Course Title: Operational Research (3 Cr.)
Course Code: CAOR451
Year/ Semester: IV/VIII
Class Load: 4Hrs. /Week (Theory: 3 Hrs. Tutorial: 1 Hrs)

Course Description

Operations Research is the study of scientific approaches to decision-making. Through mathematical modeling, it seeks to design, improve and operate complex systems in the best possible way. The mathematical tools used for the solution of such models are either deterministic or stochastic, depending on the nature of the system modeled. In addition, the course will learn very powerful modeling and solution techniques for decision-making problems that are used today by many successful companies to help them save/earn millions of dollars. The module covers topics that include: linear programming, transportation, assignment, inventory control, replacement theory and game theory. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments

Course Objectives

The general objectives of this course to provide a broad orientation of the field of optimization, with emphasis on basic theory and methods for continuous and discrete optimization problems in finite dimension, and it also gives some insight into its use for analyzing practical optimization problems.

Unit 1: Introduction to Operations Research **5 hrs.**

Introduction, History of Operations Research, Stages of Development of Operations Research Relationship between Manager and OR Specialist, OR Tools and Techniques, Applications of Operations Research, Limitations of Operations Research

Unit 2: Linear Programming Problem **10 hrs.**

Introduction to Linear Programming, Linear Programming Problem Formulation, Formulation with Different Types of Constraints, Graphical Analysis of Linear Programming, Graphical Linear Programming Solution, Multiple Optimal Solutions, Unbounded Solution, Infeasible Solution, Basics of Simplex Method, Simplex Method Computation, Simplex Method with More Than Two Variables, Primal and Dual Problems, Economic Interpretation

Unit 3: Transportation and Assignment Problem **8 hrs.**

Transportation Problems definition, linear form, Solution methods: North West corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution method, unbalanced problems and profit maximization problems. Transshipment Problems. Assignment Problem Structure and Solution: Short-Cut Method (Hungarian Method), Unbalanced Assignment Problem, Infeasible Assignment Problem, Maximization in an Assignment Problem, Crew Assignment Problem.

Unit 4: Queuing Theory **6 hrs.**

Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models.

Unit 5: Inventory Control **6 hrs.**

Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis.

Unit 6: Replacement theory **6 hrs.** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy

Unit 7: Game Theory **7 hrs.**

Introduction, Characteristics of Game Theory, Two Person, Zero sum games, pure strategy. Dominance theory, Mixed strategies (2x2, mx2), Algebraic and graphical methods

Teaching Methods

The general teaching pedagogy includes class lectures, presentations, group works, case studies, guest lecturers research works, project works, assignments (Theoretical and Practical). The teaching faculty will determine the choice of teaching pedagogy and encouraged to select software tools as per the requirements of topics for practical activities.

References/ Suggested Readings:

Hillier, F.S.& Lieberman, G.J. (1995). Introduction to Operations Research,7th edition. The McGraw-Hill Companies, Inc.

Natarajan, A. M.; Balasubramani, P. & Tamilarasi, A. (2007). Operations Research. Pearson Education Inc.

Sharma, J.K. (2009). Operational Research: Theory and Application. Macmillan Publishers India Ltd.

Taha, H.A. (2017). Operations Research: A Introduction, 10th edition, Global edition, Pearson Education, Inc. Pearson Prentice Hall.

Wagner, H. N. (2003). Operations Research by, Prentice hall. N D Vohra, Tata McGraw-Hill.

Winston, L.W. (2004). Operations Research: Applications and Algorithms, Indian University, 4th edition.

Evaluation

Examination Scheme				
Internal Assessment		**External Assessment**		**Total**
Theory	**Practical**	**Theory**	**Practical**	
40		**60**		**100**

Course Title: Project III (6 Cr.)
Course Code: CACS452
Year/Semester: IV/VIII
Class Load: Hrs./Week (Practical: 12 Hrs.)

Course Description: This final year project is a practical course where students are expected to implement the concepts learnt during four years of their study so as to build a system. The course includes realization of project management, software development, and programming skills.
Course Objectives: The objective of this course is to make students able to design and develop software applications by following appropriate development methodology.

