L:(T=0):P	$\dfrac{(L*X)+(P*Y)}{L+P}$
L:T:(P=0)	X
L:(T=0):(P=0)	X
(L=0):T :P	Y
(L=0): (T=0):P	Y
(L=0): T:(P=0)	Z

4.2.8   The details of continuous assessment are summarized in the following table:

Component	Syllabus in a course	Weightage	Period of Continuous assessment
C1	First 50%	25%	First half of the semester To be consolidated by 8th week
C2	Remaining 50%	25%	Second half of the semester. To be consolidated by 16th week
C3	Semester-end examination (All units of the course)	50%	To be completed during 18th-20th Week.
Final grades to be announced latest by 24th week			

4.2.9   A candidate's performance from all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (25 +25 + 50).

4.2.10 **Finally, awarding the grades should be completed latest by 24th week of the semester**.

4.3   **Minor/ Major Project Evaluation**
Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the guide. Components of evaluation are as follows:
Component – I (C1): Periodic Progress and Progress Reports (25%)
Component – II (C2): Results of Work and Draft Report (25%)
Component– III (C3): Final Viva-voce and evaluation (50%).
The report evaluation is for 30% and Viva-voce examination is for 20%.

4.4   In case a candidate secures less than 30% in C1and C2 put together in a course, the candidate is said to have DROPPED that course, and such a candidate is not allowed to appear for C3 in that course. In case a candidate's class attendance in a course is less than 75%, the candidate is said to have DROPPED that course, and such a candidate is not allowed to appear for C3 in that course.

Teachers offering the courses will place the above details in the Department Council meeting during the last week of the semester, before the commencement of C3, and subsequently a notification pertaining to the above will be brought out by the Chairman of the Department before the commencement of C3 examination. A copy of this notification shall also be sent to the office of the Controller of Examinations.

4.5   In case a candidate secures less than 30% in C3, he/she may choose DROP/MAKEUP option.
In case a candidate secures more than or equal to 30% in C3, but his/her grade(G) = 4, as per section 4.7 below, then he/she may be declared to have been conditionally successful in this

course, provided that such a benefit of conditional clearance based on G=4 shall not be availed for more than 8 credits for the entire programme of Master's Degree of two years.

A MAKE UP examination for odd semester courses will be conducted along with next regular odd semester examinations and for even semester courses along with a next regular even semester examinations. If a candidate is still unsuccessful, he/she may opt for DROP or again take up MAKE UP examination; however, not exceeding double the duration norm in one stretch from the date of joining the course.

4.6   A candidate has to re-register for the DROPPED course when the course is offered again by the department if it is a hard core course. The candidate may choose the same or an alternate core/elective in case the dropped course is soft core / elective course. A candidate who is said to have DROPPED project work has to re-register for the same subsequently within the stipulated period. **The details of any dropped course will not appear in the grade card.**

4.7   The grade and the grade point earned by the candidate in the subject will be as given below.

Marks(M)	Grade	Grade Point (GP = V x G)
30-39	4	V*4
40-49	5	V*5
50-59	6	V*6
60-64	6.5	V*6.5
65-69	7	V*7
70-74	7.5	V*7.5
75-79	8	V*8
80-84	8.5	V*8.5
85-89	9	V*9
90-94	9.5	V*9.5
95-100	10	V*10

Here, **P** is the percentage of marks (P = [(C1+C2)+M] secured by a candidate in a course which is rounded to nearest integer. **V** is the credit value of course. **G** is the grade and GP is the grade point.

4.8   A candidate can withdraw any course within in ten days from the date of notification of final results. Whenever a candidate withdraws a paper, he/she has to register for the same course in case it is hard core course, the same course or an alternate course if it is soft core/open elective.
A DROPPED course is automatically considered as a course withdrawn.

4.9   Overall Cumulative Grade Point Average (CGPA) of a candidate after successful Completion the required number of credits (76) is given by:

CGPA = ΣGP / **Total number of credits**

5.   Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Numerical Index	Qualitative Index
4<= CGPA <5	5	Second Class
5<= CGPA <6	6	
6<= CGPA <7	7	First Class
7<= CGPA <8	8	
8<= CGPA <9	9	Distinction
9<= CGPA <10	10	

Overall percentage = 10* CGPA or is said to be 50% in case CGPA<5

6.   Medium of Instruction

The medium of instruction shall be English. However, a candidate will be permitted to write the examinations in either English or Kannada. This rule is not applicable to languages.

7.   Provision for Appeal

If a candidate is not satisfied with the evaluation of C1 and C2 components, he / she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc., which were evaluated. He/she can do so before the commencement of semester-end examination. The grievance cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the college on the candidate if his/her submission is found to be baseless and unduly motivated. This cell may recommend taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

For every program there will be one grievance cell.

The composition of the grievance cell is as follows.

1. The Controller of Examinations ex-officio Chairman / Convener

2. One senior faculty member (other than those concerned with the evaluation of the course concerned) drawn from the department/discipline and/or from the sister departments/sister disciplines.

3. One senior faculty member / course expert drawn from outside the department.

8.   Any other issue not envisaged above, shall be resolved by the competent authority of the autonomous college, which shall be final and binding.

9.   Any matter which is not covered under this regulation shall be resolved as per the College/Mysore University regulations.

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SBRR Mahajana First Grade College (Autonomous), PG Wing

Pooja Bhagavat Memorial Mahajana Education Centre

KRS Road, Metagalli, Mysuru-570016

Master of Computer Application

Programme Structure

w.e.f. 2021-2022

List of Hard Core Courses

Sl.No.	Course Title	Credit Pattern			Credits
		L	T	P	
1	Mathematical Foundations for Computer Applications	4	0	0	4
2	Advanced Computer Networks	3	1	0	4
3	Data Structures and Algorithms	2	1	1	4
4	Operating System	3	1	0	4
5	Software Engineering	3	1	0	4
6	Object Oriented Programming with Java	3	0	1	4
7	Python Programming	3	0	1	4
8	Simulation and Modeling	3	0	1	4
9	Major Project Work	0	2	6	8

List of Soft Core Courses

Sl. No.	Course Title	Credit Pattern			Credits
		L	T	P	
1	Data Communication and Networks	3	1	0	4
2	Database Management System	3	0	1	4
3	Cloud Computing	3	1	0	4
4	System Analysis and Design	3	1	0	4
5	Web Technologies	2	1	1	4
6	Cryptography and Network Security	3	0	1	4
7	Theory of Languages and Automata	3	0	1	4
8	Probability and Statistics	3	1	0	4
9	Fundamentals of Internet of Things	3	1	0	4
10	Mobile Application Development with Android	3	0	1	4
11	Linux Programming	3	0	1	4
12	Information Retrieval	3	0	1	4
13	Big Data Analytics	3	0	1	4
14	Machine Learning	3	1	0	4
15	Advanced Java	3	0	1	4
16	Management Information Systems	3	1	0	4
17	Business Intelligence	3	1	0	4
18	Entrepreneurship Development	3	1	0	4
19	Communication Skills	3	1	0	4
20	Professional Ethics and Human Values	3	1	0	4
21	Cyber security	3	1	0	4

1	Open Elective	4 Credits

List of Open Elective Courses

Sl.No.	CourseTitle	Credit Pattern			Credits
		L	T	P	
1	World Wide Web	2	2	0	4
2	E-Commerce	3	1	0	4
3	Office Automation	2	2	0	4

Note: We follow latest Edition Textbooks as References.

HC   MATHEMATICAL FOUNDATIONS FOR COMPUTER APPLICATIONS   4:0:0

Objectives:
- Understand various concepts of mathematical logic.
- Implement set operations and functions in programming languages.
- Develop the skills to implement algebraic structures.
- Develop the basic skills of graph theory and its applications.

Outcomes:
- Develop an ability to implement various techniques of mathematical logic.
- Capability to apply the concepts of set theory.
- Ability to enhance the knowledge of algebraic structures towards computer applications.
- Ability to correlate the concepts of graph theory in computer applications.

Unit I: **Mathematical Logic**:

Statements and Notations, Connectives, Well-formed Formulas, Tautologies, equivalence of Formulas, Duality law, Normal Forms, The Predicate Calculus.

Unit II: **Set Theory**

Basic concepts, Some operations on Sets, Venn Diagrams, Cartesian Products, Relations and Ordering, Functions, Definition, Composition of functions, Inverse functions, Natural Numbers, Recursion, Recursion in Programming Languages.

Unit III: **Algebraic Structures**

Algebraic Systems, Examples and General Properties, Grammars and Languages, Polish Expressions and Their Compilation, Groups, Definitions and Examples, Subgroups and Homomorphism's.

Unit IV: **Graph Theory**

Basic concepts of Graph Theory, basic definitions, Paths, reachability, and Connectedness, matrix representation of Graphs, Trees, Storage representation and manipulation of Graphs.

References:

1. Discrete Mathematical Structures with Applications to Computer Science - Trembley, J.P. and Manohar, Tata McGraw Hill, New Delhi.
2. Discrete Mathematics and Its Applications - Kenneth H. Rosen: Fifth Edition, McGraw-Hill.

| HC | **ADVANCED COMPUTER NETWORKS** | 3:1:0 |

Objectives:

- To understand fundaments of Network hardware and software.
- To Teach the applications and services of Transport layer.
- To impart the structural mechanism of TCP/IP.
- To create the awareness on the concepts of IP Security.

