Third Year/ First Part

S.N.	Course Code	Subject
1	EG3101CT	Computer Graphics
2	EG3102CT	Data Communication and Network
3	EG3103CT	Operating System
4	EG3104CT	Computer Repair and Maintenance
5	EG3105CT	Data Mining and data warehousing
6		Elective – I
	EG3106CT.1	a) Geographical Information System
	EG3106CT.2	b) E-commerce
	EG3106CT.3	c) Management Information System
7	EG3107CT	Minor Project

Computer Graphics
EG3101CT

Year: III **Total: 6 hours /week**
Part: I **Lecture: 3 hours/week**
Tutorial: 1 hour/week
Practical: … hours/week
Lab: 2 hours/week

Course description:
This course deals with graphics hardware, two dimensional and three-dimensional graphics, fundamentals of animation techniques; graphical user interface design, web graphics design and graphics design packages.

Course objectives:
After completion of this course students will be able to:
1. Acquire the knowledge of computer graphics.
2. Familiarize with hardware involved in graphics.
3. Familiarize with the algorithms to generate two-dimensional and three-dimensional graphical objects and animations.

Course Contents:

Theory

Unit 1. Introduction [3 Hrs.]
- 1.1. History of Computer Graphics
- 1.2. Application of Computer Graphics
- 1.3. CAD and CAM

Unit 2. Graphics Hardware [8 Hrs.]
- 2.1. Input Hardware
  - 2.1.1. Keyboard, Mouse (mechanical & optical), Light pen, Touch panel (Optical, Sonic, and Electrical), Digitizers (Electrical, Sonic, Resistive), Scanner, Joystick
- 2.2. Output Hardware
  - 2.2.1. Monitors
  - 2.2.2. Monochromatic CRT Monitors
  - 2.2.3. Color CRT Monitors
  - 2.2.4. Flat Panel Display Monitors
- 2.3. Hardcopy Devices
  - 2.3.1. Plotters
  - 2.3.2. Printers
- 2.4. Raster and Vector Display Architectures, Principles and Characteristics

Unit 3. Two Dimensional Algorithms and Transformations [10 Hrs.]
- 3.1. Mathematical Line Drawing Concept
- 3.2. Line Drawing Algorithms
  - 3.2.1. Digital Differential Analyzer (DDA)
  - 3.2.2. Bresenham's Line Drawing Algorithm
- 3.3. Mid-point Circle Drawing
- 3.4. Mid-point Ellipse Drawing Algorithm
- 3.5. Review of Matrix Operations – Addition and Multiplication
- 3.6. Two-dimensional Transformations
  - 3.6.1. Translation

3.6.2. Scaling
3.6.3. Rotation
3.6.4. Reflection
3.6.5. Shearing
3.7. Two-Dimensional Viewing Pipeline

Unit 4. Three-Dimensional Graphics [16 Hrs.]

4.1. Three-dimensions transformations
4.1.1. Translation
4.1.2. Scaling
4.1.3. Rotation
4.1.4. Reflection
4.1.5. Shearing
4.2. Three-dimensional Viewing Pipeline
4.3. Three-dimensions Projections
4.3.1. Concept of Projection
4.3.2. Projection of 3D Objects onto 2D Display Devices
4.3.3. Three-dimensional Projection Methods
4.3.3.1. Parallel Projection Method
4.3.3.2. Perspective Projection Method
4.4. Three-dimensional Object Representations
4.4.1. Polygon Surfaces
4.4.2. Polygon Tables
4.5. Introduction to Hidden Line and Hidden Surface Removal Techniques
4.5.1. Object Space Method
4.5.2. Image Space Method
4.6. Introduction to Illumination/ Lighting Models
4.6.1. Ambient Model
4.6.2. Diffuse Model
4.6.3. Specular Model
4.7. Introduction to Shading/ Surface Rendering Models
4.7.1. Constant Shading Model
4.7.2. Gouraud Shading Model
4.7.3. Phong Shading Model

Unit 5. Web Graphics Designs and Graphics DesignPackages [5 Hrs.]

5.1. Introduction to graphics file formats
5.2. Principles of web graphics design – browser safe colors, size, resolution, background, anti-aliasing
5.3. Type, purposes and features of graphics packages
5.4. Examples of graphics packages and libraries

Unit 6. Virtual Reality [3 Hrs.]

6.1. Introduction
6.2. Types of Virtual Reality
6.2.1. Non-immersive Virtual Reality
6.2.2. Semi-immersive Virtual Reality
6.2.3. Fully-immersive Virtual Reality
6.2.4. Augmented Virtual Reality
6.2.5. Collaborative Virtual Reality

6.3. Applications of Virtual Reality

Practical: **[30 Hrs.]**

As a part of the laboratory exercise, the students should implement all the algorithms studied in different chapters. At the end, students are required to integrate the codes they have written in earlier practical sessions to create a small project.

The lab contains few sessions dedicated to introduce the students to some of the popular professional graphics packages and CAD packages and explore their features. The course/lab instructor recommends packages to use.

Some algorithm implementation sessions may include:

1. Implementation of Digital Differential Analyzer (DDA), a line Drawing Algorithm.
2. Implementation of Bresenham's Line Drawing Algorithm.
3. Implementation of mid-point Circle Drawing Algorithm.
4. Implementation of mid -point Ellipse Drawing Algorithm.
5. Implementation of basic 2D transformation.
6. Implementation of basic 3D transformation.
7. Implementation of basic projections.

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Introduction	3	6
2	Graphics Hardware	8	15
3	Two Dimensional Algorithms and Transformations	10	20
4	Three-Dimensional Graphics	16	25
5	Web Graphics Designs and Graphics Design Packages	5	8
6	Virtual Reality	3	6
	Total	**45**	**80**

* There may be minor deviation in marks distribution.