Course Details:
Nature of Project:

Students should develop a complete functioning system. The system should not be limited to the basic CRUD operations only. Being a final year project, students are highly recommended to implement appropriate algorithms relevant to the project. The project should include precise system analysis, design, implementation and result analysis. The students can work in group of at most two members. The students can choose appropriate language technologies that they have learnt till eighth semester; however it is not limited. While implementing the project, students should be able to write their own program modules rather than relying on predefined APIs or Plugins except in some unavoidable circumstances.

Phases of Project:

The following are the phases of project work:

4. **Proposal Submission:** Students must submit and present project proposal after 3rd week of start of the eighth semester.

5. **Mid-Term:** Students must submit progress report and defend midterm progress of their project work in the 12th week of the eighth semester.

6. **Final Submission:** Students must submit and orally defend the project work during last week of the eight semester but before final board examination. Students must have to submit the project final report to their respective department before at least ten days of final defense date. The report should be submitted in standard format as prescribed. The hard/soft copy of report should be made available to the external expert before a week of presentation date. The final presentation should be followed by the demonstration session, where students have to demonstrate the project. A viva voice will be conducted by evaluation committee.

Provision of Supervision:

There should be a regular faculty of the campus/college assigned as a supervisor. The role of supervisor is to guide the students throughout the project and provide constructive suggestions. A supervisor can supervise at most four groups of the project in a class section. The supervisor should rigorously supervise, monitor and feedback the project groups under supervision.

Evaluation Scheme:

4. **Proposal Defense** of 10% of total marks based on project proposal and its presentation.

5. **Midterm** of 70% of total marks based on;
   a. **Work Done 60%**
      i. System Analysis and Design
      ii. Implementation
      iii. Understanding of methods used in project
      iv. Ability to work with others
      v. Ability to identify problems
      vi. Amount of work performed
   b. **Documentation 10%**
      i. Report Organization
      ii. Writing Style
      iii. Completeness of Report
      iv. Readability
      v. Organization and analysis of data and results

6. **Final Defense** of 20% of total marks based on presentation and project demonstration and viva-voice. Each group member should present about the project followed by the demonstration of project developed. The project should be ready to run for the demo session.

The **10 marks of the proposal defense** will be evaluated by the research committee formed by HOD/Coordinator as a part of proposal defense. The **70 marks of the midterm** will be evaluated by the supervisor and internal examiner as a part of midterm defense. Out of the 70 marks, the supervisor will evaluate for 60 marks and internal examiner will evaluate for 10 marks. The remaining **20 marks of final defense** will be evaluated by the external examiner from the university.

Out of 100 marks, the 80 marks (Proposal + Midterm Evaluation) will be considered as internal assessment while the 20 marks (Final Defense) will be considered as external assessment. Each student in the project should get passed in each of the internal and external assessments individually. Any student failing to pass each of the assessments will be considered as fail.

The evaluation committee and evaluation criteria should be as follow;

c. **Evaluation committee**
   - Project Supervisor
   - HOD/Coordinator
   - Internal Examiner (Regular Faculty)
   - External Examiner

d. **Focus of the evaluation**
   - Presentation Skills
   - Project Demonstration
   - Project Report
   - Viva/Question Answer
   - Level of Work and Understanding

- Teamwork and Contribution

Report Contents:

4. Prescribed content flow for the project proposal

1. Introduction
2. Problem Statement
3. Objectives
4. Methodology
    a. Requirement Identification
        i. Study of Existing System
        ii. Literature Review
        iii. Requirement Analysis
    b. Feasibility Study
        i. Technical
        ii. Operational
        iii. Economic
    c. High Level Design of System (Methodology of the proposed system/ Flow Chart/ Working Mechanism of Proposed System / Description of Algorithms)
5. Gantt Chart (showing the project timeline)
6. Expected Outcome
7. References

5. Prescribed content flow for the project report

11. Cover & Title Page
12. Certificate Page
    iv. Supervisor Recommendation
    v. Internal and External Examiners' Approval Letter
13. Acknowledgement
14. Abstract Page
15. Table of Contents
16. List of Abbreviations, List of Figures, List of Tables, List of Abbreviations
17. Main Report
18. References
19. Bibliography (if any)
20. Appendices (Screen Shots/ Source Codes)

6. Prescribed chapters in the main report

6. Chapter 1: Introduction

6.1. Introduction
6.2. Problem Statement
6.3. Objectives
6.4. Scope and Limitation
6.5. Development Methodology
6.6. Report Organization

