Course Title: Discrete Structure (3 Cr.)
Course Code: MCA501
Year/Semester: I/I
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:

This course offers detailed concept about Logic and Proof, Algorithms, Mathematical Reasoning, Induction, and Recursion, Relations, Graphs, Trees, Network Flows, and Automata.

Course Objectives:

The objectives of this course are to provide theoretical as well as practical concepts and understanding of logics, number theory, induction and recursion, recurrence relation, relation and graph theory, network flows and basics of automata theory.

Course Contents:

Unit 1: Logic and Proofs **[10 hrs]**

Proposition and propositional logic, Logical connectives, tautology, contradiction and contingency, Representing English sentences into propositional logic, Propositional equivalences, rule of inferences, valid argument, rule of inferences and testing validity of argument, The predicate logic, quantifiers, rule of inferences for quantified statements, Proof techniques (direct method, indirect method, proof by contradiction, trivial and vacuous proof, proof by counter examples, proof by cases)

Unit 2: Induction and Recursion **[5 hrs]**

Mathematical induction and its principle, strong induction, recursive definitions, structural inductions, recursive algorithms and its correctness.

Unit 3: Number Theory **[6 hours]**

Divisibility and modular arithmetic, primes, greatest common divisor, least common multiples, Euclidean and extended Euclidean algorithms, Linear congruence and solving linear congruence, Chinese remainder theorem, computer arithmetic with large integers,

Unit 4: Recurrence Relations **[6 hrs]**

Recursive definitions of sequences, applications of recurrence relations, solving linear recurrence relations (homogeneous and non-homogeneous recurrence relations)

Unit 5: Relation and Graph Theory **[15 hours]**

Relation, types of relation, properties of relation, representation of relation, equivalence relation, partial order relations, and Partial order set, Total order relations, Hassie diagram, Lattice.

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Introduction to graph, undirected and directed graph, some special types of graphs, graph representation methods, Graph connectivity, graph isomorphism, Euler and Hamilton graphs, Shortest path problem: Dijkstra's algorithm, Planar graph and applications, Graph coloring and applications, Tree and tree terminologies, Applications of tree (Binary search tree, Game tree, decision tree, Huffman tree, expression tree), tree traversal and techniques, minimum spanning tree and algorithm to construct minimum spanning tree, network flows, Maxflow and Mincut.

Unit 6: Finite Automata **[6hrs]**

Deterministic Finite Automata, Non-Deterministic Finite Automata, Regular Expressions and Kleene's Theorem

Laboratory Work:

The laboratory work should cover implementation of concepts and algorithms covered in each unit of the syllabus.

References:

1. Kenneth H. Rosen, Discrete mathematics and its applications, Eighth Edition McGraw Hill Publication.
2. Ken Bogart, Scot Drysdale, Cliff Stein, Discrete Mathematics for Computer Scientists, First Edition Addison-Wesley, 2010
3. A Course in Discrete Structures, Rafael Pass Wei-Lung Dustin Tseng
4. Bernard Kolman, Robert Busby, Sharon C. Ross, Discrete Mathematical Structures, Sixth Edition Pearson Publications, 2015
5. R. Joshnsonbaugh; Discrete Mathematics, Pearson Education Asia.
6. Seymour Lipschutz and Marc Lipson; Discrete Mathematics, (Schaum's Outline).
7. Narsingh Deo: Graph Theory (with application to engineering and computer science), Prentice – Hall of India Pvt. Ltd.

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Course Title: Advanced Operating System (3 Cr.)
Course Code: MCA502
Year/ Semester: I/I
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description

The course provides the knowledge about Operating System and its functionality. Each and every Operating System function is discussed in detailed. This course also provides an attempt to throw some light on the advanced topics in O/S like Multiprocessors systems and Distributed O/S. Multiple case studies are organized so as to provide the support whatever they had pursued theoretical.

Course Objectives

The general objectives of this course is:

- To provide students with a deep understanding of the principles and technologies that underlie modern operating systems.
- To enable students to analyse and design advanced operating systems and their components.
- To prepare students to work with and develop emerging technologies in the field of operating systems, such as distributed systems, cloud computing, and mobile and embedded devices.
- To expose students to real-world case studies and examples of advanced operating systems in action.

Unit-1 Introduction **[2 Hrs.]**

Fundamentals of operating system design and architecture (concepts such as system calls, system libraries, and system services), history of operating systems, overview of modern operating systems (functions and types of operating systems).

Introduction to key concepts and technologies used in advanced operating systems, such as concurrency, virtualization, and distributed systems.

Unit-2 Processes, Threads, Deadlocks **[12 Hrs.]**

Fundamentals of processes and threads (concepts, process and thread states, process and thread scheduling, and process and thread synchronization), process and thread management in advanced operating systems (process and thread creation, process and thread termination, and process and thread scheduling).

Deadlock detection and prevention (including techniques such as deadlock avoidance, deadlock detection, and deadlock recovery).

Advanced topics in process and thread management, such as real-time systems, transactional memory, and support for concurrent programming languages.

Case Studies on

- Operating systems for the Internet of Things (IoT) and edge computing systems.
- Virtualization and virtual machine design
- Cloud computing management

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- Operating system support for mobile and embedded devices
- Operating system support for real-time and safety-critical systems
- Operating system support for high-performance computing

Unit-3 Memory and Input/Output Management **[10 Hrs.]**

Fundamentals of computer memory (including concepts such as memory hierarchy, cache memory, and virtual memory), memory management in advanced operating systems (memory allocation, paging, and swapping), memory performance and optimization (memory compression, memory deduplication, and memory tiering),

I/O systems and device management (device drivers, device controllers, and device interfaces), I/O performance and optimization (I/O scheduling, I/O caching, and I/O virtualization)

Advanced topics in memory and I/O management, such as persistent memory, memory-mapped I/O, and support for high-performance computing and big data applications.

Case study on the design and implementation of the memory management and virtual memory system used in the Linux operating system.

Unit-4 Files Organization and implementation **[5 Hrs.]**

Fundamentals of file system design, file system organization, file system implementation, file system performance (disk scheduling, disk caching, and file system optimization), file system security and protection (file permissions, access control lists, and file system encryption).

Case studies of real-world file systems, such as NTFS, ext4, and HFS+.

Case studies on operating system organization, implementation and support for big data and data-intensive applications.

Unit-5 Security and protection mechanisms **[5 Hrs.]**

Fundamentals of computer security (confidentiality, integrity, and availability), security threats and vulnerabilities (malware, phishing, and social engineering attacks), operating system security features (access control, authentication, and encryption), operating system support for security and privacy (virtualization, containers, and sandboxing).

Advanced topics in operating system security, such as cryptography, trusted computing, and secure boot.

Case study on the analysis of a real-world security breach or vulnerability in an operating system (such as the WannaCry ransomware attack that exploited a vulnerability in Microsoft Windows).

Unit-6 Distributed Operating System **[7 Hrs.]**

Fundamentals of distributed systems, distributed system models and architectures (client-server systems, peer-to-peer systems, and cloud computing), design and implementation of distributed file systems (issues such as consistency, availability, and performance), distributed resource management and scheduling (load balancing and fault tolerance), coordination and consistency in distributed systems (techniques such as distributed transactions and distributed locking), security and privacy in distributed systems (authentication, authorization, and confidentiality.

Advanced topics in distributed systems, such as distributed databases and distributed machine learning.

Case studies of real-world distributed systems, such as Google's distributed file system (GFS) and the Hadoop distributed computing platform.

Unit-7 Multiple Processor Operating Systems **[7 Hrs.]**

Fundamentals of multiprocessor systems, CPU scheduling and load balancing in multiprocessor systems, Synchronization and communication in multiprocessor systems (techniques such as locks, semaphores, and message passing), memory management in multiprocessor systems (issues such as cache coherence and memory consistency).

Advanced topics in multiprocessor systems, such as real-time systems and heterogeneous architectures.

Case studies of multiprocessor operating systems, such as UNIX, Macintosh and Windows.