References:

1. D. Hearn and M. P. Baker, "Computer Graphics", PHI Edition
2. T. I. James, D. Foley, A. Van Dam, S. K. Feiner, and J. F. Hughes, "Computer Graphics, Principles, and Practice", PHI Edition

Data Communication and Computer Network

EG3102CT

Year: II **Total: 7 hours /week**

Part: I **Lecture: 3 hours/week**

Tutorial: 1 hour/week

Practical: hours/week

Lab: 3 hours/week

Course description:

This course is designed to understand computer networks and digital data communications with a focus on Internet protocols: Application layer architectures (client/server, peer-to-peer) and protocols (HTTP-web, SMTP-mail, etc), Transport layer operation: (reliable transport, congestion and flow control, UDP, TCP); Network layer operation - (routing, addressing, IPv4 and IPv6), Data Link layer operation (error detection/correction, access control, Ethernet, 802.11, Physical Layer operation. Similarly, selected topics such as: network security (Network attack, cryptography, VPN, firewall).

Course objectives:

After completion of this course students will be able to:

1. Gain a good understanding of the architecture of computer networks.
2. Identify and understand various hardware devices and software used in computer networks.
3. Learn different types of protocols used for transmission of data.
4. Use routing and addressing.
5. Setup small home/office networks.

Course Contents:

Theory

Unit 1. Introduction [4 Hrs.]

1.1. Definition, Advantages and disadvantages, applications
1.2. Communication system: Analog and digital, Block diagram
1.3. Network as platform, Internet architecture, Trends in networking
1.4. Data Transmission: Analog and digital transmission
1.5. Transmission impairment

Unit 2. Network Architecture and Hardware/Software [9 Hrs.]

2.1. Network topologies
2.2. Network types: PAN, LAN, MAN, WAN, Intranet, Internet, Extranet
2.3. Layered network architecture, protocols, interfaces, services
2.4. OSI reference model
2.5. TCP/IP model
2.6. Network workstation and server: Hardware and software requirements
2.7. Client server and peer-to-peer model
2.8. Network devices: Repeater, Hub, NIC, Bridge, Switch, Router, Gateway

Unit 3. Physical Layer [4 Hrs.]

3.1. Channel bandwidth and throughput; Propagation time; transmission time
3.2. Transmission media:
  3.2.1. Guided: Coaxial, twisted-pair, fiber-optic
  3.2.2. Unguided: radio waves, microwaves, infrared, satellite
3.3. Introduction of Frame Relay, ATM, ISDN, PSTN and X.25

Unit 4. Data link Layer **[6 Hrs.]**

4.1. Introduction and function of data link layer and its issues
4.2. Framing
4.3. Flow Control issues at data link layer
4.4. Piggybacking and Sliding Window Protocol
4.5. Error Control issues at data link layer
4.6. Error Detection Method and Error Correction Method
4.7. Data Link Layer Protocol: HDLC, PPP

Unit 5. LAN Architectures/standards **[4 Hrs.]**

5.1. Introduction of LAN standards and architecture
5.2. Media access control, MAC address
5.3. ALOHA, FDDI, VLAN, CSMA/CD, Token ring, Token bus and IEEE 802.3, 802.4, 802.1(wireless LAN)

Unit 6. Network Layer **[8 Hrs.]**

6.1. Internetworking
6.2. Circuit switching and packet switching
6.3. Addressing issues at network layer
6.4. IP address, Different classes, Private and Public address
6.5. Subnet mask and sub-netting: Classless addressing; Network Address Translation (NAT)
6.6. Routing and its necessity; static and dynamic routing; interior and exterior routing
6.7. Dynamic routing and Static routing
6.8. Network layer protocols
6.9. Introduction to IPV6 and its necessity

Unit 7. Transport Layer **[4 Hrs.]**

7.1. Transport layer issues:
  7.1.1. Congestion control
  7.1.2. Flow control
  7.1.3. Quality of service
7.2. Transport layer addressing sockets, Port
7.3. Segmentation and reassembly
7.4. Connection oriented and connectionless service
7.5. TCP, UDP

Unit 8. Application Layer **[4 Hrs.]**

8.1. Application layer and its function
8.2. Electronic mail: SMTP, POP3, IMAP
8.3. File transfer: FTP, PUTTY, WinSCP
8.4. Web: HTTP, HTTPs
8.5. Dynamic host configuration protocol (DHCP)
8.6. DNS, WWW

Unit 9. Network Security **[2 Hrs.]**

9.1. Properties of Secure Communication
9.2. Network attacks: Active and Passive attacks

9.3. Cryptography: Symmetric Key and public key, Digital signature
9.4. Firewalls
9.5. Virtual private network

Practical: **[45 Hrs.]**

In practical, students should be able to set up small networks. They should be able to configure network hardware and network software. Following lab exercises may be helpful.

1. Configuration of network interface card and various network devices like hub, switch, router, etc.
2. Cabling: Construction of straight- through and cross-over cable and verify the physical layer connectivity.
3. Configuration of workstation PC
4. Setup peer-to-peer networking and verify it
5. Configuration of server for client server networking; also verify it.
6. Familiarization with basic network commands: Observing IP address and MAC address, Setting IP address and default gateway in PC, Verifying network layer connectivity
7. Configure the PC to obtain IP from DHCP, Release the leased IP, Renew IP (for this there should a DHCP server) -6 and 7 merge
8. Create multiple networks and route packets across multiple networks using static routing
9. Dynamic routing (e.g., RIP) and default route
10. Configure HTTP, FTP, DHCP server and verify it
11. Configuration of DNS and e-mail server
12. Design of local area network (LAN)
13. Case study: Organizational visit to study existing network system

Note: Use packet Tracer software for performing the above practical lab works

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Introduction	4	7
2	Network Architecture and Hardware/software	9	16
3	Physical Layer	4	7
4	Data link Layer	6	11
5	LAN Architectures/standards	4	7
6	Network Layer:	8	14
7	Transport Layer	4	7
8	Application Layer	4	7
9	Network Security	2	4
	Total	**45**	**80**

* There may be minor deviation in marks distribution.