Outcomes:

- To employ the mechanism of Reference models and TCP/IP.
- To understand the role of Transport Layer in computer networks.
- Employ the techniques of TCP/IP.
- Comprehend the internal working mechanism of IP Security.

Unit I: Introduction

Uses of Computer Networks, Network Hardware, Network Software, Reference Models- OSI, TCP/IP.

Unit II: Transport Layer

The Transport Service, Congestion Control, History of TCP/IP, TCP Applications and Services, Motivation for Performance Study of TCP/IP, What Do We Mean by TCP Performance?, TCP/IP Fundamentals, TCP, UDP, IP, Performance Measurements of TCP/IP Networks.

Unit III: TCP/IP

TCP/IP Performance over Wireless Networks, Wireless Networks, Generic characteristics, Wireless Local Area Networks, Cellular Communications Networks, TCP Performance Issues over Wireless Links, Inappropriate Reduction of Congestion Window, Throughput Loss in WLANs, Throughput Loss in Cellular Communication Systems, Improving TCP Performance over Wireless Links, Splitting TCP Connections, Snooping TCP at Base Stations, Notifying the Causes of Packet Loss, Adding Selective Acknowledgments to TCP.

Unit IV: IP & System Security.

Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations-Authentication Plus Confidentiality, Basic Combinations of Security Associations, Malicious Software, Types, Viruses, Antivirus Approaches, Distributed denial of service (DDoS) attacks.

References:

1. Computer Networks, Andrew S Tanenbaum, David. J. Wetherall, Pearson Education.
2. High Performance TCP/IP: Networking Concepts, Issues, and Solutions, Mahbub Hassan and Raj Jain, IST Edition, PHI Learning.
3. Network Security Essentials: Applications and Standards, William Stallings, 4th Edition, Prentice Hall.

HC   **DATA STRUCTURES AND ALGORITHMS**   **2:1:1**

Objectives:
- Impart the basic concepts of data structures and algorithms.
- Understand concepts about searching and sorting techniques.
- Know the basic concepts about stacks, queues, lists, trees and graphs.
- To gain knowledge on trees and graphs concepts.

Outcomes:
- Analyse algorithms and algorithm correctness.
- Summarize searching and sorting techniques.
- Describe stack, queue and linked list operation.
- Solve the problems by writing algorithms using fundamental data structures.

Unit I: **Basics of Data Structures and Algorithms**

Introduction to Data Structures: Basic Data Types - Abstract Data Types; Structure, operations on them and Implementation. Introduction to Algorithms: Fundamentals of Algorithmic problem solving, Problem types - Analysis of Algorithm Efficiency: Analysis framework - Orders of growth, asymptotic notations and basic efficiency classes.

Unit II: Stacks, Queues and Lists

Arrays: Single and Two dimensional - Stacks: Array representation, Expression evaluation, recursion – Queues: Linear queue, priority queues (heap), Linked lists: Singly linked, Doubly linked, Memory representation of lists

Unit III: Trees and Graphs

Trees: Basic Terminologies, Binary Trees and their memory representation, Binary Search Trees Graphs: Directed and Undirected graphs, Definitions, Representations, Weighted graphs, Traversals and searching BFS and DFS.

Unit IV: Algorithm Design

Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Greedy Method General Method, Knapsack Problem, Minimum-Cost Spanning Trees - Kruskal's and Prim's algorithm, Single-Source Shortest Path Problem, Dijkstra's algorithm, Dynamic Programming : General Method, All Pair Shortest Paths(Floyd-Warshall algorithm); Travelling Salesman Problems.

References:

1. Fundamentals of Computer Algorithms – Ellis Horowitz, Sartaj Sahini, Sanguthevar Rajasekaran 2nd Edition, Computer Science Press.
2. Data Structures with C - Seymour Lipschutz Schaum's Outline Series
3. Classical Data Structures – Debasis Samanta, 2nd Edition, PHI Learning Pvt. Ltd.

HC   **OPERATING SYSTEM**   **3:1:0**

Objectives

- Understand the fundamental principles of operating system, processes and their communication.
- Understand the concepts of process management.
- Understand the concepts of Memory Management.
- Know the concepts of file systems and the disk management in Operating Systems.

Outcomes

Students will be able to:

- Understand the usage of the operating system components and its services.
- Employ the concepts of process management.
- Employ the concepts of Memory Management
- Apply the file handling concepts in OS perspective.

Unit I:

Introduction -Computer System Organization – Computer system architecture – Operating system operations - Operating systems services-System calls- Types of system calls – Operating system structure. Processes-process concept- process scheduling-operation on processes. Multithreaded programming – Multithreading models – Threading issues.

Unit II:

Process Scheduling - Scheduling criteria-Scheduling algorithms – Thread scheduling - Multiple-processor scheduling. Process Synchronization – Critical Section problem – Peterson's solution – Semaphores Classical problems of synchronization - critical regions – Introduction to Monitors.

Unit III:

Deadlocks – System model - Deadlock Characterization - Deadlock handling - Deadlock Prevention - Deadlock avoidance - Deadlock Detection - Deadlock Recovery.

Memory Management – Swapping - Contiguous Memory allocation -Segmentation Paging.

Virtual Memory Management - Demand paging – Copy on write - Page Replacement - Thrashing.

Unit IV:

File System – File concept – Access methods – Directory structure – Directory and disk structure - File Systems structures - Directory Implementation - Allocation Methods - Free Space management. Disk Structures – Disk attachment - Disk Scheduling – Disk management.

References:

1. Operating Systems Concepts - Abraham Silberschatz Peter B Galvin, G.Gagne, 9th Edition, John Wiley & Sons.
2. Modern operating Systems-Andrew S.Tanenbaum, Third Edition, PHI Learning Pvt. Ltd.
3. Operating Systems: A Concept-based Approach - D M Dhamdhere, Second Edition, Tata McGraw-Hill Education.
4. Operating Systems-H M Deital, P J Deital and D R Choffnes3rd edition, Pearson Education.
5. Operating Systems: Internals and Design Principles-William Stallings, Seventh Edition, Prentice Hall.

HC   SOFTWARE ENGINEERING   3:1:0

Objectives

- Understand the importance of domain knowledge and its work around.
- Know the importance team work and stewardship.
- Analyze and implement solutions to complex problems involving computers.
- A solid understanding to the methods of Software Quality Assurance.

Outcomes

- Work in one or more significant application domains.
- Work as an individual and as part of a multidisciplinary team to develop and deliver quality software.
- Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.
- Demonstrate an ability to ensure Software Quality Assurance.

Unit I: Software, Software Engineering and Process Models

The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths, Prescriptive Process Models.

Unit II: Agile Development

What is Agility?, Agility and Cost of Change, What is an Agile Process? Extreme Programming.

Unit III: Requirements Modelling& Design

Requirements Analysis, Scenario – Based Modelling, UML Models that supplement the Use Case, Data Modelling Concepts, Requirements Modelling Strategies, Flow-oriented Modelling, Creating a behavioural model, Design concepts, Design Model.

Unit IV: Software Quality Assurance & Project Scheduling

Elements of Software Quality Assurance, SQA Tasks, Goals, Metrics, Formal Approaches to SQA, Software Reliability, Project Scheduling, Defining a task set for the Software Project, Defining a Task Network, Scheduling.

References:

1. Software Engineering, A Practioner's Approach - Roger S Pressman,7th Edition, McGraw Hill Education Pvt. Limited.
2. Software Engineering - Ian Sommerville, 8th Edition, Pearson Education Ltd.
3. Fundamentals of software engineering - Rajib Mall, Phi learning Pvt. Ltd, 3rd edition.

HC **OBJECT ORIENTED PROGRAMMING WITH JAVA** **3:0:1**

Objectives:

- Gain knowledge about basic of Java language syntax and semantics.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Gain knowledge on multi-threads programming.

Outcomes:

- Identify classes, objects, members of a class and relationships among them needed for a specific problem.
- Write Java programs to implement error handling techniques using exception handling.
- Develop computer programs to solve real world problems in JAVA.

Unit – I

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings.

Unit – II

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize() Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance.

Unit – III

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.

Unit – IV

Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization. I/O Basics, Reading Console Input, Writing Console Output, ThePrintWriter Class, Reading and Writing Files.

References

1. Herbert Schildt, Java 2, The Complete Reference, Tata McGraw Hill.
2. E. Balaguruswamy, Programming with JAVA A Primer, McGraw Hill Education. Pvt. Ltd.

HC   PYTHON PROGRAMMING   3:0:1

Objectives:
- To write simple Python programs.
- To develop Python programs with conditionals statements and loops.
- To use Python data structures – lists, tuples, dictionaries.
- Design user defined functions, modules, and packages and exception handling methods.
- Create and handle files in Python and learn Object Oriented Programming Concepts.

Outcomes:
- Develop algorithmic solutions to simple computational problems.
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples and dictionaries.

Unit – I: Introduction, Datatypes, Input/Output, Operators and Expressions

Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.

Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command.

Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non-Associative Operators.

Unit – II: Control Structures, Data types and functions

Control Structures: Decision making statements, Python loops, Python control statements.

Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).

Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables.

Unit – III: Modules, Classes and Objects

Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.

Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.

Unit – IV: Exception Handling and Files

Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.

File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python.