Case study could be the design and implementation of the SMP support in the Solaris operating system.

Laboratory Works

Laboratory works should be done covering all the topics listed above units

References:

1. Tanenbaum, A. S., & Bos, H. *Modern Operating Systems* (5th ed.). Pearson.
2. Silberschatz, A., Gagne, G., & Galvin, P. B. *Operating System Concepts* (10th ed.). Wiley.
3. Stallings, W. *Operating Systems: Internals and Design Principles, 9/e* (9th ed.). Pearson

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Course Title: Advance Database Management System (3 Cr.)
Course Code: MCA503
Year/Semester: I/I
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:
This course offers both theoretical as well as practical knowledge of advance database management system including object and object-relational database, query processing and optimization, distributed database concept, NOSQL, big data technologies and enhanced data models including active, temporal, spatial, multimedia and deductive databases.

Course Objectives:

The main objective of this course is to make students familiar with the concepts of advance database management system so that upon completion of the course students will be able to use and develop object oriented databases, process and optimize database queries, understand and deploy distributed databases, use NOSQL big data technologies and enhanced data models.

Course Content:

Unit 1: Object and Object-Relational Databases **[6 Hrs.]**

Overview of Object-Oriented concepts; Object database extension to SQL; The ODMG object model and the object definition language (ODL); Object Database Conceptual Design; The object query language (OQL).

Unit 2: Query Processing **[7 Hrs.]**

Translating SQL Queries into Relational Algebra and Other Operators; Algorithms for External Sorting; Algorithms for SELECT Operation; Implementing the JOIN Operation; Algorithms for PROJECT and Set Operations; Implementing Aggregate Operations and Different types of JOINs; Combining Operations Using Pipelining; Parallel Algorithms for Query Processing.

Unit 3: Query Optimization **[9 Hrs.]**

Query Trees and Heuristics for Query Optimization; Choice of Query Execution Plans; Use of Selectivities in Cost-Based Optimization; Cost Functions for SELECT Operation; Cost Functions for the JOIN Operation; Example to Illustrate Cost-Based Query Optimization; Additional Issues Related to Query Optimization; An Example of Query Optimization in Data Warehouses

Unit 4: Distributed Database Concepts **[9 Hrs.]**

Distributed Database Concepts; Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design; Overview of Concurrency Control and Recovery in Distributed Databases; Overview of Transaction Management in Distributed Databases; Query Processing and Optimization in Distributed Databases; Types of Distributed Database Systems; Distributed Database Architectures; Distributed Catalog Management

Unit 5: NOSQL Databases and Big Data Storage Systems **[7 Hrs.]**

Introduction to NOSQL Systems; The CAP Theorem; Document-Based NOSQL Systems and MongoDB; NOSQL Key-Value Stores; Column-Based or Wide Column NOSQL Systems; NOSQL Graph Databases and Neo4j

Unit 6: Big Data Technologies Based on MapReduce and Hadoop **[5 Hrs.]**

Introduction to Big Data; Introduction to MapReduce and Hadoop; Hadoop Distributed File System (HDFS); MapReduce: Additional Details; Hadoop v2 alias YARN

Unit 7: Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia, and Deductive Databases **[5 Hrs.]**

Active Database Concepts and Triggers; Temporal Database Concepts; Spatial Database Concepts; Multimedia Database Concepts; Introduction to Deductive Databases

Laboratory Works

The laboratory work should include the implementation and simulation of the concepts in above mentioned units using appropriate platforms and tools. Students should do a project using the concepts learnt. .

References:

1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill
3. Korth, Silberchatz, Sudarshan , Database System Concepts, McGraw-Hill.
4. Peter Rob and Coronel, Database Systems, Design, Implementation and Management, Thomson Learning.
5. C.J. Date & Longman, Introduction to Database Systems, Pearson Education

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Course Title: Programming Logic & Techniques using Python (3 Cr.)
Course Code: MCA504
Year/Semester: I/I
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:

This course provides Python based programming logic and techniques. It's fast-growing programming language out there and is becoming an integral part of many profession from finance, insurance, web development, research and cyber security. Students are introduced with basic python programming with data structure, file handling, OOP concept and GUI programming and Database programming. This course also cover standard python libraries for data processing, visualization and analysis.

Course Objectives:

The main objective of this course to provide knowledge to student with python programming basics, exemplify the concept of OOP, GUI and Database programming, Use and demonstrate standard python library for data processing, visualization and analysis.

Course Contents:

Unit-1 Python Language Basics **[6 Hrs.]**

Introduction to python, algorithm and flowchart, Installing python, interactive shell, editing, saving and running script

Data type, operator and expression, control structure, Arrays, Function: custom function, recursive and lambda function, string and number: converting string to number and vice-versa.

Unit-2 Data Structure and File Handling **[7 Hrs.]**

List Comprehensions: List indexing and splitting, update list value, list operation, Dictionary Comprehensions: accessing dictionary value, adding, deleting and Iterating Dictionary Values, built-in dictionary functions

File Handling: Manipulating files and directories, os and sys modules, text file: reading and writing text and number rom/to file, create and reading formatted file (CSV or tab-separated)

Unit-3 Object-Oriented programming and GUI programming **[9 Hrs.]**

Creating class and object, Constructor, inheritance abstraction, polymorphism and exception class, iterators, generators and decorators in python.

Introduction to GUI building libraries, components and event, widgets (Button, Entry, Frame, Text, Label, Checkbutton, Radiobutton, Listbox. Menu and Menu button)

Unit-4 Database programming using python **[6 Hrs.]**

Connecting to database, sending DML and DDL queries and processing result from python program, Commit and Rollback operation.

Unit-5 Basic data processing and analysis using python libraries **[15 Hrs.]**

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Numpy: Introduction, Environment Setup, Data Type, Array Attributes, Array Creation, I/O with Numpy, Array from existing Data, Array From Numerical Ranges, Indexing and slicing, Broadcasting, Iterating Over Array , Statistical Function Sort, Search and Counting Functions.

Scipy: Introduction, Basic Functionality cluster constants integrate interpolate input and output Linalg.

Pandas: Series and DataFrames, Creating DataFrames from scratch (using list, Dictionaries, Numpy array and another DataFrame), Reading data from CSV and JSON, DataFrame Operations: head and tail, attributes and underlying data, handling of missing data, slicing, fancy indexing, and subsetting, merging and joining DataFrame.

Unit-6 Data visualization with Matplotlib **[5 Hrs.]**

Matplotlib: Introduction to Matplotlib, Setting Environment, Pyplot API, Simple Plot, Multi-plots, Subplots(), Subplot2grid() functions, Grids Formatting Axes, Setting Limits, Bar Plot, Line Plot, Scatter Plot, Histogram , pie chart and Box plot.

Laboratory Work:

- To install python and implement basic python language features.
- To implement data structure like list and dictionary.
- To create, write and read text and CSV file.
- To create class and object and to implement object oriented feature like inheritance, polymorphism and exception class.
- To create GUI based applications
- To implement database application
- To use python libraries for data processing, visualization and analysis.

References:

1. Kenneth A Lampart: Fundamental of python, Cengage Learning Publishing.
2. Wes MCkinney: "Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter", 3rd Edition, O'REILLY
3. Cody Jackson (2018): Learn programming in Python with cody Jackson, Packt Publishing, Wesley.
4. Mark Summerfield: "Programming in Python 3: A Complete Introduction to the Python Language", Addison-Wesley Professional.