References:

1. Behrouz Forouzan, “Data Communications and Networking”, Edition 5, Tata McGraw-Hill., 2012.
2. Andrews S. Tanenbaum, David J Wetherall, “Computer Networks”, Edition 5, Pearson Education, 2012.
3. William Stallings, “Data & Computer Communications”, PHI, Edition 6, 2012.

4. Jerry Fitzgerald, Alan Dennis, “Business Data Communications & Networking”, John Wiley & Sons Inc, 2010.

Operating System
EG3103CT

Year: III **Total: 5 hours /week**
Part: I **Lecture: 3 hours/week**
Tutorial: hours/week
Practical: hours/week
Lab: 2 hours/week

Course description:
This course includes the basic concepts and core structure, functions and design principles of operating system. It consists of the various functions of operating system like process and memory management, file and I/O Management, Deadlock Management and Security. The course gives ideas in designing the operating system and its services.

Course objectives
After completion of this course students will be able to:
1. Describe the functions of operating system.
2. Explain design of the operating system and its components.
3. Demonstrate and simulate the algorithms used in operating system.

Course Contents:

Theory

Unit 1. Introduction **[6 Hrs.]**
- 1.1. Operating system and its functions
- 1.2. Evolution of Operating System
- 1.3. Types of Operating System
- 1.4. Operating System Components
- 1.5. Operating System Services: System Call, Shell
- 1.6. Example of Operating System: Unix, Linux, Windows, Handheld OS

Unit 2. Process Management **[10 Hrs.]**
- 2.1. Process Vs Program, Process States, Process Models, Process Control Box
- 2.2. Process Vs Thread, Thread Models, Multithreading
- 2.3. Process Scheduling Criteria, Algorithms and Goals
  - 2.3.1. Batch System: FIFO, SJF, SRTN
  - 2.3.2. Interactive System: RR, HRRN
- 2.4. Critical Section, Race Condition, Mutual Exclusion
- 2.5. Producer Consumer Problem

Unit 3. Memory Management **[10 Hrs.]**
- 3.1. Concept of Multiprogramming
- 3.2. Memory Management functions
- 3.3. Multiprogramming with fixed partition
- 3.4. Multiprogramming with variable partition
- 3.5. Internal Vs External fragmentation
- 3.6. Memory Allocation: First Fit, Worst Fit, Best Fit
- 3.7. Concept of Paging and Page fault

Unit 4. Deadlock Management **[8 Hrs.]**
- 4.1. Deadlock Concept
- 4.2. Deadlock Conditions

4.3. Deadlock Handling Strategies:
  4.3.1. Deadlock Prevention
  4.3.2. Deadlock Detection
  4.3.3. Deadlock Avoidance
  4.3.4. Recovery from Deadlock
4.4. Banker's Algorithm

Unit 5. File and Input/output Management [6 Hrs.]

5.1. File: Naming, Structure, Types, Access, Attributes, Operations, Directory Systems
5.2. File System Layout
5.3. Implementing Files: Contiguous allocation, Linked List Allocation, Linked List Allocation using Table in Memory, Inodes
5.4. Principle of I/O Hardware and Software
5.5. Disk Formatting, Disk Arm Scheduling, Stable Storage, Error Handling

Unit 6. Security [5 Hrs.]

6.1. Security Goals
6.2. Security Attacks
6.3. Active and Passive Attacks
6.4. Cryptography Basics
6.5. Access Control
6.6. Protection Mechanisms

Practical: [30 Hrs.]

1. Installation of Virtual Machine, Linux and Windows [4 Hrs.]
2. Linux Basic Commands [2 Hrs.]
3. Implementation of Process Scheduling Algorithms [8 Hrs.]
4. Process Creation, Termination [4 Hrs.]
5. Inter process communication [4 Hrs.]
6. Implementation of Banker's Algorithm [4 Hrs.]
7. Implement some Memory Management Schemes [4 Hrs.]

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Introduction	6	11
2	Process Management	10	18
3	Memory Management	10	18
4	Deadlock Management	8	13
5	File and I/O Management	6	11
6	Security	5	9
	Total	**45**	**80**

* There may be minor deviation in marks distribution.

References:

1. Andrew S. Tanenbaum, "Modern Operating Systems", 3rd Edition, PHI
2. Stalling William, "Operating Systems", 6th Edition, Pearson Education
3. Silbcrschatz A.,Galvin P., Gagne G., "Operating System Concepts", 8th Edition, John Wiley and Sons

Computer Repair and Maintenance

EG3104CT

Year: III **Total: 5 hours /week**

Part: I **Lecture: 2 hours/week**

Tutorial: hour/week

Practical: hours/week

Lab: 3 hours/week

Course Description:

This course deals about fundamental concept, theories and popular principles of repair and Maintenance systems of computer. The major focus is trouble shooting, repairing and maintenance into real-life by utilizing the knowledge and skill of computer hardware and software. This makes the learning-teaching process more interactive, skillful and interesting.