7. Chapter 2: Background Study and Literature Review

7.1. Background Study (Description of fundamental theories, general concepts and terminologies related to the project)
7.2. Literature Review (Review of the similar projects, theories and results by other researchers)

8. Chapter 3: System Analysis and Design
8.1. System Analysis
8.1.1. Requirement Analysis
i. Functional Requirements (Illustrated using use case diagram and use case descriptions)
ii. Non Functional Requirements
8.1.2. Feasibility Analysis
i. Technical
ii. Operational
iii. Economic
iv. Schedule
8.1.3. Object Modelling using Class and Object Diagrams
8.1.4. Dynamic Modelling using State and Sequence Diagrams
8.1.5. Process Modelling using Activity Diagrams
8.2. System Design
8.2.1. Refinement of Class, Object, State, Sequence and Activity diagrams
8.2.2. Component Diagrams
8.2.3. Deployment Diagrams
8.3. Algorithm Details (if any)

9. Chapter 4: Implementation and Testing
9.1. Implementation
9.1.1. Tools Used (CASE tools, Programming languages, Database platforms)
9.1.2. Implementation Details of Modules (Description of classes/procedures/functions/methods/algorithms)
9.2. Testing
9.2.1. Test Cases for Unit Testing
9.2.2. Test Cases for System Testing
9.3. Result Analysis

10. Chapter 5: Conclusion and Future Recommendations
10.1. Conclusion
10.2. Future Recommendations

While writing above chapters students should avoid basic definitions. They should relate and contextualize the above mentioned concepts with their project work.

Citation and Referencing

The listing of references should be listed in the references section. The references contain the list of articles, books, urls, etc. that are cited in the document. The books, articles, and others that are studied during the study but are not cited in the document can be listed in the bibliography section. The citation and referencing standard should be IEEE referencing standard. The text inside the document should be cited in IEEE style. The IEEE referencing standard can be found in the web.

Report Format Standards

G. Page Number

The pages from certificate page to the list of tables/figures/abbreviations/approvals 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.

H. 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

I. Paragraph Style

- All paragraphs must be justified and have spacing of 1.5.

J. 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

K. Section Headings

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

L. Figures and Tables

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

Final Report Binding and Submission:

No of Copies: 3 (College Library + Self + Dean Office)

Look and Feel: Golden Embracing with Black Binding

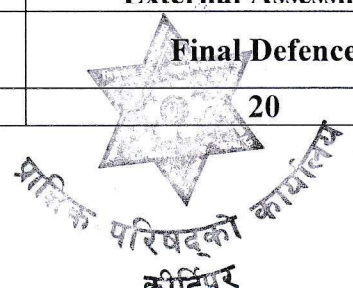
A final approved signed copy of the report should be submitted to the Dean Office, Exam Section, FOHSS.

Teaching Methods:

The major teaching methods that can be followed for this course includes class lectures, laboratory activity, group discussions, presentations, and demonstrations.

Evaluation

Examination Scheme			
Internal Assessment		**External Assessment**	**Total**
Proposal Defence	**Midterm Defence**	**Final Defence**	
10	**70**	**20**	**100**



Elective Courses

Course Title: **Database Programming**
Course Code: **CACS453**
Year/Semester: **IV/VIII**
Class Load: **6 Hrs. /Week (Theory: 3Hrs, Practical 3Hrs.)**

Course Description
This course provides the comprehensive knowledge about database programming in relational database management system, which encompasses with overview of fundamental SQL statement, PL/SQL Block, Exception, Cursors, Record, Triggers, Procedures, Functions and Packages

Objectives: The general objectives of this course is to enhance advance programming skills in relational database management system.

Unit -1
Introduction of RDBMS **10 Hrs**
Overview of the Oracle Database Architecture, Familiar with SQL*Plus, SQL*Plus Commands (DESCRIBE, LIST, APPEND, CHANGE, INPUT, DEL, CLEAR BUFFER, Using Script Files), Accepting Values at Runtime, Overview of Fundamental SQL Fundamental Command (DDL, DML, DCL, Join and Subquery)

Unit -2
PL/SQL **13 Hrs**
PL/SQL Concepts, Architecture, Block structure, Executing PL/SQL Script, DBMS_OUTPUT.PUT_LINE Statement, substitution Variable feature, PL/SQL Language fundamentals, DML Statement in PL/SQL, Transaction Control in PL/SQL. Conditional Control (if, nested if, Case), Repetitive Control (While, for, simple loop, Nested, continue, loop label)