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Course Title: Research Methodology in Computer Application (3 Cr.)
Course Code: MCA505
Year/Semester: I/I
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:

This course is about understanding the importance of research in computer application in terms of human computer interaction. It provides the basic foundation of research in computer application and the process of entire research in computer application which is discussed under research methodology in computer application. The course begins with the introduction and importance of research in computer application and includes the essential components of research process such as philosophical assumptions, conceptualization, literature review, identifying research gap and formulating research problem/questions/objectives/hypothesis, design the research focusing on measurement, instrumentation and data collection. The focus of the course is also computer/software based data analysis and interpretation techniques and skills which produced scientific knowledge Along with theoretical knowledge the course emphasizes on developing practical skills among students so that they can easily carryout research in the area of computer application. In order to develop practical skills, based on hands on practice, the course introduces software like, SPSS, Stata, Python, R and so on and engages students in a particular software (based on relevancy and availability of necessary infrastructure including teaching faculty. Finally, the course includes introduction and practice of Statistical software, Plagiarism checker, citation and referencing tools/packages which enable students to be confirmed that the scientific paper they have written avoids plagiarism, appropriately formatted and referenced.

Course Objectives:

The objective of the course is to enable students to plan their research in any topic/issue/subject in the area of computer application and develop knowledge and skill among them based on hands on practice with the help of recent methods and software based teaching. Final, students will be able to conduct their research work themselves and prepare scientific report based on or with the help of computer/statistical software. The specific objectives of the course are:

- To familiarize students with the concept and process of research and research methodology.
- To enable students to describe the process of scientific research and plan/design research.
- To develop practical skills of doing research in the areas of computer application.
- To enable the students to prepare scientific paper in the standard scientific format of the discipline computer application.

Course Contents:

Unit 1: Introduction to Research Methodology **[4 Hr.]**

Science, social science and computer application, Research and scientific research, Relationship between research, science and computer application, Research methods and methodology.

Required readings:

Lazar, Jonathan, Feng, Jinjuan Heidi, & Hochheiser, Harry. (2017). *Research Methods in Human-Computer Interaction*. Second Edition. Chapter 1, pp. 1-24. Elsevier, Morgan Kaufmann Publishers.

Unit 2: Research Topic, Literature Survey and Problem Statement **[6 Hr.]**

Identifying research topic/issue/theme, Literature survey and preparing bibliography, Doing literature review and identifying research gap, Formulating and stating research problem, Research problem/questions/objectives and hypothesis.

Required readings:

Lazar, Jonathan, Feng, Jinjuan Heidi, & Hochheiser, Harry. (2017). *Research Methods in Human-Computer Interaction*. Second Edition. Chapter 1, pp. 1-24. Elsevier, Morgan Kaufmann Publishers.

Unit 3: Research Design and Instrumentation **[10 Hr.]**

Research Design, Type of research and research design, Descriptive Research, Relational Research and Experimental Research, Relationship Between Descriptive Research, Relational Research, and Experimental Research, Measuring the human, Preparing research design: universe, population and sample size, Sample selection and instrument design, Basics of experimental research, Experimental design, Online research design, Use of qualitative methods in CA: diaries, case studies, interviews and focus groups, Ethnography: interviewing, observing, analyzing, repeating, and theorizing, Automated data collection methods.

Required readings:

Lazar, Jonathan, Feng, Jinjuan Heidi, & Hochheiser, Harry. (2017). *Research Methods in Human-Computer Interaction*. Second Edition. Chapter 2 & 3, pp. 25-69; Chapter 5, pp. 105-133; Chapter 12 & 13, pp. 329-409. Elsevier, Morgan Kaufmann Publishers.

Unit 4: Data Entry, Analysis and Interpretation **[15 Hr.]**

Data entry using software, Preparing data for statistical analysis, Application of statistics in data analysis: descriptive and inferential, Univariate, bivariate and multivariate analysis, Chi-square test, Gamma test and Spearman's Rank Order Correlation, t-test: one sample, independent and paired sample t-tests, F-test: one way and two way ANOVA, Correlation and regression, Non-parametric statistical tests, Machine learning approaches of decision making and prediction, Analyzing qualitative data.

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Required readings:

Lazar, Jonathan, Feng, Jinjuan Heidi, & Hochheiser, Harry. (2017). *Research Methods in Human-Computer Interaction*. Second Edition. Chapter 4, pp. 70-104; Chapter 11, pp. 299-327. Elsevier, Morgan Kaufmann Publishers.

Unit 5: Research Ethics and Writing Research Report **[5 Hr.]**

Working with human subjects, Research report: components and process, Preparing and submitting research proposal and report.

Required readings:

Salmani-Nodoushan, Mohammad Ali, Alavi, Seyyed Mohammad. (2004). *AAP style and research report writing*. Section Three: Reports and Theses, pp. 115-150. Zabankadeh Publications.

Lazar, Jonathan, Feng, Jinjuan Heidi, & Hochheiser, Harry. (2017). *Research Methods in Human-Computer Interaction*. Second Edition. Chapter 15, pp. 454-492. Elsevier, Morgan Kaufmann Publishers.

Wang, Gabe T. & Park, Keumjae. (2016). From Topic Selection to the Complete Paper. Chapter 7, pp. and Chapter 11. Willey Blackwell.

Unit 6: Research based Project Work: **[8 Hr.]**

Selection of a topic, Prepare research proposal, Develop a research plan or Research Design, Collect data and analyze data (computer based), Write a research report.

Required readings:

Salmani-Nodoushan, Mohammad Ali, Alavi, Seyyed Mohammad. (2004). *AAP style and research report writing*. Section Three: Reports and Theses, pp. 115-150. Zabankadeh Publications (info@zabankadeh.net).

Wang, Gabe T. & Park, Keumjae. (2016). *From Topic Selection to the Complete Paper*. Willey Blackwell.

Laboratory Work:

Use of Text editor (LaTex), Data analysis (R Programming/Python), Grammar tool (Grammarly), Referencing tool (Mendeley/EndNote), Plagiarism Checker (Turnitin), Research repository (Google Scholar, Scopus, Zotero),

References:

1. "Research Methodology Methods and Techniques", C. R. Kothari and Gaurav Garg, New Age International, 2019
2. "Research Methodology, A Practical and Scientific Approach" Edited by Vinayak Bairagi and Mousami V. Munot, CRC Press, 2019

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3. "Engineering Research Methodology: A Computer Science and Engineering and Information and Communication Technologies Perspective", Krishnan Nallaperumal,

Course Title: Technical Writing (1 Cr.)
Course Code: MCA506
Year/Semester: I/I
Class Load: 2Hrs. / Week (Practical: 2 Hrs.)

Course Description

This course intends to impart technical communication skills required in both personal and professional settings. The course not only familiarizes students with various genres, styles, and mediums of technical communication but also equips them with advanced technical, audio/video skills required for gathering, organizing, and disseminating information for maximum impact in the process of development and implementation of computer-based solutions.

Objectives

The course focuses to inculcate technical communication skills in students and stimulate their interest in the use of formal technical language to prepare and present so that it can be used more accurately, clearly, and concisely to prepare various plans and reports in the field of computer-based system/software development, administration and management. The main objectives are:

- To write computer hardware/Software system specifications.
- To prepare tender and bid documents for computer-based solutions.
- To write formal contract papers.
- To prepare system design using formal language.
- To write a project development plan.
- To write a project implementation plan.
- To write system/user manuals.
- To develop audio/video training materials for computer-based solutions.
- To analyze policies related to the use and development of computer-based solutions.
- To write a memorandum of understanding (MOU) paper.
- To write technical verification reports.
- To conduct webinars.
- To write project progress reports.

Nature/Process of the Course:
It is practical work, which will be completed under the supervision of supervisor. There will be formal orientation on technical writing process and domains. After the orientation, Student submits synopsis of work which he/she is planning to do. Based on the synopsis submitted by the student supervisor will be assigned. An individual student should prepare and present product, process and system documents (plans, reports, contracts, manuals etc.) assigned by the department/committee. These documents should be related to the field of computer system/software development, administration, management and policy making. There will not be any external examination conducted by FoHSS for this course, it is totally evaluated by the

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internal activities completed under the supervision of the supervisor and Viva. Generally, student will prepare and present a single document, but in some circumstances (short documents) students may prepare more than one documents to adjust the course weightage under the decision of department/committee.

Evaluation Criteria:

Students' work is evaluated by HoD/Director/Program Coordinator, Supervisor, and Final Viva conducted by the department.