References:

1. Programming in Python, Pooja Sharma, BPB Publications.

2. Core Python Programming, R. Nageswara Rao, 2nd edition, Dreamtech.

3. Python, The complete Reference, Martin C. Brown, McGraw Hill Education.

4. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

| HC | SIMULATION AND MODELING | 3:0:1 |

Objectives:

- To make students understand the basic principles of Simulation.
- To learn basic components of a system with classification and examples.
- To understand different methods for random number generation.
- To know different types of simulations with respect to output analysis.

Outcomes:

- Implementation of different algorithms associated with generation of Random numbers.
- Analyzing the real time problems with respect to verification and validation of Simulation Models.
- Understanding the output analysis for different types of Simulations.

Unit I: Introduction to Simulation

Definition of Simulation, Simulation as an Appropriate and In appropriate tool, Applications of Simulation; Systems and System Environment, Components of a system, Model of a system, types and examples; discrete and continuous systems.

Unit II: Random Number Generation

Properties of Random Numbers, Generation of Pseudo-Random Numbers, Techniques for Generating Random Numbers, Tests for Random Numbers (Algorithms and Problems)- Frequency tests, Runs Tests, Gap tests.

Unit III: Random Variate Generation

Inverse Transform Technique, Direct Transformation for the normal Distribution; Convolution Method, Acceptance-Rejection Technique.

Unit-IV: Verification and Validation of Simulation Models

Model Building, Verification and Validation, Verification of Simulation Models, Calibration and Validation of models – Validating Input – Output Transformations; Output Analysis for a Single Model – Types of Simulations with Respect to Output Analysis, Output Analysis for Terminating Simulations, Output Analysis for steady state Simulations – Replication Method

References:

1. Discrete System Simulation – Jerry Banks, John S Carson II, Barry L Nelson, David M Nicol, Pearson Education Asia.
2. System Simulation - Geoffrey Gordon, Prentice Hall India.
3. System Simulation with Digital Computers - N. Deo, PHI.

SC   **DATA COMMUNICATION AND NETWORKS**   **3:1:0**

Objectives:

- Understand the basics of data communication components.
- Learn the protocols of Data link layer.
- Understand different network layer services and routing protocols
- Know the different techniques involved transport layer and application layer

Outcomes:

- Acquire knowledge on basics of Data communication components.
- Understand the usage of different protocols of Data link layer.
- Working of network layer and routing protocols.
- Gain In-depth knowledge in the different concepts involved in transport layer and application layer.

Unit I: Data Communications

Components, Data Representation, Data Flow, Networks –Network Criteria and Network Models, OSI model, TCP/IP Protocol suite, Multiplexing, Transmission media-Guided and Unguided media, Circuit Switched Networks.

Unit II: Data link layer

Introduction, Framing, Flow and error control, Protocols-Noiseless Channels and Noisy Channels, Multiple Access: Medium Access Sub Layer-ALOHA, CSMA/CD, Wired LAN – Ethernet, Wireless LAN – IEEE 802.11

Unit III: Network layer

Network Layer: IPv4 ADDRESSES, IPv6 ADDRESSES,: Internet Protocol – Internetworking,IPv4, IPv6, Transition from IPv4 to IPv6, Unicast Routing protocols, Multicast routing protocols.

Unit IV: Transport Layer and Application Layer

UDP and TCP protocols, Application Layer: Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Remote logging - Telnet, FTP, Electronic Mail, WWW and HTTP.

References:

1. Data Communications and Networking - Behrouz A. Forouzan, Fourth Edition, TMH.
2. Computer Networks - Andrew S Tanenbaum, 5th Edition. Pearson Education, PHI.
3. Data communications and Computer Networks - P.C .Gupta, PHI.
4. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education.
5. Understanding communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning.
6. Computer Networking: A Top-Down Approach Featuring the Internet - James F. Kurose & Keith W. Ross, 3rd Edition, Pearson Education.
7. Data and Computer Communication- William Stallings, Sixth Edition, Pearson Education.

SC   DATABASE MANAGEMENT SYSTEM   3:0:1

Objectives:

- Understand the different issues involved in the design and implementation of a database system.
- Understand and use data manipulation language to query, update, and manage a database.
- Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS.
- Study different tools and terminologies of Data Mining and Date Warehousing.

Outcomes:

- Employ the techniques of SQL in Relational database.
- Implement simple database system by utilizing Data models and schema.
- Employ normalization techniques to overcome Database anomalies.
- Implement various Techniques of Data Mining and Data Warehousing.

Unit I: Database System Concepts and Data Modeling using ER Model

Introduction, Characteristics of the Database Approach, Advantages of Using a DBMS, Data Models, Schemas, and Instances, Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Roles, and Structural Constraints, Weak Entity Types.

Unit II: Relational Data Model and Relational Database Constraints

Relational Model Concepts, Relational Constraints and Relational Database Schemas, Update Operations and Dealing with Constraint Violations, SQL Data Definitions and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, More Complex SQL Queries, INSERT, DELETE and UPDATE Statements in SQL, Specifying Constraints as Assertions and Triggers, Views in SQL.

Unit III: Introduction to SQL programming and Normalisation

Database Programming: Issues and Techniques, Database Programming with Function Calls:SQL/CLI and JDBC, Database Stored Procedures and SQL/PSM; Informal Design Guidelines for Relational Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Unit IV: Data Mining and Data Warehousing

Overview of Data Mining Technology, Association Rules, Classification, Approaches to Other Data Mining Problems, Commercial Data Mining Tools; Introduction, Definition and Terminology of Data Warehousing, Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse, Typical Functionality of a Data Warehouse, Data Warehouse versus Views, Problems and Open Issues in Data Warehouses.

References:

1. Fundamentals of Database Systems -Navathe and Elmasri –Pearson Education, Fifth Edition.
2. Introduction to Database systems - CJ Date, Published by Addison-Wesley.
3. Database Systems Concepts, 3rd edition - Abraham Silberschatz, Henry Korth and S. Sudarshan McGraw Hill International Editions.
4. Principles of database systems - Ullman, Computer Science press.

SC   **CLOUD COMPUTING**   **3:1:0**

Objectives:

- Ability to understand various basic concepts related to Cloud Computing technologies.
- Demonstrate the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Learn cloud services for individuals.
- Understand the technologies for data security in cloud.

Outcomes:

- Demonstrate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications.
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud.
- Identify the cloud services for the individuals
- Acquire the knowledge on the core issues of cloud computing such as security, privacy, and interoperability.

Unit I:

Introduction: Cloud Computing in a Nutshell, Layers and Types of Clouds, Desired Features of Cloud, Cloud Infrastructure Management, Challenges and Risks. Migrating into a Cloud- The Seven-Step Model of Migration into a Cloud.

Unit II:

Software as a Service (SaaS): Evolution of SaaS, Challenges of SaaS Paradigm, New Integration Scenarios, SaaS Integration of Products and Platforms, SaaS Integration Services, Business – to Business Integration Services.

Infrastructure As a Services (IaaS): Introduction, Background & Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, Provisioning in a Cloud Context- Amazon Elastic Computer Cloud, Aneka.

Platform As a service (PaaS): Aneka Cloud Platform, Hybrid Cloud Implementation, Aneka Hybrid Cloud Architecture.

Unit III:

The Enterprise Cloud Computing Paradigm- Background, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain.

Unit IV:

Data Security in the Cloud- Introduction, Current State, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security.

References:

1. Cloud Computing: Principles and Paradigms – Rajkumar Buyya, James Broberg, Andrzej M Goscinski, Wiley publication.
2. Cloud Computing: A Practical Approach - Toby Velte, Anthony Velte, McGraw-Hill Osborne Media.
3. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud - George Reese, O'Reilly Publication.
4. Cloud Computing Explained: Implementation Handbook for Enterprises - John Rhoton, Recursive Press.

| SC | SYSTEM ANALYSIS AND DESIGN | 3:1:0 |

Objectives:

- Understand the basics of system concepts and learn the feasibility study of the system.
- Learn the data analysis of a new system and tools associated in structured analysis.
- Understand the concepts of system testing and standards related to Documentation and management
- Understand the concepts of system security and recovery management

Outcomes:

- Gather data for analysis and specify the requirements of a system.
- Design system components and environments.
- Build general and detailed models that assist programmers in implementing a system.
- Design a user interface for data input and output, as well as controls to protect the system and its data.

Unit I:

System Concept: Definition, Characteristics, Elements of system, Physical and abstract system, open & closed system and man-made information systems.

System Development Life Cycle: Various phases of system development, Considerations for system planning and control for system success.

Initial Investigation: Determining user's requirements and analysis, fact finding process and techniques.

Feasibility study: Determination of feasibility study, Technical, Operational & Economic Feasibilities, System performance constraints, identification of system objectives and feasibility report.

Unit II:

Cost/Benefit Analysis: Data analysis cost and benefit analysis of a new system and categories determination.

Tools of structured Analysis: Logical and Physical models, context, diagram, data dictionary, data diagram, IPO and HIPO charts, Gantt charts and pseudo codes. Flow charts- system flow chart, run flow charts etc., decision tree and decision tables.

Unit III:

Input/ Output and Form Design: Input and output form design methodologies, menu, screen design and layout consideration.

Management standards: Programming and operating standards.

Documentation standards: User and programming manual.

System testing & quality: System testing, quality assurance and software maintenance.

Unit IV:

System security: Data Security, Disaster/ recovery and ethics in system development.

Organization of EDP: Introduction, Job Responsibilities & duties of EDP Personnel- EDP manager, System Analyst, Programmers, Operators etc. Selection of Data Processing Resources: purchase, lease, rent-advantages and disadvantages.