Unit -3 **5 Hrs**
PL/SQL Exception
Exception scope, user-defined exception, exception propagation, advance exception concepts (RAISE_APPLICATION_ERROR, EXCEPTION_INIT)

Unit -4
Database Cursors **5 Hrs**
Types of cursors, cursor loop, Nested cursors cursor for loops, parameterized cursors, Nested cursors

Unit -5
Database Triggers **5 Hrs**
Database Triggers BEFORE, AFTER Triggers, row and statement triggers, INSTEAD OF triggers

Unit -6
Record and procedures **5 Hrs**
Record (Record types, Nested record) Procedure (Block Structure, Anonymous Block, creating procedure, IN, OUT parameters in Procedure)

Unit-7

Functions and Package **5 Hrs**

Functions (creating and invoking function and optimizing function in execution, creating packages, extending the package, package instantiation and initialization,

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small work should be carried out using the concept learnt in each unit in individual or group.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Benjamin Rosenzweig, E. R. (2015). Oracle PL/SQL by Example. New Yourk: Prentice Hall.
2. Gupta, S. K. (2016). Advanced Oracle PL/SQL Developer's Guide . Birmingham: Packt Publishing.
3. Lex de Haan, T. G. (2014). Beginning Oracle SQL. Apress.
4. McLaughlin, M. (2014). Oracle Database 12c PL/SQL Programming. New Delhi: McGrawHill Education.

Course Title: Geographical Information System (3 Cr.)
Course Code: CACS454
Year/Semester: IV/VIII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed knowledge as well as practical skills on GIS theory, design and implementation. It includes introduction, GIS and Map, GIS data sources and structures, spatial data analysis, GIS data modeling and creating map apart from this this encourages to students to develop a real time basic GIS project.

Course objectives

The general objectives of this course are to provide theoretical knowledge as well as practical skills of geographical information system to make students capable of capturing, analyzing and visualize real world data.

Course Contents

Unit 1: Introduction **6 Hrs.**
- 1.1 Definition, functions and Applications of GIS
- 1.2 Components of GIS
- 1.3 GIS as Information System
- 1.4 Nature & Sources of GIS data
- 1.5 Recent trends and future of GIS

Unit 2: GIS and Map **8 Hrs.**
- 2.1 Map and their characteristics
- 2.2 Mapping concept and Techniques
- 2.3 Map Projection

Unit 3: GIS data Sources & Structures **12 Hrs.**
- 3.1 Capturing GIS data
- 3.2 Sources: Maps, GPS, Images and Databases
- 3.3 Structures: Vector, Raster and TIN data structures
- 3.4 GIS data modeling
- 3.5 GIS database design

Unit 4: Spatial Data Modeling and Analysis **12 Hrs.**
- 4.1 Spatial data modeling
- 4.2 Vector based analysis
- 4.3 Raster based analysis

Unit 5: GIS data modeling & Creating Maps **10 Hrs.**
- 5.1 Surface modeling
- 5.2 Hydrology modeling
- 5.3 Designing and printing the map

Laboratory Works

Students should develop basic GIS project implementing the concepts given in course of study and may add more (if required).

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Books

1. Kang-tsung Chang, (2010). "Introduction to Geographic Information Systems" Tata McGraw Hill, New Delhi.
2. C.P.Lo and Albert K.W.Yeung (2006). "Concepts and Techniques of Geographic Information Systems" Prentice Hall of India, New Delhi.
3. Albert, C.T.L. and Yeung, K.W. (2002). "Concepts and Techniques of Geographical Information Systems", New Delhi: Prentice Hall.
4. Chakraborty, D. and Sahoo, R.N. (2007). Fundamentals of GIS. India: Viva Books.
5. ESRI guide to GIS analysis Andy Mitchell, ESRI press, Red lands

Course Title: **Data Analysis and Visualization (3 Cr.)**
Course Code: **CACS455**
Year/Semester: **IV/VIII**
Class Load: **5 Hrs. / Week (Theory: 3Hrs. Practical: 2Hrs.)**

Course Description

This course introduces to extend student's knowledge and practice in data analysis and visualization, software, and applications. It provides the board overview of techniques of the visualization process, detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques.