Synopsis	HoD. /Director /Coordinator	Supervisor	Final Viva
10 - Marks	10 - Marks	Content Selection(Complexity) – 10 Marks Communication Skill – 10 Marks Language & Grammar – 10 marks Tools used in Report Preparation (Report Formatting, Grammar Tool, Text Editor, Citation, Referencing) – 10 Marks Research Work (Audience Analysis, Simplicity, Modularity) – 10 Marks	Report: 10 Marks Presentation: 10 Marks Viva: 10 Marks
Total Marks: 100 Marks			

The Final Viva team will be formatted including the following members:

- HoD/Director/Program Coordinator - 1
- Supervisor - 1
- Domain Expert – 1(At least)

Report Format:

Report format varies as per nature and type of the report. It should be prepared under a well-accepted common standard format of the domain. It is highly recommended to include digital content like audio, video, and animation (if applicable).

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Course Title: Algorithm Analysis and Design (3 Cr.)
Course Code: MCA551
Year/Semester: I/II
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:

This Course introduce basic knowledge of algorithm analysis and design. It consist of mathematical tools for analysis of algorithm, Complexity analysis of iterative and recursive algorithms, Various algorithm design techniques like Divide and conquer approach, Greedy approach, Dynamic programming approach, Back tracking and Branch and Bound, Basic Geometric algorithms, NP-completeness and approximation algorithms. For each topic, beside in-depth coverage, one or more representative problems and their algorithm shall be discussed.

Course Objectives:

- To learn importance of designing an algorithm effective way by considering space and time complexity.
- To introduce asymptotic notation for analysis of algorithm.
- To discuss various algorithm design techniques with proper illustrative examples.
- To introduce geometric algorithm and complexity theory.

Course Contents:

Unit-1 Fundamental of Algorithm Analysis **[6 Hrs.]**

Algorithm Fundamentals: Introduction and its basic properties, pseudo code for expressing algorithms, Explanation of the RAM model and its use for algorithm analysis.

Performance analysis: Time and space complexity with best, worst and average case, complexity calculation of simple algorithms.

Asymptotic Notations and its properties: Big-O, Big-Ω and Big-θ notation and their geometrical interpretation and examples.

Unit-2 Iterative vs. Recursive Algorithm **[6 Hrs.]**

Iterative Algorithm: Algorithm for GCD, Fibonacci Numbers, sequential search, Bubble sort, insertion sort, selection sort with analysis of their time and space complexity.

Recursive Algorithm: Definition of Recursive algorithm with some example, Recurrence relation: definition, solution of recurrence equations: substitution method, recursion tree method, iteration method, Master theorem

Unit-3 Algorithm Design Techniques **[24 Hrs.]**

Divide and Conquer Approach: Application and description of Divide and Conquer approach, Applications: Binary search, Merge sort, Quick sort, Randomized Quick sort, Heap sort examples and their time complexity analysis [6Hrs.]

Greedy Approach: Definition of Greedy approach for algorithm design, elements of Greedy approach, Algorithms: Fractional knapsack problem, MST (Minimum Spanning Tree), Huffman coding algorithm examples and complexity analysis. [6Hrs.]

Dynamic Programming Approach: Introduction to dynamic programming, recursion vs. dynamic programming, Matrix Chain Multiplication algorithm, 0/1 knapsack problem, String Editing algorithm, Floyd Warshall algorithm for all pair shortest path problem examples and its complexity analysis. [6Hrs.]

Back tracking and Branch and Bound Approach: Introduction, Recursion vs. Backtracking, Algorithm for subset sum, 8-Queen problem, Graph coloring examples and complexity analysis, Branch and Bound: Travelling salesman problem [6Hrs.]

Unit-4 Geometric Algorithms **[6 Hrs.]**

Introduction to Computation Geometry, Representation of point, Lines, Line segment, Ray, polygon, mouth and ear of polygon, polygon triangulation, segment intersection computation detection of point of intersection.

Convex Hull Computation in 2D: Graham's scan algorithm, examples and its complexity analysis. Closest Pair problem, algorithm, examples and complexity analysis

Unit-5 NP-Complete Problems and Approximation algorithms **[6 Hrs.]**

NP Completeness: Introduction, class P, NP, NP complete, NP Hard with example, cooks theorem, NP Complete Problems: Vertex Cover Problem.

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Approximation Algorithms: Concept and application, Vertex Cover Problem, Subset Sum Problem.

Laboratory Works:

The laboratory work includes implementation of following algorithm and perform their analysis for time and space complexity.

- Implantations and complexity analysis of basic iterative and recursive algorithms.
- Implementation and comparative analysis of binary search and linear search, and merge sort, quick sort and heap sort using divide and conquer approach.
- Implementation and complexity analysis of knapsack problem, minimum cost spanning trees algorithm using greedy approach
- Implementation and comparative analysis of 0/1 knapsack problem with fractional knapsack, and implementation of String Editing, All pairs shortest path problem using dynamic Programming approach.
- Implementation and complexity analysis of 8-queen problem using backtracking approach.
- Implementation and complexity analysis of Graham's Scan algorithm.
- Implementation of Approximation algorithms.

References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, ***Introduction to Algorithms,*** MIT Press, 2009
2. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, ***Computer Algorithms***, Universities Press, 2007
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ***The Design and Analysis of Computer Algorithms,*** Pearson Education, 1999.
4. Anany Levitin, ***Introduction to the Design and Analysis of Algorithms***, Pearson, 3rd Edition, 2011.
5. Gilles Brassard, Paul Bratley, ***Fundamentals of Algorithmics***, Pearson Education, 1995.
6. Richard E. Neapolitan, Kumarss Naimipour, ***Foundations of Algorithms using C++ Psuedocode,*** Second Edition, 1997.

Course Title: Object-Oriented Software Engineering (3 Cr.)
Course No: MCA552
Year/Semester: I/II
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:
This course is to train the students on Object Oriented Software Engineering features. It helps the students to develop projects using object-oriented analysis, design, and testing techniques

Course Objectives:

In the theoretical part, students will learn about the principles and methods of Object-Oriented software engineering, including current and emerging Object-Oriented software engineering practices and support tools. In the practical part, students will become familiar with the development of Object-Oriented software products from an industry perspective.

Unit 1 Introduction **[4 Hrs.]**
System development as an industrial process, Software life cycle models-process of change, reuse and methodology, Requirement analysis and specification, object-oriented software Development

Unit 2: Object Oriented software development **[5 Hrs.]**
Introduction to object-orientation, object- oriented system development-function /data methods, Object oriented analysis, construction and testing, object -oriented programming with examples

Unit 3: Object Oriented Programming **[2 Hrs.]**
Introduction, Object, Class and instances, Inheritance, Polymorphism

Unit 4: Architecture and analysis concept **[5 Hrs.]**
Architecture-model architecture, requirements, analysis, design, implementation and test model, Analysis-requirement and analysis model, construction, Real-time system-classification of real-time systems.

Unit 5: Database Specialization, Component and testing **[5 Hrs.]**
Database-RDBMS, Object DBMS, components-use of components, component management, testing-on testing, Unit, integration, system and the testing process

Unit 6: Notation **[5 Hrs.]**
The Unified Modeling Language, Package, Component, Deployment, Use Case, Activity, Class, Sequence, Interaction Overview, Composite Structure, State Machine, Timing, Object and Communication Diagrams

Unit 7: Managing object-oriented software engineering **[6 Hrs.]**
Introduction, Project selection and preparation, product development organization, project organization and management, project staffing, software quality assurance, software metrics

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Unit 8: Other Object-Oriented Methods **[6 Hrs.]**

Object oriented analysis and design, hierarchical object-Oriented design, object Modeling Technique and responsibility-driven design

Unit 9: Case Study **[10 Hrs.]**

Case studies on Warehouse management, Telecom System, Weather Monitoring System, Cryptanalysis, Vacation Tracking System, Satellite based navigation, Traffic Management

Laboratory Works

The laboratory work should include all chapter using tool implementing Object Oriented Approach.