References:

1. System Analysis and Design- Awad, Elias M- 2nd Edition, Galgotia Publication Pvt.Ltd.
2. System Analysis & Design - V K Jain, Dreamtech Press
3. Modern System Analysis &Design - A Hoffer, F George, S Valaciah Low Priced Edition, Pearson Education.
4. Information Technology & Computer Applications -V.K.Kapoor, Sultan Chand & Sons, New Delhi.

SC   **W**EB **T**ECHNOLOGIES   **2:1:1**

Objectives:

- To help students understand the basis of Internet and how communication happens over the World Wide Web.
- To help students understand the basic building blocks of web pages using HTML and CSS.
- To help students understand and use Java script and PHP.
- To help students understand how data driven, dynamic web pages can be created using database connectivity.

Outcomes:

- Develop an ability to implement HTML5 pages using fundamental tags.
- Able to develop style sheet using CSS for a given problem.
- Able to extend JavaScript to validate a form with event handler for a given problem.
- Able to develop a dynamic website with database backend.

Unit I:

Introduction to Internet, WWW, Web Browsers, and Web Servers, URLs, MIME, HTTP, Security.
Quick introduction to HTML5 : Creating simple web page, basic text formatting, presentation elements, phrase elements, lists, font, grouping elements, basic links, internal document links, email link, Image, Audio and Video, image maps, image formats, Tables – attributes, nested tables, Forms – Attributes, form controls. Introduction to HTML 5 - New tags of HTML 5 – embedding Media content, building input forms, painting on canvas.
Cascading Style Sheet : Introduction, Levels of Style Sheet and specification formats, embedded style sheet, External Style Sheet, inline Style Sheet, Class and ID method, DIV and SPAN tags, Inheritance with CSS, Introduction to CSS 3, HTML 5 and CSS3.

Unit II:

JavaScript: JavaScript in HTML, Language Basics – Variables, operators, statements, functions, Data type conversions, reference types, Document object Model - browser object model - window object, location object, navigator object, screen object, history object, Events and Event handling, Button elements, Navigator object, validations with regular expressions. Introduction to Dynamic documents, Positioning elements, moving elements, elements visibility, changing colors and fonts, dynamic content, Locating mouse cursor, reacting to a mouse click, dragging and dropping of elements.

Unit III:

PHP : Introduction to Server side Programming, Introduction to PHP , PHP and HTML, essentials of PHP, Why Use PHP, Installation of Web Server, WAMP Configurations, Writing simple PHP program, embedding with HTML, comments in PHP, Variables, Naming Conventions, Strings, String Concatenation, String functions, float functions, Arrays, Array – Key pair value, Array functions, is SET, UNSET, gettype(), settype(), control statements (if, switch), Loops, User Defined Functions (with argument, return values), global variable, default value, GET - POST method, URL encoding, HTML Encoding, Cookies, Sessions, Include statement. File:read and write from the file. Ethical use of features of PHP.

Unit IV:
PHP with MySQL, Creating Connection, Selecting Database, Perform Database (query), Use returned data, close connections, file handling in PHP – reading and writing from and to FILE. Using MySQL from PHP (Building a Guestbook).

References:
1. Internet and World Wide Web: How to Program - Paul Deitel, Harvey Deitel, Abbey Deitel, Pearson
2. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2ndEdition. Paperback – 2016by DT Editorial Services (Author)
3. Programming PHP, Rasmus Lerdorf, Kevin Tatroe, O'Reilly Media Release, March 2002.

SC   CRYPTOGRAPHY AND NETWORK SECURITY   3:0:1

Objectives:

- Understand the principles Computer Security.
- Learn conventional cryptosystem.
- Know public key cryptosystem
- Have a detailed knowledge about authentication, hash functions and application level security mechanisms.

Outcomes:

- Implement the principles and practices of cryptographic techniques.
- Build simple cryptosystems by applying encryption algorithms.
- Comprehend secure identity management (authentication), message authentication, and digital signature techniques.
- Employ the authentication protocol and web security methods.

Unit I: Computer Security Concepts and Classical Encryption Techniques

Introduction-computer security concepts, attacks, security services, security mechanisms; Classical encryption techniques-symmetric cipher models, substitution techniques, transposition techniques, rotor machines

Unit II: Block Ciphers-DES and Introduction to Public Key Cryptography

Symmetric ciphers-Block cipher principles; DES-Algorithm, strengths and weaknesses of DES, attacks on DES and defense, multiple encryptions; Asymmetric ciphers-Essential mathematics, public key cryptography,

Unit III: RSA, MAC and Digital Signatures

RSA, Diffie Hellman key exchange, random number generation, Data integrity and authentication Hash functions; MAC; Digital signatures;

Unit IV: Key Management, Authentication and System Security

Key management; Authentication, Web and system security, Web security; IP security; E mail security; System security-intruders, malicious software, firewalls

References:

1. Cryptography and Network Security -Principles and Practice - William Stallings, PEARSON.
2. Cryptography and Network Security –Atul Kahate, Tata McGraw Hill.

SC   THEORY OF LANGUAGES AND AUTOMATA   **3:0:1**

Objectives:

- Introduce concepts in automata theory and theory of computation.
- Identify different formal language classes and their relationships.
- Design grammars and recognizers for different formal languages.
- Prove or disprove theorems in automata theory using its properties.

Outcomes:

- Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
- Design grammars and automata (recognizers) for different language classes.
- Identify formal language classes and prove language membership properties.
- Prove and disprove theorems establishing key properties of formal languages and automata.

Unit I:

Brief introduction to Formal Proof: Deductive Proofs, Proving equivalences about sets, the contrapositive, Proof by contradiction, Counterexamples, Central concepts of automata theory: Alphabets, strings, languages.

Finite Automata: Deterministic Finite Automata, Nondeterministic Finite Automata, Equivalence of DFA and NFA, Finite Automata with Epsilon transitions.

Unit II:

Regular Expressions, Finite Automata and Regular Expressions: Converting DFAs to regular expressions by eliminating states, converting regular expressions to automata, Applications of regular expressions, Brief overview of algebraic laws of regular expressions.

Properties of Regular Languages: The pumping lemma for regular languages, Applications of the pumping lemma, Closure properties and decision properties of regular languages (proofs not necessary), Minimization of DFAs

Unit III:

Context-Free Grammars, Parse Trees, Applications of context-free grammars, Ambiguity in grammars and languages.

Pushdown Automata : Definition, Languages of a PDA, Equivalence of PDAs and CFGs, Deterministic Pushdown Automata.

Normal Forms for Context-free grammars

Unit IV:

The pumping lemma for context-free languages, Closure properties of context-free languages (proofs not necessary).

Brief introduction to Turing Machine: Notation for Turing Machine, Instantaneous descriptions for Turing Machines, Transition Diagrams for Turing Machine. Definition of Post's Correspondence Problem.

References:

1. Introduction to Automata Theory, Languages and Computation - Hopcroft J. E and Ullman, J.D, Narosa Publishing House, Delhi.

2. Introduction to Languages and Theory of Computation, -John C Martin3rd edition. TMH Publication.

SC   **PROBABILITY AND STATISTICS**   **3:1:0**

Objectives:

- Extend and formalize knowledge of the theory of probability and random variables.
- Introduce new techniques for carrying out probability calculations and identifying probability distributions.
- Study elementary concepts and techniques in statistical methodology.

Outcomes:

- Use axioms and theorems to describe events and compute probabilities.

- Identify the types of random variables involved in a given problem and calculate relevant probabilities.
- Describe an appropriate statistical model for the given data and compute population parameters using appropriate estimators.

Unit I:

Probability: The concept of probability, the axioms and theorems, conditional probability, Independent Event's, Bayes Theorem. Random Variables and Probability Distributions:

Random variables, discrete probability distributions and Distribution functions: Bernoulli, Binomial, Hyper Geometric, Geometric, Poisson, Uniform.

Unit II:

Continuous Probability distribution and Distributions functions: Exponential, Normal, Uniform, Concepts of Chi square, t joint Distributions, Independent random variables, Functions of random Variables.

Unit III:

Mathematical Expectation: Definition, Functions of Random variables. The variance and Standard Deviation, Moments, Moment Generating Functions, Covariance, Correlation Coefficient. Sampling Theory &Estimation: Population and sample, Random Sampling with and without replacement, the sample mean, sampling distribution of means, proportions, differences. The sample variance, the sample distribution of variances, Point estimates, Interval estimates. Variance analysis.

Unit IV:

Tests of Hypotheses and Significance: Statistical Decisions, Statistical hypotheses, Null Hypotheses, Tests of hypotheses and significance, Type I and Type II errors, level of significance, Tests involving the Normal distribution, One-Tailed and Two-tailed, Special tests of Significance for large and small samples, The Chi-square test for goodness of fit. Introduction to regression and curve fitting.

References:

1. Fundamentals of Statistics - S C Gupta and V K Kapoor.
2. Fundamentals of Statistics - S C Gupta.
3. Probability and Statistics with Reliability, Queuing and Computer Applications -Jusgir S Trivedi, Prentice Hall of India.
4. Probability, Random Variables and Stochastic Processes - Papoulis and S. Unnikrishna Pillai, McGraw Hill, 4th Edition.
5. Probability and Statistics for Engineers- Richard A Johnson, Prentice Hall India.