Course Objectives:

At the end of the course student will be able to

1. Explain basic operation of computer
2. Perform the maintenance of computer, its accessories and peripherals
3. Take Care of computer and its accessories

Course Contents:

Theory

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

1.1. Definition of Computer, Hardware and software
1.2. Computer Repair and Maintenance
1.3. Importance of Computer Repair and Maintenance
1.4. Hardware maintenance
1.5. Software Based maintenance

Unit 2. System Case **[2 Hrs.]**

2.1. Style and size
2.2. Form Factors
2.3. Switches
2.4. LEDs
2.5. Drive bay

Unit 3. Power Supply **[2 Hrs.]**

3.1. Ratings
3.2. Working Principle
3.3. Block Diagram
3.4. SMPS Concept

Unit 4. Mother Board and System Devices **[2 Hrs.]**

4.1. Form factor
4.2. Parts
4.3. Chipset and controller
4.4. Buses
4.5. BIOS

Unit 5. Processor **[3 Hrs.]**

5.1. Arithmetic Logic Unit (ALU)
5.2. Control Unit, Register
5.3. Buses (Data bus, Address Bus, Control Bus)

Unit 6. UPS **[2 Hrs.]**

6.1. Introduction to UPS
6.2. Importance of UPS
6.3. UPS system Maintenance

Unit 7. Input Devices **[2 Hrs.]**

7.1. Scanner
  7.1.1. Basic operation of Scanner
  7.1.2. Types of Scanners
  7.1.3. Resolution
  7.1.4. Port/slot
7.2. Repair of Scanner

Unit 8. Storage devices **[4 Hrs.]**

8.1. Hard disk (Construction and Operation, Speed, Disk Geometry, Track, Cylinder and sectors, Capacity, Partitioning and Formatting)
8.2. Compact Disk (CD/DVD, Color book Specification, Performance and Reliability, CD/R-W principle)
8.1. External HDDs Vs SSDs

Unit 9. Output devices **[3 Hrs.]**

9.1. Monitor
  9.1.1. CRT (Simple working Principle)
  9.1.2. LED
9.2. Printer
  9.2.1. Basic Operation & Installation of Printer
  9.2.2. Types of Printers
  9.2.3. Resolution
  9.2.4. Port/slot
9.3. Repair of printer

Unit 10. System Care **[8 Hrs.]**

10.1. Preventive Maintenance
  10.1.1.General system care factors
  10.1.2.Cooling and Ventilation
  10.1.3.Power protection
  10.1.4.Data loss and virus protection
10.2. Data problem detection
  10.2.1. Virus detection and protection
  10.2.2. Background of viruses
  10.2.3. Virus scanning and antivirus software
10.3. Backup and Disaster Recovery:
  10.3.1.Risk of data,
  10.3.2.Backup methods devices and media,
  10.3.3.Backup scheduling,

10.3.4. Recovery of data

Practical: **[45 Hrs.]**

1. **Identification and Selection of Required Tools**
   - 1.1. **Physical Assembly procedure:**
     - 1.1.1. Safety procedure
     - 1.1.2. System case selection and preparation
     - 1.1.3. layout of mother board
     - 1.1.4. Secondary storage devices fitting and connections
     - 1.1.5. Memory insertion
     - 1.1.6. Power Connection
     - 1.1.7. Processor and heat sink fitting
     - 1.1.8. Connection of indicators and switches
     - 1.1.9. Setting of jumpers
     - 1.1.10. Insertion of peripheral cards like audio, NIC, Modem, Video Cards etc if necessary
   - 1.2. **Installation of Operating Systems:**
     - 1.2.1. Management of Hard Disk (Partition and formatting)
     - 1.2.2. BIOS setup and installation of Operating system (Windows, Linux etc.)
     - 1.2.3. Installation of Device drivers, Configuration, Installation of Application Programs and antivirus
   - 1.3. **Connecting Multiple Computers Together:**
     - 1.3.1. Construction of UTP cable (Straight through and Cross-cable, connecting through HUB, Switch or Direct connection, Assigning IP numbers and testing of networking
   - 1.4. **Troubleshooting and Repairing Techniques:**

     System Case, LEDs or Case Buttons, Key Lock, Power Sources and Power Protection Devices Cooling fans, air circulation, Motherboard and System Devices, General Failures, CMOS Memory or Real-Time Clock, System BIOS, Resources and Expansion Cards, Processor, System Memory, Memory Not Recognized, Out of Memory Problems, Performance Issues, Video Cards, Failure or Improper Operation, Image Quality Problems, Performance or Video Mode Issues, Monitors, Failure or Improper Operation, Hard Disk Drives, Booting or Operation Problems, Configuration Issues, Disk Compression Issues, Drive Letter Issues, File System Problems, Operating System, CD/DVD- ROM Drives, Drive Not Recognized, Configuration Problems, Audio Issues, Peripheral I/O Ports, Keyboards, Mice, Modems, Network Card, Operation and Connection Problems, Speed Issues, Applications Program Failure.

2. **Installation and maintenance of peripheral equipment**
   - 2.1. **Printer**
     - 2.1.1. Installation of printer driver
     - 2.1.2. Replacement of tonner/cartridge
     - 2.1.3. Troubleshoot and maintenance of Printer
   - 2.2. **Scanner**
     - 2.2.1. Identification of Scanner component
     - 2.2.2. Connection of scanner
     - 2.2.3. Installation of scanner device

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Introduction	2	3
2	System Case	2	3
3	Power Supply	2	3
4	Mother Board and System Devices:	2	3
5	Processor	3	4
6	UPS	2	3
7	Input devices	2	3
8	Storage Devices	4	5
9	Output Devices	3	4
10	System Care	8	9
	Total	**30**	**40**

* There may be minor deviation in marks distribution.

Reference:

1. Winn, L. Rosch (1994). *The hardware Bible* (3rd Edition). Brady Publishing
2. Peter, Norton (2000). *Introduction to Computers* (4th Edition). New York city: McGraw-Hill Higher Education
3. Mark, Minasi (1998). *The Complete PC Upgrade and Maintenance Guide.* United States: Sybex Inc
4. Mueller, Scott (2015). *Upgrading and Repairing PCs (22nd ed).* Que Publishing

Data Mining and Data Warehousing
EG3105CT

Year: III **Total: 6 hours /week**
Part: I **Lecture: 3 hours/week**
Tutorial: … hour/week
Practical: … hours/week
Lab: 3 hours/week

Course description:
This course studies algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. The course will cover all these issues and will illustrate the whole process by examples.