References

1. Ivar Jacobson, -Object-Oriented software engineering, Pearson Education, 7th edition
2. Ian Sommerville-Software Engineering, Pearson Education,9th edition
3. Grady Booch-Object-oriented analysis and design. Pearson Education,3rd edition
4. Timothy C. Lethbridge- Object-Oriented Software Engineering, Grawhill,2nd edition

Course Title: Internet & Web Programming (3 Cr.)
Course Code: MCA503
Year/Semester: I/II
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:
The contemporary web technologies are covered in-depth in this course. With the help of React.js, Node.js, MongoDB, and Progressive Web Applications, this course teaches students how to create graphical user interfaces for modern software applications utilizing React.js, Node.js, MongoDB, and Progressive Web Applications.

Course Objectives:
The primary goal of the course is to introduce the essential ideas behind the framework for creating, integrating, and deploying Web client and server Web applications using the approach of progressive web development.

Unit 1: Introduction to Web Technology **5 Hrs.**
Clients, Servers, and Communication. The Internet-Basic Internet Protocols The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study, Generation of Web; Semantic Technologies and Linked Data Foundations; Advance Concept of Markup Languages and Style-Sheets and JavaScript.

Unit 2: React, NodeJS, Express **20 Hrs.**
The MERN Stack-Theory: Module Introduction, Features, Objectives, Application Areas, Functional Components, Understanding the Front-End Back-End and APIs, Connecting Node and React, Creating Developing Environment and Development Servers, Installing Node JS;

React.js: Overview of JSX, react Js environment setups, a real-time application by using react JS, react JS component life cycles overview, routing in react JS and other JS concepts, event handling in JSX, how to write styles in react JS, react server integration & deployment, react router with navigation, flux, redux overview, fetch data using GRAPHQL, HOOKS.

Node.js and Express.js-Building REST API: Module Introduction, Setting Up Project, Sending Requests and Responses, Implementing Routing, adding a POST Route, Patch Route, Adding Place-Specific Routs, Handling Errors, adding own Error Model, Adding Controller, Setting Up the User Routs, Validating API Input, Validating Patch Requests and User Routs, Using Google's Geocoding API to convert an Address into Coordinates.

Unit 3: Introduction to NoSQL Database Management System **8 Hrs**

MongoDB: Module Introduction, Installing MongoDB; Understanding the Basics and CRUD Operation; Schemas & Relation; Exploring; The Shell & server; MongoDB Compass; Create, Read, Update, Delete Operation; Working with Indexes;

Working With MongoDB: SQL vs NoSQL, Basic Concept of SQL, Creating Backend and Connecting it to the Database, Creating Document with MongoDB, Getting and Sending Data from/to the Database, Installing Mongoose, Model & Schemas, Understanding ObjectID; Connecting React.js Frontend to the Backend.

Unit 4: Progressive Web Application (PWA) **15 Hrs.**

Introduction: Overview, Features, Objectives, Application of PWA, PWA and Native Mobile App (NMA); **Designing a PWA** (Web application (HTML, CSS, JavaScript, App manifest, service worker, application shell, dynamic content, cache) **Creating a PWA** (Design and create a web application, converting a web application into a PWA, Using PWA frameworks) **Deploy and distribute PWA** (Make the PWA installable, enable offline mode, and caching of static and dynamic assets, Make PWA multiplatform to run on desktop and mobile OS) **Implement CRUD operations** (Create new data records, read existing data records, update existing data records, Delete existing data record)

Laboratory Works:

All of the aforementioned topics should be covered in laboratory work, Students are required to create real-time online applications utilizing React.js, Node.js, MongoDB, as well as Progressive Web Apps.

References:

1. Biswas, N. (2021). MERN Projects for Beginners: Create Five Social Web Apps Using MongoDB, Express.js, React, and Node. Apress.
2. Blokdyk, G. (2020). Progressive Web Applications A Complete Guide. 5STARCooks.
3. Lim, G. (2021). Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App. Independently published .
4. Wargo, J. M. (2020). Learning Progressive Web Apps. Addison-Wesley Professional.

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Course Title: Project I (3 Cr.)
Course Code: MCA554
Year/Semester: I/II
Class Load: 6 Hrs. / Week (Practical: 6 Hrs.)

Course Description:

The course is intended to provide the emerging trends and practices in software development technologies and their implementations. It includes an open discussion on system analysis and design, software engineering, project management, and recent programming languages and platform practices.

Course Objectives:

The course's main purpose is to give students the required skills and knowledge to develop and present real-time projects based on the recent trend and practices of the system development life cycle. The main objectives are:

- To analyze and design software.
- To develop software.
- To implement problem solving algorithms/statistics.
- To test and deploy the software.
- To develop user/system software manual.

Course Content:

Nature of Project: This project should be developed individually or at most a pair of students. They may develop system software addressing the issues of an operating system, databases, computer networks, information security, system utilities, etc., and applications like web applications and mobile applications addressing issues in e-Commerce, e-Governance, GIS, ERPs, MIS systems, etc. Apart from these applications, Students may also develop projects on Blockchain, machine learning, and data science etc. Students are not limited to using specific programming languages, tools, and technology. They are highly encouraged to implement recent practices of system development.

Phases of Project: The project should be developed and evaluated in the following phases:

1. Project proposal submission:
   The project proposal should be submitted and presented by the 2nd week of the semester in a specified format to the research committee formed by the department.
2. Project mid-term evaluation:
   The mid-term progress report should be submitted by the 12th week of the semester. It should be evaluated by a domain-specific expert assigned by the department.
3. Project final evaluation:

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The final evaluation of the project should be conducted by an external examiner assigned by the TU, FoHSS, Office of the Dean. It should be conducted before the final semester examination.

Provision of Project Supervision: Department will assign a project supervisor to guide students throughout the course of project development. He/She will continuously monitor, evaluate and suggest project feedback to the students.

Project Evaluation: The project should be evaluated based on the following parameters:

- The project idea
- Significance of the project
- Study of Literature
- Selection of development methodology
- Project analysis and design
- Implementation of theory and algorithms
- Level of work done
- Report formatting
- Project presentation

Evaluation Marks distribution should be as follows:

Project Proposal Evaluation (Research Committee)	Mid-term Evaluation (Project Domain Expert assigned by Department)	Final Evaluation (External Assigned by Dean's Office)	Project Supervisor's Continuous Evaluation	Total
10 Marks	20 Marks	20 Marks	50 Marks	100 Marks

Report Format:

Prescribed Project Proposal Format:

1. Introduction
2. Problem of Statement
3. Objectives
4. Project Development Methodology
    a. Requirement Identification
        i. Study of the existing system
        ii. Review of Literature
        iii. Requirement Analysis
    b. Feasibility Study
    c. System Design: Methodology, Proposed System Architecture
    d. Algorithms (if any)
5. Project development schedule (Gantt Chart)
6. Expected Outcomes

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7. References

Prescribed Final Project Report format:

1. Cover and Title Page
2. Certificate Page
    a. Declaration
    b. Supervisor's Recommendation
    c. External Examiner's Approval Sheet
3. Acknowledgement
4. Abstract
5. Table of Contents
6. List of Abbreviations
7. List of Figures
8. List of Tables
9. Main Report
10. References
11. Bibliography (if any)
12. Appendices (Screenshots, Source Code, Supervisor's log sheet)

Prescribed Chapters in the Main Report:

Chapter 1: Introduction

- 1.1 Introduction
- 1.2 Problem Statement
- 1.3 Objectives
- 1.4 Scope and Limitations
- 1.5 Project Development methodology
- 1.6 Report Organization

Chapter 2: Background Study and Literature Review

- 2.1 Background Study
- 2.2 Literature Review

Chapter 3: System Analysis and Design

- 3.1 System Analysis (what the system should do?)
    - 3.1.1 Requirement Analysis
        - 3.1.1.1 Functional Requirements
        - 3.1.1.2 Non-Functional Requirements
    - 3.1.2 Feasibility Analysis
        - 3.1.2.1 Technical Feasibility
        - 3.1.2.2 Operational Feasibility
        - 3.1.2.3 Economic Feasibility
        - 3.1.2.4 Schedule Feasibility

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3.1.3 Data/Object Modeling
3.1.4 Process Modeling
3.2 System Design (how to accomplish the objective of the system?)
3.2.1 System Architecture
3.2.2 Database Design
3.2.3 UI/UX Design
3.2.4 Deployment Design
3.2.5 Report Design (if any)
3.3 Algorithm/Statics detail

Chapter 4: Implementation and Testing

4.1 Implementation
4.1.1 Tools and Technology
4.1.2 Implementation Detail
4.2 Testing
4.2.1 Unit Testing
4.2.2 System Testing
4.3 Result Analysis

Chapter 5: Conclusion and Future Recommendation

5.1 Conclusion
5.2 Future Recommendation

Citation and References:

The citation and reference standard should be in Institute of Electrical and Electronics Engineers (IEEE) format.