SC   FUNDAMENTALS OF INTERNET OF THINGS   3:1:0

Objectives:

- Learn the impact of IoT applications and architectures in real world.
- Illustrate the various methods of deploying smart objects and connect them to network.
- Infer the role of IoT in Industry.
- Understand the role of IoT in Smart and Connected Cities and Public Safety.

Outcomes:

- Interpret the impact of IoT networks in new architectural models.
- Compare and contrast the deployment of smart objects and technologies to connect them as network.
- Elaborate the need of IoT Access Technologies.
- Identify the application of IoT in Smart and Connected Cities and Public Safety.

Unit I: Basics of IoT

What is IoT?, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and OT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack.

Unit II: Smart Objects and Access Technologies

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies (Any Three)

Unit III: IoT in Industry

IoT in Industry: Smart and Connected Cities-An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples-Smart Traffic Control.

Unit IV: Public Safety

Overview of Public safety, An IoT Blueprint for public safety, Emergency Response IoT Architecture, IoT Public Safety Information Processing.

References:
1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things- David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 1st Edition, Pearson Education.
2. Internet of Things- Srinivasa K G, CENGAGE Leaning India.
3. Internet of Things (A Hands-on-Approach)-Vijay Madisetti and Arshdeep Bahga, 1stEdition, VPT.
4. Internet of Things: Architecture and Design Principles - Raj Kamal,1stEdition, McGraw Hill Education.

SC   MOBILE APPLICATION DEVELOPMENT WITH ANDROID   3:0:1

Objectives:

- Understand the concepts of mobile applications.
- Learn to design mobile applications.
- Learn android application development environment.
- Gain knowledge on Google maps and publishing android applications.

Outcomes:

- Acquire knowledge on basics of mobile application development.
- Acquire knowledge on mobile application design patterns.
- Implement android application using android application environment.
- Students must independently develop android applications and publish them.

Unit I: Getting Started with Android Application Development

All about Android - The Consumer Perspective, The Versions of Android, The Developer Perspective, The Business Perspective, Android Background Material - Getting a Feel for the Big Picture, the main window, Viewing modes, The Designer tool

Unit II: Kotlin for Java Programmers

Defining the Java Issues That Kotlin Fixes - Improving control over null references, removing raw data types, Using invariant arrays, Working with proper function types, Getting rid of the checked exceptions, Kotlin for Everyone - Moving from Development to Execution with Kotlin, What is a compiler? Understanding native code compiler or interpreter issues, Considering the Android Runtime (ART)

Unit III: Overview of Jetpack

Understanding the Benefits of Jetpack - Eliminating boilerplate code, Managing background tasks, Navigating between activities and fragments, Managing memory, Performing configuration changes, Considering the Jetpack Components – Foundation, Architecture, Behavior, UI

Unit IV: Publishing Android App

Creating a Google Play Developer Account - Preparing Your Code, Un-testing the app, Choosing Android versions, Setting your app's own version code and version name, Choosing a package name. Monetizing and Marketing Your App - Choosing a Revenue Model, Charging for your app, Offering an extended free trial, Freemium apps, Selling things with your app, Subscription pricing, Earning revenue from advertising, Variations on in-app advertising, Donationware, Offering your app for free, Marketing Your Application

References:

1. Android® Application Development ALL-IN-ONE, Barry Burd and John Paul Mueller, 3rd Edition.
2. Android in Practice - Charlie Collins, Michael Galpin and Matthias Kappler, DreamTech.
3. Beginning Objective C - James Dovey and Ash Furrow, Apress.
4. Android for programmers: An App-Driven Approach - Paul Deitel ,Harvey Deitel, Abbey Deitel and Michael Morgano, Pearson.

SC <div align="center">**LINUX PROGRAMMING**</div> 3:0:1

Objectives:
- Understand and make effective use of Linux utilities and Shell scripting language (bash) to solve Problems.
- Implement in C some standard Linux utilities such as ls, mv, cp etc. using system calls.
- Develop the skills necessary for systems programming including file system programming, process and signal management, and inter process communication.
- Develop the basic skills required to write network programs using Sockets.

Outcomes:
- Work confidently in Linux environment.
- Work with shell script to automate different tasks.
- Write simple system programs involving file and process management.
- Ability to write simple socket programs.

Unit I:

A brief history of Unix and Linux, Architecture, Features.

Unix/Linux Shell: Linux shell commands for getting help: Commands for getting help :whatis, man, info, apropos.

Useful unix/linux shell commands :pwd, whoami, who, ls, env, echo, history, passwd, cat, more, less, file, chmod, chown, cp, mv, mkdir, rmdir, whereis, which, locate, ln.

Quick overview of basic Linux Utilities: File handling utilities, links: hard and symbolic links, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters: grep, Text processing utilities and Backup utilities.

Shell programming with Bourne again shell(bash)- Introduction, shell responsibilities, tab completion, pipes and Redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples.

Unit II:

Sed and Awk: Sed: Scripts, Operation, Addresses, Commands.

Awk: Execution, Fields and Records, Scripts, Operation, Patterns, Actions, Associative Arrays, String and Mathematical functions, System commands in awk, Applications

Unit III:

Process : Process concept, Layout of a C program image in main memory. Process environment :environment list, environment variables, getenv, setenv, Kernel support for process, process identification, process control : process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process, system call interface for process management-fork, vfork, exit, wait, waitpid, exec family, Process Groups, Sessions and Controlling Terminal, Differences between threads and processes.

Unit IV:

Inter process Communication: Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pies-creation, IPC between related processes using unnamed pipes, FIFO: creation, IPC between unrelated processes using FIFOs(Named pipes), differences between unnamed and named pipes, popen and pclose library functions.

Sockets: Introduction to Berkeley Sockets, IPC over a network, Client-Server model, Socket address structures (unix domain and Internet domain), Socket system calls for connection oriented protocol and connectionless protocol, example: client/server programs-Single Server-Client connection, Comparison of IPC mechanisms.

References:
1. Linux "man" pages and "info" pages.
2. The Linux Documentation Project : http://www.tldp.org/
3. Unix Concepts and Applications - Sumitabha Das, 4th Edition, TMH.
4. Beej's Guide to Network Programming : https://beej.us/guide/bgnet/
5. Unix Network Programming - W. R. Stevens , PHI.
6. System Programming using C++ - T. Chan, Unix PHI.
7. Beginning Linux Programming - N. Mathew, R. Stones, 4th Edition, Wrox, Wiley India Edition.
8. C Programming Language - Kernighan and Ritchie, PHI.

| SC | **INFORMATION RETRIEVAL** | 3:0:1 |

Objectives:

- Become familiar with difference between Information retrieval and data Base Management Systems.
- Learn different indexing techniques used in retrieval system.
- Understand the concepts of cluster analysis.
- Understand the text classification techniques.

Outcomes:

- Locate relevant information in large collections of data.
- Impart features of retrieval systems for Text data.
- Analyze the performance of retrieval systems using test collection.
- Implement different clustering algorithms.

Unit I: Boolean retrieval and classical models

An example information retrieval problem, A first take at building an inverted index, Processing Boolean queries; The term vocabulary and postings lists: Document delineation and character sequence decoding, Determining the vocabulary of terms, Faster posting list intersection via skip pointers, Positional postings and phrase queries. Index construction – Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, dynamic indexing, other types of indexes.

Unit-II: Computing scores in a complete search system

Efficient scoring and ranking, components of an information retrieval system, vector space scoring and query operator interaction, information retrieval system evaluation, Standard test collections, Evaluation of unranked and ranked retrieval results, Assessing relevance, A broader perspective: System quality and user utility, Results snippets

Unit-III: Data Cluster analysis

What is Cluster Analysis, Different Types of clustering's, Different types of clusters, Kmeans – the basic K-means algorithm, additional Issues, K – means and different types of clusters, Strengths and weaknesses, K – means as an optimization Problem, DBSCAN – Center based approach, The DBSCAN Algorithm, Strengths and weaknesses, Fuzzy Clustering, Minimum spanning tree clustering

Unit-IV: Text classification and naive bayes

The text classification problem, Naive bayes text classification, properties of Naive bayes, feature selection, Evaluation of text classification; Support vector machines and machine learning on documents – Support vector machines and machine learning on documents - Support vector machines: The linearly separable case, Issues in the classification of text documents, Machine – learning methods in ad hoc information retrieval; Web search basics – Background and history, Web characteristics, Advertising as the economic model, The search user experience;

References:

1. Introduction to information Retrieval – Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Cambridge University Press.
2. Introduction to Data Mining – Pang – Ning Tan, Vipin Kumar, Michael Steinbach, Pearson.

3. Information Retrieval: Algorithms and Heuristics - David A. Grossman, Ophir Frieder, Second Edition, Springer.

SC   **BIG DATA ANALYTICS**   **3:0:1**

Objectives:

- To identify the characteristics of datasets and compare the trivial data and big data for various applications.
- To introduce to the students the concept and challenges of big data.
- To make students understand the implementation of parallel processing with Map Reduce.
- To teach the students to apply their skills and use tools to manage and analyze the big data.

Outcomes:

- Understand the concept and challenges of big data and why existing technology is inadequate to analyse the big data.
- Develop an ability to collect, manage, store, query, and analyse various form of big data.
- Understand the significance of No SQL databases over RDBMS.
- Map the impact of big data for business decisions and strategy.