Course objectives:
After completion of this course students will be able to:
1. Explain the concept of Data preprocessing, Data Mining and Data Warehousing
2. Understand Data preprocessing Techniques.
3. Discuss multi-dimensional data representation and OLAP operations
4. Understand the concept and use of clustering, classification, and association rule mining algorithms.
5. Discuss on advanced concept and trends of Data Mining and Data Warehousing.

Course Contents:

Theory

Unit 1. Introduction to Data Mining [5 Hrs.]
- 1.1. Basic concepts of Data Mining
- 1.2. Use and benefits of Data Mining
- 1.3. Application of data mining
- 1.4. Knowledge Discovery Process (KDD)
- 1.5. Data Mining Functionalities
- 1.6. Data Mining System Architecture

Unit 2. Data Preprocessing [5 Hrs.]
- 2.1. Data Objects and attribute types
- 2.2. Statistical description of data
- 2.3. Data Preprocessing Concepts
- 2.4. Data Preprocessing
  - 2.4.1. Data Cleaning
  - 2.4.2. Data Integration
  - 2.4.3. Data Reduction
  - 2.4.4. Data Transformation

Unit 3. Data Warehousing and Online Analytical Processing (OLAP) [8 Hrs.]
- 3.1. Basic concepts of data warehousing
- 3.2. Use and benefits of data warehousing
- 3.3. Application of data warehousing
- 3.4. Characteristics of Data Warehouse
- 3.5. Operational Database Vs. Data Warehouse
- 3.6. Data Warehouse Architecture
- 3.7. Data Warehouse Models: Enterprise Warehouse and Data marts

3.8. Multi-dimensional Data, Data Cube
3.9. Data Warehouse Schemas
  3.9.1. Star Schema
  3.9.2. Snowflake Schema
  3.9.3. Fact Constellation Schema
3.10. Fact tables and Dimensions Tables
3.11. OLAP Operations in Multidimensional data models: Roll-up, Drill-Down, Slice and Dice, and Pivot (Rotate) Operations
3.12. Types of OLAP Servers: ROLAP, MOLAP, HOLAP

Unit 4. Mining Frequent Pattern and Associations [7 Hrs.]

4.1. Frequent patterns, Market basket analysis, Frequent Item sets, Support and Confidence, Association Rules
4.2. Finding Frequent Itemset (Apriori Algorithm)
4.3. Limitation and improving Apriori Algorithm

Unit 5. Classification [8 Hrs.]

5.1. Concept of Classification, Learning and Testing of Classification
5.2. Decision Tree Induction
5.3. Bayesian Classification
5.4. Rule Based Classification
5.5. Linear Regression

Unit 6. Clustering [8 Hrs.]

6.1. Concept and Definition of Clustering
6.2. Clustering Methods and General Characteristics
  6.2.1. Partitioning Method (k-Means, k-Medoids)
  6.2.2. Hierarchical Method (Agglomerative, Divisive)

Unit 7. Data Mining Trends and Applications [4 Hrs.]

7.1. Multimedia Data Mining
7.2. Text mining
7.3. Web Mining
  7.3.1. Web Content Mining
  7.3.2. Web Usage Mining
  7.3.3. Web Structure Mining
7.4. Data Mining support in SQL Server
7.5. Data Mining in Oracle
7.6. Data Mining Standards
7.7. Importance of data mining in Marketing, E- commerce and CRM
7.8. Aspects of Security and Privacy in Data Mining

Practical: [45 Hrs.]

1. Design data warehouse by using SQL Server or Oracle.
2. Implement OLAP operations
3. Implement clustering algorithms K-means and K- medoid by using Weka
4. Implement classification algorithms Naïve-Bayes and decision trees by using Weka
5. Implement regression algorithms by using Weka
6. Implement association mining algorithms by using Weka

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Introduction to Data Mining	5	8
2	Data Preprocessing	5	8
3	Data Warehousing and Online Analytical Processing (OLAP)	8	16
4	Mining Frequent Pattern and Associations	7	12
5	Classification	8	12
6	Clustering	8	16
7	Data Mining Trends and Applications	4	8
	Total	**45**	**80**

* There may be minor deviation in marks distribution.

References:

1. Jiawei Han, Micheline Kamber, Jian Pei; *Data Mining: Concepts and Techniques*, Morgan Kaufman Publication, 3rd Edition
2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, *Introduction to DataMining*, Pearson Publication, First Edition
3. Charu C. Agrawal, *Data Mining: The Textbook*, Springer Nature Publication, First Edition
4. Sam Anahory, Dennis Murray, *Data warehousing In the Real World***,** Pearson Education.
5. Alex Berson and Stephen J. Smith, *Data Warehousing, Data Mining & OLAP*, Tata McGraw Hill, 1st Edition.

Geographical Information System
(Elective I)
EG3106CT.1

Year: III **Total: 7 hours /week**
Part: I **Lecture: 3 hours/week**
Tutorial: 1 hour/week
Practical: hours/week
Lab: 3 hours/week

Course description:
This course is designed to introduce students a computer-based GIS, Geographic Information Systems, and its applications to spatial data management as a tool to understand the world by describing and explaining the human relationship to the physical environment.