Course objectives

Upon completion of this course, students should be able to 1. Explain the concept of visualization in the processing and analysis of data. 2. Develop visualization methods and visualization systems using software applications. 3. Perform creative work in the field of visualization.

Course Contents

	Hours
Unit 1: Introduction to visualization Introduction of visual perception, Visual representation of data, Data Abstraction, Visual Encodings, Use of Color, Perceptual Issues, Information overloads	6
Unit 2: Creating visual representations Visualization reference model, Visual mapping, Visual analytics, Design of Visualization applications.	7
Unit 3: Non spatial data visualization Visualization of one, two and multi-dimensional data, Tabular data, quantitative values (scatter plot), Separate, Order, and Align (Bar, staked Bar, dots and line charts), Tree data, Displaying Hierarchical Structures, graph data, rules for graph drawing and labeling, text and document data, levels of text representation, visualizations of a single text document, word cloud, flow data Time series data, characteristics of time data, visualization time series data, mapping of time	15
Unit 4: Spatial Data Visualization Scalar fields, Isocontours (Topographic Terrain Maps), scalar volumes, Direct Volume Rendering(Multidimensional Transfer Functions) , Maps (dot, pixel), vector fields Defining Marks and Channels	10
Unit 5: Software tools and data for visualization The iris data set, The Detroit Data Set, The Breakfast Cereal Data Set, The Dow Jones Industrial Average Data Set (time series), MS spread sheet, Python, Matlab, Java, Tableau	10

Evaluation

Evaluation Scheme

Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using any one software tools mention in unit 5.

Text Books:

3. Fry, Visualizing Data. O'Reilly Media, 2008, ISBN 0596514557
4. Ware, Information Visualization: Perception for Design, 3rd ed. Morgan Kaufmann, 2012,

Reference Books:

5. Telea, Data Visualization: Principles and Practice. A. K. Peters, Ltd, 2007, ISBN 1568813066.

Course Title: **Machine Learning (3 Cr.)**
Course Code: **CACS456**
Year/Semester: **IV/VIII**
Class Load: **6 Hrs. / Week (Theory: 3Hrs. Practical: 3Hrs.)**

Course Description

This course presents comprehensive introduction to several topics on basic concepts and techniques of Machine Learning (ML). It also explores the understanding of the Supervised and unsupervised learning techniques, probability based learning techniques, performance evaluation of ML algorithms and applications of ML.

Course objectives

Upon completion of this course, students should be able to 1. Explain the concept of supervised, unsupervised and semi-supervised learning. 2. Develop algorithms to learn linear and non-linear models using software. 3. Perform creative work in the field machine learning to solve given problem.

Course Contents

	Hours
Unit 1: Introduction to machine learning History of machine learning, Brain-neuron learning system, Definition and types of learning, need of machine learning, Data and tools, review of statistics, training, validation and test data, theory of learning – feasibility of learning – error and noise – training versus testing, generalization bound – approximation-generalization tradeoff – bias and variance – learning curve	10
Unit 2 Introduction to Supervised Learning Classification problems, Linear Regression- Predicting numerical value, Finding best fit line with linear regression, Perceptron, learning neural networks structures, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, support vector machines, Separating data with maximum margin, Finding the maximum margin,	11
Unit 3: Bayesian and instance based learning Probability theory and Bayes rule. Classifying with Bayes decision theory, Conditional Probability, Bayesian Belief Network, K-nearest neighbor	11
Unit 4:Introduction to un-supervised learning and dimensionality reduction Introduction to clustering, K- Mean clustering, different distance functions for clustering, Hierarchical clustering, Supervised learning after clustering, dimensionality reduction techniques, Principal component analysis	10
Unit 5: Measures for Performance Evaluation of ML algorithms Classification accuracy, Confusion matrix Misclassification costs, Sensitivity and specificity, ROC curve, Recall and precision, box plot, confidence interval	6

Evaluation

Evaluation Scheme

Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	100
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using software like matlab, python.

Text Books:

1. Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

Reference Books:

3. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.

Course Title: Multimedia System
Course Code: CACS457
Year/Semester: IV/VIII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed concept and structure of Multimedia system. It includes introduction, Sound & Audio System, Images and Graphics, Video and Animation, Data Compression, Abstractions for programming , Multimedia design and applications . It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of Multimedia System, applications and tools to make students capable of implementing, managing and developing the issues of multimedia application in their personal as well professional life.