Unit I: Wholeness of Big Data

Introduction; Understanding Big Data, Caselet: IBM Watson: A Big Data system; Capturing Big Data; Benefitting, Management, Organizing and Analysing Big data; Technology Challenges for Big Data; Big Data Sources and Applications

Unit II: Big Data Architecture and Distributed Computing Using Hadoop

Google query Architecture; Standard Big Data Architecture; Big data Architecture Examples – IBM Watson, Ebay, Netflix, Paypal; Introduction to Hadoop Framework, HDFS Design Goals, Master Slave Architecture; Installing HDFS – Reading and Writing Local files into HDFS, Reading and Writing Data Streams into HDFS

Unit III: Parallel Processing with Map Reduce:

Introduction, How Google search Works, Map Reduce overview; Sample Map Reduce Application: Word count, Map Reduce Programming, Map Reduce Jobs Execution, Hive and Pig Language capabilities

Unit IV: No SQL databases

Introduction, RDBMS Vs NOSQL, Types of NoSQL Databases, Architecture of No SQL, CAP theorem; HBase – Architecture Overview, Reading and Writing Data; Cassandra – Architecture Overview, Protocols, Data Model, Cassandra Writes and Reads, Replication

References

1. Big Data Made Accessible, Anil Maheshwari, Kindle Edition.
2. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, Wiley Publisher.
3. Big Data Analytics, M. Vijayalakshmi, Radha Shankarmani, Wiley.
4. Data Science and Analytics, V.K.Jain, Khanna Publishing.

SC   **MACHINE LEARNING**   **3:1:0**

Objectives:

- To acquire basic knowledge on machine learning techniques.
- To learn the techniques in the area of pattern recognition and data analytics.
- To introduce the concepts of Dimensionality Reduction and Decision Tress.
- To Impart the mechanism of Kernel machines.

Outcomes:

- Understand the basic principles of machine learning techniques.
- Understand the supervised and unsupervised machine learning algorithms.
- Choose appropriate techniques for real time problems.
- Employ the concepts of Clustering and Kernel machines.

Unit I

Introduction to Machine Learning, types of machine learning, examples. Supervised Learning: Learning class from examples, VC dimension, PAC learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of a supervised learning algorithm. Parametric Methods: Introduction, maximum likelihood estimation, evaluating estimator, Bayes' estimator, parametric classification.

Unit II

Dimensionality Reduction: Introduction, subset selection, principal component analysis, factor analysis, multidimensional scaling, linear discriminant analysis. Clustering: Introduction, mixture densities, k-means clustering, expectation-maximization algorithm, hierarchical clustering, choosing the number of clusters. Non-parametric: Introduction, non-parametric density estimation, non-parametric classification.

Unit III

Decision Trees: Introduction, univariate trees, pruning, rule extraction from trees, learning rules from data. Multilayer perceptron: Introduction, training a perceptron, learning Boolean functions, multilayer perceptron, backpropagation algorithm, training procedures.

Unit IV

Kernel Machines: Introduction, optical separating hyperplane, v-SVM, kernel tricks, vertical kernel, defining kernel, multiclass kernel machines, one-class kernel machines. Bayesian Estimation: Introduction, estimating the parameter of a distribution, Bayesian estimation, Gaussian processes.

References

1. Introduction to Machine Learning, E. Alpaydin, 2nd edition, MIT Press.
2. Machine Learning: A Probabilistic Perspective, K. P. Murphy, MIT Press.
3. Machine Learning in Action, P. Harrington, Manning Publications.
4. Pattern Recognition and Machine Learning, C. M. Bishop, Springer.
5. Machine Learning: An Algorithmic Perspective, S. Marsland, 1st edition. Chapman and Hall.
6. Machine Learning, T. Mitchell, McGraw-Hill.

SC   ADVANCED JAVA   3:0:1

Objectives:

- Define JDBC and describe the various JDBC drivers.
- List the advantages and explain the life cycle of a servlet.
- Understand various types of properties in Java beans.
- To Know the applications of Java Server Pages.

Outcomes:

- Develop component-based Java software using JavaBeans.
- Develop server-side programs in the form of servlets.
- Implement Entity Java bean in stateless and stateful environment.
- Employ the concepts of EJB and JAR files.

Unit I: J2EE overview and JDBC

The ABC of Programming Languages, Taking Programming Languages up a notch, Distributive Systems – Real Time Transmissions, Software objects, Web services, The Tier – Clients, Resources and Components, J2EE Multi – Tier Architecture, Client tier implementation, Enterprise Application Strategy, A new Strategy, The Enterprise Application.

Unit II: Servlets

Introduction, Life cycle of servlet, A simple Java servlet, Anatomy of Java servlet – Deployment Descriptor, Reading Data from a client, Reading HTTP Request Headers, Sending Data to a client and writing the HTTP Response Header, Cookies and Tracking Sessions

Unit III: Java Server Pages

Introduction, JSP tags – Variables and Objects, Methods, Control statements, Loops, Tomcat, Request String, User Sessions, Cookies, Session objects

Unit IV: Enterprise JavaBeans

Introduction, EJB containers, classes and interfaces, Deployment Descriptors – Anatomy, Environment Elements, Referencing EJB and other resources, query element; Session Java Bean- Stateless and stateful, creating a session java bean; Entity Java Bean – Container Managed Persistence, Bean Managed Persistence; The JAR File

References:

1. The Complete Reference J2EE, Jim Keogh, 1st edition, McGraw Hill Education.
2. Core and Advanced Java, Black Book, Dreamtech Press.

| SC | MANAGEMENT INFORMATION SYSTEMS | 3:1:0 |

Objectives:

- Understand the role information system in business.
- Learn different functional business management systems.
- Understand e-commerce applications and decision support systems.
- Analyzing security and ethical challenges in IT.

Outcomes:

- Explain the role of IS in business.
- Ability to explain different enterprise management and functional management systems in business.
- Identify the applications of e-commerce and issues of e-commerce.
- Understand decision support systems.

Unit I: Information System Concepts

Information Systems in Business: Introduction, The real world of Information Systems, The fundamental role of IS in business, Trends in IS, Types of Information systems, Managerial challenges of IT.

System Concepts: A foundation, Components of an Information System, Information System Resources, Information System activities, Recognizing Information Systems.

Unit II: Enterprise Business Systems and Functional Business System

Enterprise Business Systems: Introduction, Cross-functional enterprise applications, Enterprise application integration, Transaction processing systems, Enterprise collaboration systems. Functional Business Systems: Introduction, Marketing systems, Manufacturing systems, Human resource systems, Accounting systems, financial management systems.

Customer relationship management: Introduction, What is CRM? The three phases of CRM, Benefits and challenges of CRM, Trends in CRM, Enterprise resource planning: Introduction, What is ERP? Benefits and challenges of ERP, Trends in ERP. Supply chain Management: Introduction, What is SCM? The role of SCM, Benefits and challenges of SCM, Trends in SCM

Unit III: Electronic Commerce and Decision Support Systems

Electronic commerce fundamentals: Introduction, The scope of e-commerce, Essential e-commerce, processes, Electronic payment processes.

e-Commerce applications and issues: E-commerce application trends, Business-to- Consumer e-commerce, Web store requirements, Business-to-Business e-commerce, e-commerce marketplaces, Clicks and bricks in ecommerce.

Decision Support Systems- Decision support in business: Introduction, Decision support trends, Decision support systems (DSS), Management Information Systems, On-line analytical processing, Using DSS, Executive information systems, Enterprise portals and decision support, Knowledge management systems, Business and Artificial Intelligence (AI), An overview of AI, Expert systems.

Unit IV: Security and Ethical Challenges, Security Management in IT

Security and Ethical Challenges: Security, Ethical and societal challenges of IT: Introduction, Ethical responsibility of business professionals, Computer crime, Privacy issues, other challenges, Health issues, societal solutions. Security management of IT: Introduction, Tools of security management, Internetworked security defenses, other security measures, System Controls and audits.

References:

1. Management information systems- managing information technology in the internet worked enterprise, James A. O'Brien, George M. Marakas, 7th edition, Tata McGraw-Hill Publishing Company Limited.
2. Management information systems, S Sadogopan, 2nd edition, PHI.
3. Information systems for modern management, Robert G. Murdick, 3rdeditionPHI.

SC   **BUSINESS INTELLIGENCE**   **3:1:0**

Objectives:

- Understand the basics of Business Intelligence and its evolution.
- Know the concepts of querying, reporting and OLAP architecture.
- Learn about the Business Intelligence lifecycle and its methodologies.
- Get an overview of various technologies associated with Business Intelligence.

Outcomes:

- Acquire the knowledge on Business Intelligence methodologies.
- Comprehend the User models of Business Intelligence in real time scenarios.
- Employ the lifecycle strategies on various BI capabilities.
- Compare and contrast various BI implementations in major companies.