Course objectives:
After completion of this course students will be able to:
1. Explain GIS, development and components of GIS
2. Explain data capturing techniques
3. Analyze spatial and non- spatial data

Course Contents:

Theory

Unit 1. Introduction **[4 Hrs.]**
- 1.1. Historical Background
- 1.2. Scope and application areas
- 1.3. Benefits and importance
- 1.4. Functional components
- 1.5. GIS in Organizations
- 1.6. Elements of GIS

Unit 2. Coordinate System **[4 Hrs.]**
- 2.1. Geographic coordinate system
- 2.2. Map Projections
- 2.3. Commonly used map projection system
- 2.4. projected coordinate system

Unit 3. Data Models **[7 Hrs.]**
- 3.1. Introduction, Common Spatial Data Models
- 3.2. Vector Data, Raster Data
- 3.3. Other Data Models:
  - 3.3.1. TINs
  - 3.3.2. Object Data Model
  - 3.3.3. 3-d Data Model
- 3.4. Data and File Structure

Unit 4. Maps, Digitization and Output **[10 Hrs.]**
- 4.1. Map concept
  - 4.1.1. Map elements
  - 4.1.2. Map layers

4.1.3. Map scales and representation
4.1.4. Map Boundaries and Spatial Data

4.2. Digitizing
4.2.1. The Digitizing Process
4.2.2. Digitizing Errors
4.2.3. Node and Line Snapping

4.3. Reshaping
4.3.1. Line Smoothing and Thinning
4.3.2. Scan Digitizing, Editing Geographic Data
4.3.3. Features Common to Several Layers

4.4. Coordinate Transformation:
4.4.1. Control Points
4.4.2. The Affine Transformation
4.4.3. Other Coordinate Transformations
4.4.4. Caution When Evaluating Transformations
4.4.5. Projection Vs Transformation

4.5. Output: Maps, Digital Data, Metadata

Unit 5. Capturing Data [5 Hrs.]

5.1. Different methods of data capture
5.2. Data preparation
5.3. Conversion and integration
5.4. GPS
5.5. Remote Sensing

Unit 6. Spatial Analysis and Terrain Analysis [9 Hrs.]

6.1. Introduction
6.2. Selection and Classification
6.3. Proximity Functions and Buffering
6.4. Overlay: Raster Overlay, Vector Overlay
6.5. Terrain Analysis:
6.5.1. Introduction
6.5.2. Slope and Aspect
6.5.3. Hydrologic Functions, Profile Plots, Contour Lines
6.5.4. Viewsheds, Shaded Relief Maps

Unit 7. Spatial Data Infrastructure [6 Hrs.]

7.1. SDI concepts and its current trend
7.2. The concept of metadata and clearing house
7.3. Critical factors around SDIs

Practical: [45 Hrs.]

1. Handle GIS devices
2. ArcGIS installation
3. Explore interactive GIS, create map layouts, Reuse a custom map layout
4. Build a file geodatabase, Use Arc Catalog utilities, modify an attribute table, Join tables
5. Examine metadata, Work with map projections, learn about vector data formats, Explore sources of vector maps

6. Digitize polygon features, use advanced edit tools, digitize point features, Digitize line features
7. Map Designing using tools

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Introduction	4	7
2	Coordinate system	4	7
3	Data Models	7	12
4	Map, Digitization and output	10	18
5	Capturing Real World	5	9
6	Spatial Analysis & Terrain Analysis	9	16
7	Introduction to Spatial Data Infrastructure	6	11
	Total	**45**	**80**

* There may be minor deviation in marks distribution.

References:

1. De By R, Knippers R.A, sun Y. Principles of geographic information systems: An introductory textbook, international institute for Geoinformation science and Earth observation, the Netherlands
2. Paul B, GIS Fundamentals: A First Text on Geographic Information Systems Fifth Edition,
3. Chang K.T. Introduction to Geographic Information System

E-Commerce
(Elective I)
EG3106CT.2

Year: II **Total: 7 hours /week**
Part: I **Lecture: 3 hours/week**
Tutorial: 1 hour/week
Practical: hours/week
Lab: 3 hours/week

Course Description:
This course aims to guide the students in both the theoretical and practical aspects of developing computer solutions for real-world problems. This course deals with the introduction, different business models for e-Commerce, concept of mobile computing, different types of on-line business systems, techniques and implementation for electronics payment system, and legal considerations in e-Commerce.

Course Objectives:
After completing this course, the students will be able to
1. Explain the steps required to set-up your E-commerce website for advertising purposes
2. Introduce the e-commerce.
3. Identify security issues of e-Commerce and e-commerce related Public Policy.
4. Explain the types of payment system and payment gateway.
5. Describe the legal and ethical issues of e-commerce and cyber law,
6. Familiarize with online marketing.

Course Contents:

Theory

Unit 1. Fundamental concept of e-Commerce [6 Hrs.]
- 1.1. Definition of Electronic Commerce
- 1.2. Scope of Electronic Commerce
- 1.3. Electronic E-commerce and the Trade Cycle
- 1.4. Emergence of Internet and commercial use of Internet
- 1.5. E-commerce Models, Personal web server, Internet information server, ASP page Contain scripts, Contain objects and components, Database access,
- 1.6. Application of E-Commerce

Unit 2. Business Models of e-Commerce [6 Hrs.]
- 2.1. Business to Business (B2B)
- 2.2. Business to Consumer (B2C)
- 2.3. Consumer to Consumer (C2C)
- 2.4. Development of B2B e-commerce
- 2.5. Difference between B2C and B2B e-Commerce
- 2.6. e-Procurement
- 2.7. Just in Time Delivery
- 2.8. Integration with Back-end Information System
- 2.9. Electronic marketing in Business-to-Business
- 2.10. Electronic Data Interchange (EDI)
- 2.11. EDI: The Nuts and Bolts, EDI & Business
- 2.12. Auctions and Services from Traditional to Internet Based EDI

Unit 3. E-marketing and Advertising Concepts [5 Hrs.]

3.1. Define E-marketing
3.2. Explain Traditional Marketing
3.3. Online Marketing vs offline marketing
3.4. Tools for online and offline marketing
3.5. Issues with online marketing
3.6. Model of an online video store

Unit 4. Mobile and Wireless Application [5 Hrs.]