Report Format Standards:

1. **Page Number**

   The pages from certificate page to the list of tables/figures should be numbered in roman starting from i. The pages from Chapter 1 onwards should be numbered in numeric starting from 1. The page number should be inserted at bottom, aligned center.

2. **Page Size and Margin**

   The paper size must be a page size corresponding to A4. The margins must be set as Top = 1, Bottom = 1, Right = 1, Left = 1.25.

3. **Paragraph Style**

   All paragraphs must be justified and having spacing of 1.5.

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4. **Text Font of Document**

The contents in the document should be in Times New Roman font. The font size in the paragraphs of document should be 12.

5. **Section Headings**

Font size of the headings should be 16 for chapter title, 14 for section headings, 12 for the sub-section headings. All the heading should be bold faced.

6. **Figures and Tables**

Position of figures and tables should be aligned center. The figure caption should be centered below the figure and table captions should be centered above the table. All the captions should be of bold face with 12 font size.

Course Title: Academic Writing I (1 Cr.)
Course Code: MCA555
Year/Semester: I/II
Class Load: 2 Hrs. / Week (Practical: 2 Hrs.)

Course Description

This course, offered to MCA students of faculty of Humanities and Social Sciences, intends to impart academic writing skills required in both personal and professional setting. The course not only familiarizes students with various genres, styles and medium of academic writing but also equips them with advance academic writing skills and practices required for gathering, organizing, drafting and disseminating information for maximum impact.

Objectives:

The course focuses to inculcate academic writing skills in students and stimulate their interest in the use of academic writing so that they can communicate and disseminate their ideas and experiences with supporting details with accuracy, clarity and precision. Through extensive reading and practical exercises, it aims to equip students with the knowledge of academic writing structure typically used by academics in the pursuit of research based learning. The main outcome of the course is to make students able to write research articles.

Nature/Process of the Course:
It is practical work and will be completed under the supervision of supervisor. There will be formal orientation on academic writing process and domains. After the orientation, Student submits synopsis of work which he/she is planning to do. Based on the synopsis submitted by the student supervisor will be assigned. An individual student should prepare and present article assigned by the department/committee. It should be reviewed by peer(s). The article should be related to the field of computer system/software development, administration, management and policy making. There will not be any external examination conducted by FoHSS for this course, it is totally evaluated by the internal activities completed under the supervision of the supervisor and Viva.

Evaluation Criteria:
Students' work is evaluated by HoD/Director/Program Coordinator, Supervisor, and Final Viva conducted by the department.

Synopsis	HoD. /Director /Coordinator	Supervisor	Final Viva
10 - Marks	10 - Marks	Language & Grammar – 10 marks Tools used in Report Preparation (Data Collection & Processing, Report Formatting, Grammar Tool, Text Editor,	Report: 10 Marks Presentation: 10 Marks Viva: 10 Marks

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		Citation, Referencing) – 10 Marks Peer Review/Feedback – 10 Marks Research Work(Literature Review, Data Collection & Analysis, Finding) – 20 Marks	
Total Marks: 100 Marks			

The Final Viva team will be formatted including the following members:

- HoD/Director/Program Coordinator - 1
- Supervisor - 1
- Domain Expert – 1(At least)

Report Format:

The article should contain common contents like an abstract, introduction, literature review, methodology, data collection, processing and analysis, finding and references or the concerned department/campus may develop guidelines for organizing the research activities/report.
IEEE standards will be followed for document formatting/citation.

Publishing the research work:

The research work conducted by the student is highly recommended to publish in at least a peer-reviewed DOI-indexed journal that belongs to the field of computer application. The concerned department/campus should publish such (computer applications) journals regularly to publish the students' research work.

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Course Title: Digital Humanities (3 Cr.)
Course Code: MCA556
Year/Semester: I/II
Class Load: 3Hrs. / Week (Theory: 3 Hrs.)

Course Description:

As mentioned in many literatures and often expressed in everyday life interaction digital technology has swept over the world, the humanities too have undergone a rapid change in relation to the use and application of digital technologies in scholarship. However, the perceived effects of this may not always be completely visible on the surface of the constituent disciplines. This course is therefore designed to introduce digital humanity and describe its various aspects. The course focuses on the application of technology in the various spheres of society and its effects on various aspects of human life. The focus of the course is 'Digital Humanities' which includes its concept, basic components and activities, computation and humanities, major debates, principles and scenarios, humanistic approach, and so on. It also deals with the methods and theories of digital humanity. Finally, the course highlights the uses and application of digital technology and its effects on humanities and change taking place in humanities.

Course Objectives:

The major objective of this course is to enable students to understand the digital technology and its relationship to human society and human life. This general objective is expected to achieve when students will be able:

- To comprehend with the concept of digital humanity and its importance,
- To describe various aspects of digital humanity in relation to the use and application of digital technology,
- To explain the relationship between digital technology and changing humanities,
- To apply digital technology to humanity and promoting humanity,
- To analyze the digital humanities from the perspective of computer applications, and
- To apply the gained knowledge and skills in practicing digital humanities.

Course Contents:

Unit 1: Digital Humanities **[6 Hrs.]**

Humanity and the humanities, Humanities computing and its history, Understanding digital humanities: knowing knowledge, Role of technology in humanities, Multimedia and implementation of multimedia program.

Readings:

Svensson, Patrik. (2016). Introducing the Digital Humanities. In *Big Digital Humanities Book Subtitle: Imagining a Meeting Place for the Humanities and the Digital.* Chapter one, pp. 1-35. University of Michigan Press.

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Berry, David M. (2012. Introduction: Understanding the Digital Humanities. In *Understanding Digital Humanities* edited by David M. Berry. Chapter 1, pp. 1-20. Palgrave Macmillan.

Evans, Leighton and Rees, Sian. (2012). An Interpretation of Digital Humanities. In *Understanding Digital Humanities* edited by David M. Berry. Chapter 2, pp. 21-41. Palgrave Macmillan.

Rockwell, Geoffrey. (2013). Is Humanities computing an academic discipline? Section I, chapter 1, pp. 13-34 in Melissa Terras Julianne Nyhan Edward Vanhoutte (Eds.) *Defining Digital Humanities: A Reader*. ASHGATE.

Drucker, Johanna. (2021). *The Digital Humanities Coursebook: An Introduction to Digital Methods for Research and Scholarship*. Chapter 1, pp. 1-18. Routledge.

Unit 2: Theories and Methods in Digital Humanities **[6 Hrs.]**

The ever-emerging field of digital humanities, The current state of affairs, Accepting the challenge, Critique of digital humanities, Making and Building in Digital Humanities and Beyond, History and Questions of Method, The epistemology of the digital humanities, Theories and debates in digital humanities, Code of conduct for the digital humanities, Suggestions for the digital humanities.

Readings:

Svensson, Patrik. (2016). Sorting Out the Digital Humanities. In *A New Companion to Digital Humanities* Edited by Susan Schreibman, Ray Siemens, and John Unsworth. Part V, chapter 33, pp. 476-492. Wiley Blackwell.