Unit I: Introduction and Basics

Understanding Business Intelligence: Limited Resources, Limitless Decisions, Business Intelligence Defined: No CIA Experience Required, BI's Big Four, The BI Value Proposition, A Brief History of BI, Data collection from stone tablets to databases, BI's Split Personality: Business and Technology, BI: The people perspective; Meeting the BI Challenge: The BI Spectrum- Enterprise versus departmental BI, Strategic versus tactical business intelligence, Power versus usability in BI tools, Reporting versus predictive analytics

Unit II: Business Intelligence User Models and OLAP

Basic Reporting and Querying: Querying and reporting in context, Reporting and querying toolkit characteristics, Self-Service Reporting and Querying, Building and using ad-hoc queries, building simple on-demand self-service reports, Adding capabilities through managed querying/reporting, Data Access: Classical BI: pull-oriented information access, Emerging BI: pushing critical insights to users. OLAP: Online Analytical Processing: OLAP in Context, OLAP Application Functionality, OLAP Architecture: The OLAP Cube, OLAP access tools. OLAP versus OLTP

Unit III: The BI Lifecycle

The BI Big Picture: So Many Methodologies, So Little Time, Starting at the beginning, The exception to the rule: Micro-BI, Customizing BI for Your Needs: Your not-so-clean slate, Initial activities, Selecting BI products and technologies, Taking a Closer Look at BI Strategy: The Big Picture, Your Current BI Capabilities (or Lack Thereof), Assessing your business infrastructure, Assessing the technology stack, top to bottom, Keep the good stuff, Throw out the bad stuff

Unit IV: BI and Technology

Data Warehouses and BI, consolidating information across silos, Structuring data to enable BI, Data Models, Dimensional data model, Other kinds of data models, Data Marts, Operational Data Stores, The BI Software Marketplace - A little history, Mergers and acquisitions Major Software Companies in BI – Oracle, Microsoft, SAP, IBM

References:

1. Business Intelligence For Dummies- Swain Scheps, 1st edition, Wiley publishing.
2. Business Intelligence and Analytics: Systems for Decision Support, Ramesh Shardha. 10th edition, Pearson, 2014.
3. Business analytics for managers: taking business intelligence beyond reporting, Gert H.N, 2nd edition, Wiley Publishing.

| SC | ENTREPRENEURSHIP DEVELOPMENT | 3:1:0 |

Objectives:

- To know the fundaments of entrepreneurship
- To learn importance of women and rural entrepreneurship
- To understand different motivating factors for entrepreneurs
- To know essence and characteristics of management

Outcomes:

- Analyze the history and need for entrepreneurship
- Employ the functions of women and rural entrepreneurship
- Inculcating the behaviors of entrepreneurs
- Comprehend the need and importance of management

Unit I: Entrepreneur & Entrepreneurship

Introduction, Evolution of the concept of Entrepreneur, Characteristics of successful entrepreneurs, the charms of becoming of an Entrepreneur, The Entrepreneurial Decision Process, Functions of Entrepreneur, Need for an Entrepreneur, Types of Entrepreneurs, Concept of Entrepreneurship, Growth of Entrepreneurship in India.

Unit II: Women and Rural Entrepreneurship

Concept of Women Entrepreneur, Functions of Women Entrepreneurs, Growth of Women Entrepreneurship in India, Problems of Women Entrepreneur, Developing Women Entrepreneurship, Meaning of Rural Entrepreneurship, Need for Rural Entrepreneurship, Rural Entrepreneurship/Industrialization in Retrospect, Problems of Rural Entrepreneurship. How to develop Rural Entrepreneurship.

Unit III: Entrepreneurial Motivation

Meaning of Entrepreneurial Motivation, Motivational Cycle or Process, Entrepreneurial Motivating Factors, Entrepreneurial Motivational Behavior – Creativity, Self-Efficacy, Locus of control, Risk taking, Leadership, Communication

Unit-IV: Management

Meaning of Management, Characteristics of Management, Difference between Management and Administration, Management as Science, Art and Profession, Importance of Management, Scope of Management, Functions of Management, Management Process, Principles of Management.

References:

1. Entrepreneurial Development, S.S Khanka, 1st edition, S.Chand Publication.
2. Dynamics of Entrepreneurship Development, Vasant Desai,6th edition, Himayala Publishing House.
3. Entrepreneurship: New Venture Creation, David H. Holt, Pearson Publication.

SC   **COMMUNICATION SKILLS**   **3:1:0**

Objectives:

- The factors governing good communication and how good communication skills can be developed.
- How good communication skills are a critical building block to both personal and business success.
- How to use effective communication skills in business.
- The need to modify communication depending on business situation and circumstances.

Outcomes:

- Understand and apply knowledge of human communication and language processes as they occur across various contexts from multiple perspectives.
- Understand and evaluate key theoretical approaches used in the interdisciplinary field of communication.
- Find, use, and evaluate primary academic writing associated with the communication discipline.
- Communicate effectively orally and in writing.

Unit I

Importance of communication, its basic model, formal and informal communications, barriers to communication, feedback and its effectiveness, Non- Verbal communication.

Unit II

Oral communication, Speaking: Paralanguage: Sounds, stress, intonation- Art of conversation – Presentation skills, – Public speaking- Expressing Techniques, understanding your audience, importance of listening, role of visual aids, persuasive communication.

Unit III

Written communication – Good writing – Styles and Principles – Text, Email, Memorandums, reports, Letters, resume writing.

Unit IV

Group Discussion, Interview skills- types of interviews, telephonic interview, Time management, Stress management.

References

1. Business Communication for Success, University Of Minnesota Libraries Publishing Edition, 2015.
2. Soft skills: know yourself & know the world, Dr. Alex K.
3. Basic Management skills for all, S J McGrath E H, 9th Edition, PHI Learning.

SC   PROFESSIONAL ETHICS AND HUMAN VALUES   3:1:0

Objectives:
- Understand the fundamentals of Human values.
- Know the concepts of engineering ethics and responsibilities.
- Learn about the Business Intelligence lifecycle and its methodologies.
- Get an overview of Global issues and its practices.

Outcomes:
- Implement the aspects of Human Values.
- Interpret the ethics of engineering and its associated responsibilities.
- Employ the code of ethics in their profession.
- Get the awareness on Global issues in various streams.

Unit I: Human Values

Objectives, Morals, Values, Ethics, Integrity, Work ethics, Respect for others, living peacefully, Honesty, Courage, Valuing time, Cooperation, Commitment, Self-confidence, Challenges in the work place, Spirituality.

Unit II: Engineering Ethics and Safety, Responsibilities

Overview, Senses of engineering ethics Variety of moral issues, Moral dilemma, Moral autonomy Profession, Models of professional roles, Responsibility, Self-control, Self-interest, Self-respect, Safety definition, Safety and risk, Risk analysis, Confidentiality, Employee rights

Unit III: Engineering as Social Experimentation

Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, Industrial standards, A balanced outlook on law.

Unit IV: Global Issues

Globalization, Multinational corporations, Environmental ethics, Computer ethics, Weapons development, Engineers as managers, Engineers as advisors in planning and policy making Moral leadership.

References:

1. A Textbook on Professional Ethics and Human Values - R. S. Naagarazan, New age international publishers.
2. Human Values and Professional Ethics, Dr. Gurpreet Singh Uppal, 1st edition.
3. Human Values, Tripathi A. N., 3rd edition, New Age International Pvt Ltd Publisher.

SC   CYBER SECURITY   3:1:0

Objectives:

- Understand cybercrime, legal issues and cyber offences.
- Learn hand held devices, tools and methods used in cybercrime.
- Understand organizational implications and forensics.

Outcomes:

- Understand the concept of cybercrime and offenses.
- Analyze the tools and methods used in cyber security.
- Understand the need of cyber security organizations.

Unit I: Cybercrime and Cyber offenses

Cybercrime: Introduction, Cybercrime definition and origins of the word, Cybercrime and information security, who are Cybercriminals, Classifications of cybercrimes, Cybercrime: The legal perspectives, Cybercrimes: An Indian perspective, Cybercrime and the Indian ITA 2000, a global Perspective on cybercrimes.

Cyber offenses: Introduction, How criminal plan the attacks, Social Engineering, Cyber stalking, Cybercafé and Cybercrimes, the Fuel for Cybercrime.

Unit II: Cybercrime: Mobile And Wireless Devices

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Tools and Methods Used in Cybercrime: Introduction, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Unit III: Computer Forensics

Introduction, Historical background of cyber forensics, Digital forensics science, the need for computer forensics, cyber forensics and digital evidence, forensics analysis of email, digital forensics life cycle, Network forensics, setting up network forensics laboratory, computer forensics and steganography, Forensics and social networking: The security/privacy threats, Challenges in computer forensics, Special tools and techniques, Forensics Auditing, Anti Forensics.

Unit IV: Cyber security: Organizational Implications

Introduction, Cost of cybercrimes and IPR Issues: Lessons for Organizations, Web threats for organization, Security and Privacy Implications from Cloud Computing, Social media marketing, Protecting People's Privacy in the Organization, Organizational Guidelines for Internet Usage, Safe Computing Guidelines and Computer Usage Policy, Incident Handling: An essential component of cyber security., forensics best practices for organizations, Media and asset protection, importance of end point security in organizations.

References:

1. Cyber Security, Nina Godbole, Sunit Belapure, 1st edition, Wiley Publication.
2. Cyber Security & Global- Kennetch J. Knapp, Information Science Reference.
3. Information Systems Security, Nina Godbole, 1st edition, Wiley India.
4. Principles of Information Security, Michael E. Whitman, Herbert J. Mattord, 6th edition, Cengage Learning.
5. Cryptography and Network Security, William Stallings, 4th edition, Pearson Publication.

OE   WORLD WIDE WEB   [2:2:0]

Objectives:

- To provide the conceptual and technological development in the field of Internet and web designing.
- To provide a comprehensive knowledge of Internet, its applications and the TCP/IP protocols widely deployed to provide Internet connectivity worldwide.
- To understand how the World Wide Web with its widespread usefulness has become an integral part of the Internet.
- To provide an overview of basic concepts of web design.