Course Contents

Unit 1: Introduction **(6 Hrs)**

1.1 Multimedia and its applications
1.2 Global structure of Multimedia
1.3 Medium
1.4 Multimedia system and properties
1.5 Characteristics of a Multimedia system
1.6 Challenges for Multimedia Systems
1.7 Components of Multimedia System
1.8 Multimedia building blocks
1.9 Scope of Multimedia

Unit 2: Sound / Audio System **(5Hrs)**

2.1 Overview sound system
2.2 Producing digital audio
2.2 Music and speech
2.3 Speech Generation
2.4 Speech Analysis
2.5 Speech Transmission
2.6 Representation of audio files
2.7 Computer Music –MIDI
2.8 MIDI versus Digital Audio

Unit 3: Images and Graphics **(5 Hrs)**

3.1 Uses of images and Graphics
3.2 Digital Image Representation
3.3 Image and graphics Format
3.4 Working with image and graphics
3.5 Image Synthesis , analysis and Transmission

Unit 4: Video and Animation **(6 Hrs)**

4.1 Digital Video
4.2 Video signal representation
4.3 Computer Video Format
4.4 Computer- Based animation
4.5 Animation Language
4.6 Timeline and frame based animation
4.7 Timeline and Tween-Based animation

4.8 Methods of controlling Animation
4.9 Display of Animation
4.10 Transmission of Animation

Unit 5: Data Compression **(8 Hrs)**

5.1 Need for Data Compression
5.2 Compression Basics
5.3 Storage Space
5.4 Coding Requirements
5.5 Lossless and Lossy Compression techniques
5.6 Source, Entropy and Hybrid Coding
5.7 Lossy Sequential DCT- based Mode
5.8 Expanded Lossy DCT-based Mode
5.9 JPEG and MPEG Compression

Unit 6: Abstractions for programming **(6 Hrs)**

6.1 Abstractions Levels
6.2 Libraries
6.3 System Software
6.4 Toolkits
6.5 Higher Programming Languages
6.6 Object –oriented approaches

Unit 7: Multimedia design **(6 Hrs)**

7.1 Development phases and development teams
7.2 Analysis phase
7.3 Design Phase
7.4 Development phase
7.5 Implementation Phase
7.6 Evaluation and testing phase
7.7 Multimedia User Interface Design

Unit 8 : Multimedia Application **(6 Hrs)**

8.1 Media preparation and composition
8.2 Media integration and communication
8.2 Media Entertainment
8.4 Telemedicine
8.5 E-learning
8.6 Digital video editing and production systems
8.7 Video conferencing
8.8 Video-on-demand

Laboratory Works

Labs consist of at least 8 practical experiments and two assignments covering the topics of the syllabus.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Books

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications and Applications, Pearson Education Asia
2. John F. Koegel Buford , Multimedia Systems, Pearson Education Asia

Reference Books

1. Fred Halsall , Multimedia Communications, Applications, Networks, Protocols and Standards, Pearson Education Asia
2. Ralf Steinmetz and Klara Nahrstedt, Multimedia fundamentals, Pearson Education Asia

Course Title: Knowledge Engineering (3 Cr.)
Course Code: CACS458
Year/Semester: IV/VIII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. 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. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of knowledge engineering to make students capable of analysis, design, implementing and managing of knowledge engineering in their personal as well professional life.

Course Contents

Unit 1: Introduction [6 Hrs.]

1.1 Overview of data. Information and knowledge
1.2 Knowledge engineering and Knowledge management
1.3 Artificial intelligence use in knowledge Engineering
1.4 Knowledge based system and its applications

Unit 2: Knowledge Acquisition [8 Hrs]

2.1 Information gathering
2.2 Information retrieval
2.3 Applications of Natural Language processing
2.3.1 Morphology, lexicon, syntax and semantics
2.3.2 Parsing, POS tagging, named entity tagging

Unit3: Machine Learning [12 Hrs]

3.1 Machine Learning and its applications
3.2 Supervised and unsupervised learning
3.3 Classification and clustering
3.4 Classification algorithms
3.4.1 Linear classifiers
3.4.2 nearest neighbor
3.4.3 Support Vector Machines
3.4.4 Decision tree
3.4.5 Random forest
3.4.6 Neural networks
3.4.7 Case based reasoning