Hughes, Lorna, Constantopoulos, Panos, and Dallas, Costis. (2016). Digital Methods in the Humanities: Understanding and Describing their Use across the Disciplines. In *A New Companion to Digital Humanities* edited by Susan Schreibman, Ray Siemens, and John Unsworth. Part V, chapter 11, pp.150-170. Wiley Blackwell.

Warwick, Claire. (2016). Building Theories or Theories of Building? A Tension at the Heart of Digital Humanities. In *A New Companion to Digital Humanities* Edited by Susan Schreibman, Ray Siemens, and John Unsworth. Part V, chapter 37, pp.538-552. Wiley Blackwell.

Rettberg, Scott. (2016). Electronic Literature as Digital Humanities. In *A New Companion to Digital Humanities* edited by Susan Schreibman, Ray Siemens, and John Unsworth. Part V, chapter 37, pp.538-552. Wiley Blackwell.

Hunter, John. (2019). The Digital Humanities and "Critical Theory": An Institutional Cautionary Tale. In Matthew K. Gold and Lauren F. Klein (Eds.) *Debates in the digital humanities* 2019. Chapter 16, pp.184-194. University of Minnesota Press.

Unit 3: Making Digital Humanities **[9 Hrs.]**

Digital humanities as a field, Making digital humanities, Electronic literatures as digital humanities, Scholarly practices in digital humanities, Levels of scholarly practice: theory and analysis; toolmaking and platform development; and applied research, Beyond creative production: platforms, scholarship, and research infrastructure in electronic literature, Globalization of digital humanities.

Readings:

Svensson, Patrik. (2016). Introducing the Digital Humanities. In *Big Digital Humanities Book Subtitle: Imagining a Meeting Place for the Humanities and the Digital.* Chapter two, pp. 36-81. University of Michigan Press.

Svensson, Patrik. (2016). Making Digital Humanities. In *Big Digital Humanities Book Subtitle: Imagining a Meeting Place for the Humanities and the Digital.* Chapter five, pp. 172-221. University of Michigan Press.

Rettberg, Scott. (2016). Electronic Literature as Digital Humanities. In *A New Companion to Digital Humanities* edited by Susan Schreibman, Ray Siemens, and John Unsworth. Part II, chapter 9, pp.127-136. Wiley Blackwell.

O'Donnell, Daniel Paul, Walter, Katherine L., Gil, Alex, and Fraistat, Neil. (2016). Only Connect: The Globalization of the Digital Humanities. In *A New Companion to Digital Humanities* edited by Susan Schreibman, Ray Siemens, and John Unsworth. Part IV, chapter 34, pp.493-510. Wiley Blackwell.

Unit 4: Digital Humanities in Practice **[9 Hrs.]**

Digitization and digital resources in the humanities: Reasons for digitization, Growth of digitizes heritage content, Best practice in digitization, Digitization and the humanities, Current issues in digitization.

Users in digital humanities: What we know about humanities users, How to study users? Luddites or critics, Case study, methods, findings, recommendation.

Institutional models for digital humanities: Service or research: service computing; equality or subordination; centers or networks; Establishing the center, Lobbying, promotion and dissemination of digital humanities, Training, Guidelines, Teams or individuals, Strategic mission, Communication.

The pedagogy of digital humanities.

Readings:

Terras, Melissa. (2012). Digitization and digital resources in the humanities. In *Digital Humanities in Practice* edited by Claire Warwick, Melissa Terras and Julianne Nyhan. Chapter 3, pp. 47-70. Facet Publishing.

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Warwick, Claire. (2012). Studying users in digital humanities. In *Digital Humanities in Practice* edited by Claire Warwick, Melissa Terras and Julianne Nyhan. Chapter 1, pp. 1-20. Facet Publishing.

Warwick, Claire. (2012). Institutional models for digital humanities. In *Digital Humanities in Practice* edited by Claire Warwick, Melissa Terras and Julianne Nyhan. Chapter 9, pp. 193-216. Facet Publishing.

Malazita, James. (2021). Epistemic Infrastructure, the Instrumental Turn, and the Digital Humanities. In *People, Practice, Power: Digital Humanities outside the Center* edited by Anne McGrail, Angel David Nieves, and Siobhan Senier. Debates in the Digital Humanities. Part I, chapter 1, pp. 3-23. University of Minnesota Press.

Unit 5: Digital Humanities in Nepal **[9 Hrs.]**

Digitization and digital resources, Institutional effort in digitization, Open access and online teaching materials for digital humanities, Open educational resources (OER), OER initiatives, Open learning environment, Users in digital humanities, Research and teaching in digital humanities, Use of technology in humanities; Social media.

Readings:

Mahony, Simon, Tiedau, Ulrich and Sirmons, Irish. (2012). Open access and online teaching materials for digital humanities. In *Digital Humanities in Practice* Edited by Claire Warwick, Melissa Terras and Julianne Nyhan. Chapter 8, pp. 167-191. Facet Publishing.

Useful links to connect to digital humanities in Nepal:

https://sites.google.com/view/balkd/home

Unit 6: Practicing Digital Humanities **[9 Hrs.]**

Data modeling and use, Digitization, Metadata, markup, and data description, Database design, Information visualization, Data mining and analysis, Mapping and GIS, Three-dimensional and virtual models, Interface, Web presentation formats and networked resources, Project design and intellectual property.

Readings:

Mahony, Simon, Tiedau, Ulrich and Sirmons, Irish. (2012). Open access and online teaching materials for digital humanities. In *Digital Humanities in Practice* Edited by Claire Warwick, Melissa Terras and Julianne Nyhan. Chapter 8, pp. 167-191. Facet Publishing.

Drucker, Johanna. (2021). *The Digital Humanities Coursebook: An Introduction to Digital Methods for Research and Scholarship*. Routledge.

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Course Title: Digital Marketing (3 Cr.)
Course Code: MCA 557
Year/Semester: I/II
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:

This Course presents different concepts of digital marketing including search engine optimization, search engine marketing, social media marketing, mobile and email marketing. It also present latest concepts used by the marketers.

Course Objectives:

The primary objective of this course is to introduce different aspects and medium of digital marketing used for the effective promotion of good and services through the use of digital media.

Course Contents:

Unit 1: Introduction to Digital Marketing **[6 Hrs.]**

Basic concepts of marketing and digital marketing, Comparison of traditional marketing and digital marketing, Benefits of digital marketing, Digital marketing strategies, Technology behind digital marketing, Digital consumer, Ethics and privacy in digital marketing.

Unit 2: Online Advertising **[4 Hrs.]**

Introduction and importance of online marketing, Online AdFormat, Search Engine Ad, Network Advertising, Affiliate programs, landing page, Offline advertising.

Unit 3: Email Marketing **[6 Hrs.]**

Email marketing, benefits of Email marketing, Types of email, Email marketing softwares and tools, Building email marketing strategy and building email marketing subscriber list, Opt-in Email advertising, Email tracking.

Unit 4: Mobile Marketing **[5 Hrs.]**

Mobile marketing and its benefits, Mobile marketing strategies, Mobile sites and in-app ads, Characteristics of an effective mobile site, SMS marketing, SMS campaign development process.

Unit 5: Search Engine Optimization and Search Engine Marketing **[12 Hrs.]**

Introduction to SEO and its working process, Importance of SEO, Search engine algorithms, Keyword research process and tools, On-page and Off-page optimization strategies, Title and meta tags, Speed optimization, Google ads, AdGroups and keywords setup, Keyword selection and research tools, Keyword match types, AdRank and quality score optimization, Google ads(Google ADWords) tool.

Introduction and importance of SEM, Strategies and techniques used for SEM, Site targeting, Keyword targeting, demographics targeting.