Outcomes:

- Understand the working scheme of the Internet and World Wide Web.
- Understand fundamental tools and technologies used for web design.
- Comprehend the technologies for Hypertext Mark-up Language (HTML).
- Figure out the various security hazards on the internet and need of security measures.

Unit I

Introduction to Internet: What is Internet?, Evolution and History of Internet, Growth of Internet, Internet Services, How does the Internet Work?, Anatomy of Internet, Internet addressing, Internet vs. Intranet, and Impact of Internet.

Internet Technology and Protocol: ISO-OSI Reference Model, TCP/IP Protocol Suit, Data Transmission, Switching, Routers and Gateways, and Network Protocols.

Unit II

Internet Connectivity: Getting connected, Different types of connections, Levels of Internet Connectivity and Internet Service Provider.

Internet Tools and Multimedia: Current trends on Internet, Interactivity tools, Multimedia and Animation.

WWW and Web Browser: WWW, Evolution of Web, Basic Elements of WWW, Web Browsers and Search Engines.

Unit III

Web Publishing: Web Publishing, Standard Generalized Mark-up Language(SGML), Web Page Design.

HTML: An Introduction, HTML Categories, HTML Lists, HTML Tables, HTML Links, HTML Forms, HTML Frames, Style Sheets, Adding Pictures and Image Attributes.

Unit IV

Computer Networks: Computer Networks, Network Components, Network Topologies, Types of Network Architecture, Networks, Medium of Communication and Network Security.

Internet and Web Security: Overview of Internet Security, Aspects and Need of security, E-Mail Threats and Secure E-Mail, Web Security and Privacy concepts, Firewall, Cryptography, Digital Signature, Authentication, Authorization and Access Control, Copyright issues and Virus.

References

1. Internet Technology and Web Design by Instructional Software Research and Development (ISRD) Group, Tata MC Graw Hill.
2. Programming the World Wide Web, 4th Edition, Robert W. Sebesta.

OE   E-COMMERCE   [3:1:0]

Objectives:

- To impart knowledge on E-Commerce.
- To provide an overview of various applications connected with E-Commerce.
- To enable the learner for aiming careers in special software development involving E-Commerce technologies.
- Understand the security issues in E – commerce.

Outcomes:

- Analyse the impact of E-commerce on business models and strategy
- Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational structures.
- Assess electronic payment systems and its securities.
- Recognize and discuss global E-commerce issues.

Unit 1: Introduction to E-Commerce

Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle,

Electronic Markets, Electronic Data Interchange and Internet Commerce.

Unit 2: Business to Business E-Commerce

Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational Ecommerce. Business models for E-commerce, Business Process Re-Engineering.

Unit 3: Business to Consumer E-Commerce and E-Business

Consumer trade transaction, Web metrics, Elements of E-Commerce, Industry impacts of E-business. Integrating Intranet and internet web applications across multiple networks. Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

Unit 4: Security Issues

How criminals plan attacks, passive attack, Active attacks, cyber stalking, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security, Search engines, Intelligent agents in E-Commerce Electronic payment systems

References

1. E-Commerce: Strategy, Technologies & Applications, David Whitley, McGraw Hill.
2. E-commerce: The Cutting Edge of Business, K. K. Bajaj and Debjani Nag, 2nd Edition, McGraw Hill.
3. Handbook of Electronic Commerce, Shaw et al., Springer.
4. Global Electronic Commerce- Theory and Case Studies, C. Westland and T. H. K. Clark, University Press.
5. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Sunit Belapure and Nina Godbole, Wiley India.

OE   OFFICE AUTOMATION   **[2:2:0]**

Objectives:

- Provide a basic introduction to computers and computing environment.
- Enable the students in crafting professional documents using word pre-processors.
- Enable students use spreadsheets for tabulating and calculating data and create graphical representations of data.
- Enable students to design professional presentations.

Outcomes:

- Understand the basics of computer hardware and software.
- Prepare documents of different types.
- Ability to develop and use spreadsheets for tabulating and analysing for productivity.
- Prepare presentations.

Unit I

Introduction to Computers, Basic Anatomy of Computers and Introduction to MS-Office.

Unit II

MS-Word – Word Basics, Formatting Features, Menu, Commands, Tool Bars and their Icons, Mail Merge and Macros Creating Tables.

Unit III

MS-Excel - Introduction, Menu, Commands, Tool Bars and their Icons, and Functions.

Unit IV

MS-Power Point – Menu, Toolbar, Navigating in PowerPoint, Working with PowerPoint and Introduction to MS-Access.

References:

1. MS Office for Everyone – Sanjay Saxena, Vikas Publishing House.
2. Step by Step Microsoft Office XP, PHI.

COURSE RELATED RESEARCH ARTICLES:

Software Engineering

1. Taking the emotional pulse of software engineering —A systematic literature review of empirical studies, Mary Sánchez-Gordón , Ricardo Colomo-Palacios https://academic.oup.com/gigascience/articlepdf/doi/10.1093/gigascience/giz054/28698071/giz054.pdf

2. Software engineering for scientific big data analysis, Bjorn A. Gru¨ning , Samuel Lampa, Marc Vaudel and Daniel Blankenberg, https://www.researchgate.net/publication/333326758_Software_engineering_for_scientific_big_data_analysis

3. Software Engineering for Machine Learning: A Case Study, Saleema Amershi, Andrew Begel, Christian Bird, Robert DeLine, https://ieeexplore.ieee.org/abstract/document/8804457

Data Communication and Networks:

1. Comprehensive review for energy efficient hierarchical routing protocols on wireless sensor networks, Springer,2018, https://link.springer.com/article/10.1007/s11276-018-1696-1

2. A Survey on Recent Advances in Transport Layer Protocols, Michele Polese and et al, IEEE 2019, https://ieeexplore.ieee.org/abstract/document/8786240

Cloud Computing:

1. Research on Key Technologies of Cloud Computing, Shufen Zhang, Hongcan Yan, XuebinChen, Published by Elsevier, https://www.sciencedirect.com/science/article/pii/S1875389212015994

2. Open Source Solution for Cloud Computing Platform Using OpenStack, Rakesh Kumar, Neha Gupta, Shilpi Charu, Kanishk Jain, Sunil Kumar Jangir, https://www.researchgate.net/publication/263581733_Open_Source_Solution_for_Cloud_Computing_Platform_Using_OpenStack

3. The Challenges of Cloud Computing Management Information System in Academic Work, T.Rodmunkong,P.Wannapiroon,and P.Nilsook, https://www.researchgate.net/publication/273897590_The_Challenges_of_Cloud_Computing_Management_Information_System_in_Academic_Work

Cryptography and Network Security:

1. A Review Paper on Cryptography, Abdalbasit Mohammed Qadir and Nurhayat Varol, IEEE 2019, https://www.researchgate.net/profile/Abdalbasit_Mohammed/publication/334418542_A_Review_Paper_on_Cryptography/links/5db07f61299bf111d4c01521/A-Review-Paper-on-Cryptography.pdf

2. Security Evaluation of Computer Network Based on Hierarchy, Linbin Wen, International Journal of Network Security,2019,.

http://ijns.jalaxy.com.tw/contents/ijns-v21-n5/ijns-2019-v21-n5-p735-740.pdf

Internet of Things:

1. A Study on Internet of Things based Applications, Deeksha Jain, P. Venkata Krishna and V. Saritha, https://www.researchgate.net/publication/227172798_A_Study_on_Internet_of_Things_based_Applications

2. IoT enabled Smart Fog Computing for Vehicular Traffic Control, Akashdeep Bhardwaj, Sam Goundar, https://eudl.eu/pdf/10.4108/eai.31-10-2018.162221

3. A Review of Smart Parking Using Internet of Things (IoT), Sahil Rupani, Nishant Doshi, https://www.sciencedirect.com/science/article/pii/S1877050919317235

Information Retrieval

1. Query expansion techniques for information retrieval: A survey, Hiteshwar Kumar Azad, Akshay Deepak, https://www.sciencedirect.com/science/article/pii/S0306457318305466

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2. Very Deep Convolutional Networks for Large-Scale Image Recognition, Karen Simonyan and Andrew Zisserman, https://arxiv.org/pdf/1409.1556.pdf

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ADDITIONAL WEB RESOURCES

1. Programming Paradigms
   https://see.stanford.edu/Course/CS107
2. Introduction to Robotics
   https://see.stanford.edu/Course/CS223A
3. Programming Methodology
   https://see.stanford.edu/Course/CS106A
4. Programming Abstractions
   https://see.stanford.edu/Course/CS106B
5. Programming for the Puzzled
   https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s095-programming-for-the-puzzled-january-iap-2018/
6. Machine Learning
   https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/
7. Machine Learning for Healthcare
   https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s897-machine-learning-for-healthcare-spring-2019/
8. Introduction to Deep Learning
   https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s191-introduction-to-deep-learning-january-iap-2020/
9. Advanced Data Structures
   https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-851-advanced-data-structures-spring-2012/
10. Kotlin Tutorial
    https://www.w3schools.com/kotlin/index.php
11. Python Programming
    https://www.w3schools.com/python/default.asp
12. Angular JS
    https://www.w3schools.com/angular/default.asp
13. Cyber Security
    https://www.w3schools.com/cybersecurity/index.php
14. Data Scientist
    https://www.codecademy.com/learn/paths/data-science
15. Analyze data with Python
    https://www.codecademy.com/learn/paths/analyze-data-with-python

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