Unit 4: Knowledge representation and reasoning [7Hrs]

4.1 Proposition logic, predicate logic and reasoning
4.2 Knowledge representation languages
4.3 Non-monotonic reasoning
4.4 Probabilistic reasoning

Unit 5: Ontology Engineering [6 Hrs]

5.1 Overview to Ontology
5.2 Classifications of ontology
5.3 Methodology use in Ontology

5.4 Ontology VS Language

Unit 6: Knowledge Sharing [9 Hrs]
6.1 Information Distribution and Integration
6.2 Semantic web and its applications
6.2.1 RDF and linked data
6.2.2 Description logic
6.2.3Web Ontology language
6.3 Social web and semantics

Laboratory Works
The practical work consists of all features of knowledge engineering and case studies.

Teaching Methods
The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Books

3. Kendal, Simon, Creen, Malcolm, An Introduction to Knowledge engineering, Springer first edition, 2007
4. R.J. Brachman and H.J. Levesque. Knowledge representation and resoning (Elsevier 2004)

Reference Books

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A modern approach (Prentice Hall edition , second edition, 2002)
2. P. Jackson, Introduction to expert systems, Addison Wesley, 1999.
3. John Debenham, Knowledge Engineering: Unifying Knowledge Base and Database Design , Springer , 1998

Course Title: Information Security (3 Cr.)
Course Code: CACS459
Year/Semester:
Class Load: 6 Hrs. / Week (Theory: 3Hrs. Practical: 3 Hrs.)

Course Description: The course introduces the theoretical as well as practical concepts of computer and information security. The course includes concepts of cryptographic algorithms, authentication systems, access controls, malicious logics, network security and security audits.

Course Objectives: The objectives of this course are to familiarize the students with the computer security concepts, security policies and security mechanisms so that students will be able to design, implement and manage the secure computer systems.

Course Contents:

Unit I: Overview of Computer security (4 Hrs)

1.1. Computer Security Concepts
1.2. Computer Security, Information Security, Network Security
1.3. Threats, Attacks and Assets
1.4. Security Requirements
1.5. Security Design Principles
1.6. Attack Surfaces and Attack Trees
1.7. Computer Security Strategy

Unit II: Cryptographic Algorithms (12 Hrs)

2.1. Classical Cryptosystems: Ceasar, Vignere, Playfair, Rail Fence Ciphers
2.2. Modern Ciphers: Block vs. Stream Ciphers, Symmetric vs. Asymmetric Ciphers
2.3. Symmetric Encryption: Fiestel Cipher Structure, Data Encryption Standards (DES), Basic Concepts of Fields: Groups, Rings, Fields, Modular Arithmetic, Galois Fields, Polynomial Arithmetic, Advanced Encryption Standards (AES)
2.4. Number Theory: Prime Numbers, Fermat's Theorem, Primility Testing: Miller-Rabin Algorithm, Euclidean Theorem, Extended Euclidean Theorem, Euler Totient Function
2.5. Asymmetric Encryption: Diffie-Helman Key Exchange, RSA Algorithm

Unit III: Message Authentication and Hash Functions (6 Hrs)

3.1. Message Authentication
3.2. Hash Functions
3.3. Message Digests: MD4 and MD5
3.4. Secure Hash Algorithms: SHA-1
3.5. HMAC
3.6. Digital Signatures

Unit IV: User Authentication (5 Hrs)

4.1. User Authentication Principles
4.2. Password-Based Authentication
4.3. Token-Based Authentication
4.4. Biometric Authentication
4.5. Remote User Authentication
4.6. Two Factor Authentication

Unit V: Access Control (5 Hrs)

5.1. Access Control Principles
5.2. Subjects, Objects and Access Rights
5.3. Access Control Matrix and Capability Lists
5.4. Discretionary Access Control
5.5. Role Based Access Control
5.6. Attribute Based Access Control
5.7. Identity, Credential and Access Management
5.8. Trust Frameworks

Unit VI: Malicious Software and Intrusion (4 Hrs)
6.1. Malicious Software
6.2. Virus and its phases, Virus Classification
6.3. Worm, Worm Propagation Model, State of Worm Technology
6.4. Trojan Horse
6.5. Intrusion and Intruders
6.6. Intrusion Detection System
6.7. Analysis Approaches: Anomaly Based, Signature Based
6.8. Honeypots