4.1. Define Mobile and wireless
4.2. Growth of Mobile Commerce
4.3. Wireless Application Protocol (WAP)
4.4. Use of technologies for mobile commerce
4.5. Architecture of Wireless Application Protocol
4.6. Generations in Wireless Communications
4.7. Security Issues related to Wireless Communication

Unit 5. The network infrastructure for e-commerce [8 Hrs.]

5.1. Network and internets
5.2. Network routers
5.3. Internet protocol suites
5.4. Internet naming convention, (URLs, TCP, FTP, ISP, Telnet, Search engine)
5.5. Broadband technologies (ADSL, Wi-Fi, LTE (4G), Bluetooth)
5.6. Web-based client/server
5.7. Software agents, Types of software agents
5.8. Internet Security
5.9. Multimedia delivery
5.10. Managerial issues

Unit 6. Electronic Payment System (EPS) [4 Hrs.]

6.1. Define Electronic payment system
6.2. Types of electronic payment system
6.3. Digital token-based E-payment system
6.4. Smart Cards & E-payment systems
6.5. Credit card-based payment systems
6.6. Digital wallet (eSewa, Khalti, ConnectIPS)
6.7. Online banking facilities of banks (Nepali banks)
6.8. Risk factor in electronic payment system

Unit 7. Introduction to Entrepreneurship [6 Hrs.]

7.1. Entrepreneurship development
7.2. Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager
7.3. Attributes and characteristics of a successful Entrepreneur
7.4. Entrepreneurial Culture
7.5. Legal and Ethical Issues

Unit 8. Public Policy [5 Hrs.]

8.1. From legal issues to privacy
8.2. E-commerce related legal incidents

8.3. Ethical and other public policy issues
8.4. Protecting privacy
8.5. Protecting intellectual property
8.6. Internet indecency and censorship
8.7. Taxation and encryption policies
8.8. E-commerce Law
8.9. Forms of Agreement
8.10. Government policies

Practical: **[45 Hrs.]**

1. Project should be done by students in any e-commerce site (the project should include: business model, payment mode, network infrastructure, marketing strategy, SWOT analysis and working process of site) (Refer Amazon, Alibaba, E-bay, Paypal etc.)
2. Study visit to fully developed E-Commerce management organization.

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Fundamental concept of E-Commerce	6	11
2	Business Models of e-Commerce	6	11
3	E-marketing and Advertising Concepts	5	9
4	Mobile and Wireless Application	5	9
5	The network Infrastructure for E-commerce	8	13
6	Electronic Payment System (EPS)	4	7
7	Introduction to Entrepreneurship	6	11
8	Public Policy	5	9
	Total	**45**	**80**

* There may be minor deviation in marks distribution.

References:

1. Noel Jerke, April 2012. E-Commerce Developer's Guide to Building Community and using Promotional Tools. Sybex Inc.
2. Kenneth C. Laudon and Carol Guercio Traver, (11^{th} edition), 2015. E-commerce 2015 business, technology, society. Pearson
3. Janice Reynolds, (2nd edition, 2015. The Complete E-Commerce Book, Design, Build & Maintain a Successful Web-based Business. Focal Press
4. Amir Manzoor, (1^{st} edition), 2015. E-commerce 2016. Printed in the United States of America.

Management Information System
(Elective I)
EG3106CT.3

Year: III **Total: 7 hours /week**
Part: I **Lecture: 3 hours/week**
Tutorial: 1 hour/week
Practical: hours/week
Lab: 3 hours/week

Course Description:
The main aim of this course is to introduce the Management of Information Systems (MIS). Managing information systems has become a task for all levels of managers and all function areas of the business. This MIS course is designed to familiarize students with the concepts related to the utilization of information technology in business organizations. This course will focus on technical and managerial aspects of information technology adoption in the organization. This course should provide the student with knowledge of the core principles of MIS, focusing on breadth rather than depth of knowledge. In this course has included case studies, group assignments, and related software exercises that will provide an opportunity to apply MIS concepts to real-world applications.

Course Objectives:
After completing this course, the student will able to:
1. Explain the significance of information systems in organizations, Strategic management processes and the implications for the management.
2. Describe different types of management information systems.
3. Identify the basic technologies used in the field of Management Information System.
4. Explain the developments of electronic commerce and the role of Internet.
5. Describe the processes of developing and implementing information systems.
6. Familiarize with ethical and social issues related to information system.

Course contents:

Theory

Unit 1. Foundation of Information System [7 Hrs.]
- 1.1. Introduction to information system
- 1.2. Role of information system in Business
- 1.3. Components of Information Systems
- 1.4. Types of information systems
- 1.5. Effectiveness and efficiency criteria in information system

Unit 2. An overview of Management Information Systems [6 Hrs.]
- 2.1. Structure of a Management information system
- 2.2. Structure of a Management information system
- 2.3. MIS versus Data processing
- 2.4. Decision Making In MIS
- 2.5. MIS & Information Resources Management

Unit 3. Concept of Planning [8 Hrs.]
- 3.1. Concept of organizational planning
- 3.2. The Planning Process
- 3.3. Computational support for planning

3.4. The importance of planning
3.5. Business applications of information technology
3.6. Information System for Business Operations (SDLC)
3.7. Information System for Strategic Advantage
3.8. Decision Support Systems and its benefits and characteristic

Unit 4. Managing Information Technology [5 Hrs.]

4.1. Enterprise & global management
4.2. Security & Ethical challenges
4.3. Planning & implementing changes
4.4. Information Technology Trends

Unit 5. MIS in functional areas of business [7 Hrs.]

5.1. Accounting information systems
5.2. Geographical information systems
5.3. Human resource information systems
5.4. Inventory information systems
5.5. Manufacturing information systems
5.6. Marketing information systems
5.7. Quality information systems

Unit 6. Information security [6 Hrs.]