Unit 6: Social Media Marketing (SMM) **[6 Hrs.]**

Concept of social media marketing, Characteristics of successful social media marketing, Social media marketing plan, Social media marketing tools, Publishing blogs, podcast and webinars, Social media monitoring, Social media: Facebook, Twitter, Youtube, Instagram, Linkedin. Social media boosting (paid form).

Unit 7: Web Analytics and Reporting **[5 Hrs.]**

Introduction to web analytics, Tools and technology used of web analytics and reporting, Analytics process, Introduction to audience reports, traffic and content report, Big data and its application in the digital marketing.

Unit 8: Latest Digital Marketing Trends **[4 Hrs.]**

AI-based assistants for digital marketing (smart speakers, chatbots, voice search, augmented reality (AR)), Influencer marketing, Digital display advertising.

Laboratory Works:

Laboratory work should be done covering all the listed topics of each units.

References:

1. The Art of Digital Marketing, Ian Dodson, Wiley.
2. Understanding Digital Marketing, Fifth Edition, Damian Ryan, Kogan Page Ltd.
3. Digital Marketing Strategy, An Integrated approach to online marketing, Simon Kingsnorth, Kogan Page Ltd.
4. Contemporary Issues in Digital Marketing, Outi Niininen, Routledge.
5. Digital Marketing, A Practical Approach, Third Edition, Alan Charlesworth, Routledge.
6. Digital Marketing Management, Debra Zahay, Business Expert Press.
7. Search Engine Optimization and Marketing, A Recipe for Success in Digital Marketing, Subhankar Das, CRC Press.
8. Digital Marketing, All-In-One, Stephanie Diamond, John Wiley & Sons Inc.

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Course Title: Knowledge Management (3 Cr.)
Course Code: MCA558
Year/Semester: I/II
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:

This course offers detailed concept about knowledge representation, logic, reasoning and principles. It includes introduction, knowledge acquisition, knowledge representation and reasoning.

Course objectives:

The general objectives of this course are to provide theoretical as well as practical knowledge of knowledge management to make students capable of analysis, design, implementing and managing of knowledge in their personal as well professional life, establish a foundation of key terms and concepts, historical events and contributions, organizational benefits, and guiding principles on which to build greater understanding of knowledge management.

After completion of the course the learner will be able to

- Discuss KM, learning organizations, intellectual capital and related terminologies in clear terms and understand the role of knowledge management in organizations.
- Demonstrate an understanding of the history, concepts, and the antecedents of management of knowledge and describe several successful knowledge management systems
- Evaluate the impact of technology including telecommunications, networks, and Internet/intranet role in managing knowledge.
- Discuss new jobs, roles and responsibilities resulting from the New or Knowledge Economy Ponder KM's current and future impact on individuals, organizations and society at large

Course Contents:

Unit 1: Introduction **[7 hrs]**

Definition of knowledge, Types of expertise – associational, motor skill, theoretical Characteristics of knowledge – explicitness, codifiability, teachability, specificity Reservoirs of knowledge, Meaning of Knowledge Management, Forces Driving Organizational issues in KM, KM Systems & their role Relevance of KM in today's dynamic & complex environment Future of Knowledge Management

KM Cycle: Knowledge creation, capturing tacit knowledge, Types of knowledge and its implications for KM, Challenges in Building KM Systems – Conventional versus KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – Nonaka's Model of Knowledge Creation and Transformation. Knowledge Architecture

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Unit 2: KM Solutions for capture, sharing & applications: **[10 hrs]**

KM Processes, KM Systems, Mechanisms & Technologies Knowledge Capturing Techniques: Brain Storming – Protocol Analysis – Consensus Decision Making – Repertory Grid- Concept Mapping –Blackboarding, Nominal Group Technique, Delphi method,

Unit 3: Knowledge Representation **[7 hrs]**

Propositional & Predicate Logic: Syntax and semantics for prepositional logic, Syntax & semantics of First Order Predicate Logic (FOPL), Properties of well-formed formula (wff), Conversion to clausal form, Inference rules, The resolution principle, Non-deductive inference methods

Structured Knowledge Representations: Production Rules, Semantic Nets, Frames, Conceptual Dependencies and Scripts

Unit 4: Knowledge codification: **[10 hrs]**

Modes of Knowledge Conversion – Codification Tools and Procedures – Knowledge Developer's Skill Sets – System Testing and Deployment – Knowledge Testing – Approaches to Logical Testing, User Acceptance Testing – KM System Deployment Issues – User Training – Post implementation.

Unit 5: Knowledge transfer and sharing **[8 hrs]**

Transfer Methods– Role of the Internet – Knowledge Transfer in e-world – KM System Tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Decision Making Architecture – Data Management – Knowledge Management Protocols – Managing Knowledge Worker

Unit 6: KM Impact **[6 hrs]**

Dimensions of KM Impact – People, Processes, Products & Organizational Performance Factors influencing impact – universalistic & contingency views Assessment of KM Impact – Qualitative & quantitative measures Identification of appropriate KM solutions, Ethical Legal and Managerial Issues, The future of KM.

Laboratory Works:

The Lab work should cover the use of knowledge management tools, develop knowledge management applications, design and develop enterprise applications.

References:

1. Madanmohan Rao . Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions. Butterworth-Heinemann. ISBN: 0750678186.
2. Stuart Barnes (Ed.). Knowledge Management Systems Theory and Practice. Thomson Learning.

3. Kimiz Dalkir, Knowledge Management in Theory and Practice, Elsevier, Butterworth Hinemann.
4. Applying Knowledge Management

Faculty of Humanities & Social Sciences
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Course Title: E-Governance (3 Cr.)
Course Code: MCA559
Year/Semester: I/II
Class Load: 5 Hrs. / Week (Theory: 3 Hrs. Practical: 2 Hrs.)

Course Description:

This course contains concepts of e-Government and E-Governance policies, e-government security, models, managing and data warehousing / data mining.

Course Objectives:

The objectives of this course are:

- To Introduce e-Governance.
- To identify e-Governance models.
- To identify infrastructure and policy for e-Governance.
- To implement e-Government security policies.
- To implement data warehouse manage it.

Unit 1: Introduction to e-Government and e-Governance **[6 Hrs.]**

Difference between e-Government and e-Governance, e-Government as information system, Benefits of e-Government, e-Government life cycle, online service delivery and electronic service delivery, Evolution of E-Governance, Its scope and content, Present global trends of growth in E-Governance

UNIT 2: e-Governance Models **[7 Hrs.]**

Introduction to Model of Digital ,Comparative Analysis Model ,Mobilization and Lobbying Model ,Interactive-service Model/Government-to-Citizen to- Government Model (G2C2G) ,Evolution in E-Governance and Maturity Models, Five Maturity Levels ,Characteristics of Maturity Levels ,Towards Good Governance through E-Governance Models

UNIT 3: Infrastructure development of e-Government **[10 Hrs.]**

Network infrastructure, Computing Infrastructure, Data centers, e-Government architecture, Interoperability Framework, Cloud Governance,

E-readiness, Data System Infrastructure , Legal Infrastructural Preparedness ,Institutional Infrastructural Preparedness , Human Infrastructural Preparedness , Technological Infrastructural Preparedness ,

UNIT 4: e-Government Security **[9 Hrs.]**

Challenges and approach of e-government security, security management model, e-Government security architecture, security standards

UNIT 6: Data Warehousing and Data Mining in Government **[6 hrs.]**

Introduction , National Data Warehouses, Census Data, Prices of Essential Commodities ,Other areas for Data Warehousing and Data Mining Agriculture , Rural Development , Health , Planning , Education Commerce and Trade

Case Studies **[10 Hrs.]**

Recent trends and practices in the implementation of E-governance in different countries.

References:

कीर्तिपुर

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1. Richard Heeks, Implementing and managing e-Government
2. C.S. R Prabhu, e-Governance: Concepts and Case studies, prentice hall of India Pvt. Ltd.
3. J. Satyanarayana, e-Government, prentice hall of India Pvt. Ltd
4. Backus, Michiel, e-Governance in Developing Countries, IICD Research Brief, No. 1, March 2001