Unit VII: Network Security (5 Hrs)
7.1. Overview of Network Security
7.2. Email Security: S/MIME, Pretty Good Privacy (PGP)
7.3. Secure Socket Layer (SSL) and Transport Layer Security (TLS)
7.4. IP Security (IPSec)
7.5. Firewalls and their types

Unit VIII: Security Auditing (7 Hrs)
8.1. Security Audit
8.2. Security Auditing Architecture
8.3. Security Audit Trail
8.4. Implementing Logging Function
8.5. Audit Trail Analysis

Laboratory Works:
The laboratory work includes implementing and simulating the concepts of cryptographic algorithms, hash functions, digital signatures, authentication & authorization systems, and malicious logics. The laboratory work covers implementing programs for following;

- Classical ciphers like Caeser, Playfair, Railfence
- DES, AES
- Primality Testing, Euclidean Algorithm, RSA
- MD5, SHA
- Authentication systems like password based, Captcha, two factor authentication etc.
- Role Based Access Controls
- Malicious Logics

Teaching Methods

The major teaching methods that can be followed for this course includes class lectures, laboratory activity, group discussions, presentations and case studies. For the laboratory work, the instructor can choose any programming language based on comfort level of students.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
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Text Book:

4. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson
5. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson.

Reference Books:

1. Mark Stamp, Information Security: Principles and Practices, Wiley
2. Matt Bishop, Introduction to Computer Security, Addison Wesley
3. Matt Bishop, Computer Security, Art and Science, Addison Wesley
4. Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson

Course Name: Internet of Things (3 Cr.)
Course Code: CACS460
Year/Semester: IV/VIII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description: The course introduces basics of IoT. It covers introductions of IoT, Devices and platform for developingIoT Systems, Design methodology, Data Analytics for IoT, Servers & Cloud offering and IoT system security.

Objective:
The objective of this course is to introduce the students about the principles, techniques, development and applications of IoT System.

Course Contents:

Unit 1: Introduction to IoT **[8Hrs.]**

1.1 Definition and Characteristics of IoT.
1.2 Physical and Logical Design of IoT.
1.3 IoT Enabled Technologies
1.4 IoT and M2M
1.5 Domain Specific IoTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

Unit 2: Sensor, Actuators and Interfacing **[18 Hrs.]**

2.1 Roles of Sensors and actuators, Types of sensors: Active and passive, analog and digital, Contact and no-contact, Absolute and relative
2.2 Working of sensors: Position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light, radiation, temperature, chemical, biosensor, camera.
2.3 Development boards: Arduino and Raspberry pi installation, interfacing and programming using python.

Unit 3: IoT Platform Design Methodology **[6 Hrs.]**

Case Study on IoT System for Weather Monitor

Unit 4: Data and Analytics for IoT **[10Hrs.]**

4.1 An Introduction to Data Analytics for IoT
4.2 Machine Learning
4.3 Big Data Analytics Tools and Technology
4.4 Edge Streaming Analytics
4.5 Network Analytics

Unit 5: IoT Physical Servers and Cloud Offering **[3Hrs.]**

Cloud storage models and Communication APIs of IoT Systems

Unit 6: Securing IoT Systems **[3Hrs.]**

6.1 IoT Security Challenges
6.2 IoTSystem's Security Practices

Course Name: Internet of Things (3 Cr.)
Course Code: CACS460
Year/Semester: IV/VIII
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Unit 4: Data and Analytics for IoT **[10Hrs.]**

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Unit 5: IoT Physical Servers and Cloud Offering **[3Hrs.]**

Cloud storage models and Communication APIs of IoT Systems

Unit 6: Securing IoT Systems **[3Hrs.]**

6.1 IoT Security Challenges
6.2 IoTSystem's Security Practices

Laboratory Work:

Implement the concept mentioned in the course using Python as a programming language, Arduino or Raspberry pi as a System board. All sensors mentioned in course should be implemented in a single project or separately to observe their working mechanism.

Evaluation:

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20	60	-	

Reference Books:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things (A Hands-on-Approach)", University Press India Pvt. Ltd., 2015.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Pearson Education (Cisco Press Indian Reprint).
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw Hill Education, 2017.
4. Gary Smart, "Practical Python Programming for IoT", ISBN-10: 1838982469
5. Gaston C. Hillar Internet of Things with Python, ISBN-10: 1785881388