6.1. Security threats and vulnerability
6.2. Controlling security threat and Vulnerability
6.3. Management security threat in e-Business
6.4. Disaster management
6.5. MIS and Security Challenges
6.6. Firewall

Unit 7. Knowledge based systems [3 Hrs.]

7.1. Artificial intelligence
7.2. Expert systems
7.3. Neural networks

Unit 8. Office information system [3 Hrs.]

8.1. Nature of office
8.2. Types of office information systems
8.3. Client server computing

Practical: [45 Hrs.]

Project Work:

Students should complete at least one MIS Project on the following Topics by including the above contents.

1. Restaurant Information System
2. College Management System

Final written exam evaluation scheme			
Unit	**Title**	**Hours**	**Marks Distribution***
1	Foundation of Information System	7	12

2	An overview of Management Information Systems	6	11
3	Concept of planning	8	14
4	Managing Information Technology	5	10
5	MIS in functional areas of business	7	12
6	Information security challenges in e-Enterprises	6	11
7	Knowledge based systems	3	5
8	Office information system	3	5
	Total	**45**	**80**

* There may be minor deviation in marks distribution.

References:

1. Brian (2004). *Introduction to Information System*. New York: MCGRAW HILL.
2. Murdick (1971). *Information System for Modern* Management New Jersey:PHI.
3. Jawadekar,S.S(2019). *Management Information System* (6th ed). India: MC GRAW HILL.

Minor Project

EG3107CT

Year: III **Total: 3 hours /week**

Part: I **Lecture: … hours/week**

Tutorial: … hour/week

Practical: 3 hours/week

Lab: … hours/week

Course description:

This course provides students with an idea of how to transform the theoretical knowledge gained in earlier semesters into practical applications. The students will build a real-life project during this course using the knowledge gained in earlier semesters.

Course objectives:

After completing this course, the students will be able to:

1. Learn and gain the knowledge about the programming tool they used to implement the real-life project.
2. Plan, design, develop and implement the real-life problem as a project.
3. Formulate project documentation and oral presentation for his/her final year project.

Project Overview:

1. Group formation (3-4 persons / group)
2. Project concept development
    a. Finding Project concept
    b. Scope of project
    c. Completion time
3. Proposal preparation and presentation-2 weeks
4. Mid-term defense (should complete literature review, methodology, project design and project progress report)-8 weeks after the proposal acceptance
5. Final defense (should deliver complete project and report)-4 weeks after mid-term defense
6. Project documentation (must follow project documentation guide line given by supervisor or the department)
7. Submission of hard cover project document to department-1 week after final defense

The project should:

1. Be intended to develop an Computer Engineering solution to a practical problem
2. Be carried out using an engineering approach
3. Emphasize design
4. Be carried out in a group (3-4 person/group)
5. Normally result in the production of a piece of software
6. Include technical documentation based on documentation guideline.
7. Be fully described from inception to completion in a written report produced to a good level of professional competence

Procedure:

1. Explain the minor project concept in a class by project teachers.
2. Preliminary selection of topic.
3. Discussion with department regarding the feasibility/practicality of the project (e.g. cost, usefulness, market).
4. Finalization of topic.

5. Submission of the detail proposal (Extensive literature review).
6. After approval by project teachers, start of minor project work in laboratory /home.
7. Monitoring of the work progress by project teachers and report to department.
8. A mid-term progress report should be submitted by the student on the date fixed by department.
9. Presentation of mid-term progress of the minor project along with report.
10. Final presentation of minor project should be conducted by the department and should be evaluated by the project teachers in the presence of other teachers in the related field, not involved in minor projects, but from the same department.
11. Students must submit a group report in the format prescribed below.

Requirements for report writing:
Font Name: Times New Roman
Top Margin: 1 inch
Left Margin: 1 inch
Right Margin: 1 inch
Bottom Margin: 1 inch
Gutter: 0.25 inch (left)
Header and Footer: 0.5 inch
Line Spacing: Single
Paragraph Spacing: 8 pt
Font Size: 12 pt (for normal text)
Follow following standard for headings

1. Heading1 (16pt, Bold)
1.1. Heading2 (14pt, Bold)
1.1.1. Heading3 (13pt, Bold)
1.1.1.1. Heading4 (12pt, Bold)

Arrangement of Contents in a report:
The sequence of contents in a major project report is as follows
1. Cover Page
2. Title Page
3. Certificate of Approval
4. Acknowledgment
5. Executive Summary
- Executive Summary should be one-page synopsis of the project report and it must clearly give the overview of the project.
6. Table of Contents
- The table of contents should list all material following it as well as any material which precedes it.
7. List of Figures (if any)
- The list should use exactly the same captions as they appear below the figures in the text.
8. List of Tables (if any)
- The list should use exactly the same captions as they appear above the tables in the text.
9. List of Symbols (if any)
- The list should provide the detail of the symbols used in the report.
10. Abbreviations (if any)

- Abbreviation list should provide the details of the abbreviations used in the report in alphabetical order.

11. Main body
    - 11.1. Chapter 1: Project Overview (Introduction, Objectives and Scope, Project Features,
      Feasibility, System Requirement)
    - 11.2. Chapter 2: Literature Review
    - 11.3. Chapter 3: Design and Methodology (e.g. System Design, methods used, tools, data source)
    - 11.4. Chapter 4: Result and Analysis
    - 11.5. Chapter 5: Conclusion, Recommendation and Limitations
12. References
    - The reference material should include the author name, title, year. Do not mention the references of the websites in the report.
13. Appendices (if any)
    - Appendices are provided to give supplementary information, which is included in the main text may serve as a distraction and cloud the central theme. Appendices should be numbered using Arabic numerals, e.g. Appendix 1, Appendix 2, etc. Tables and References appearing in appendices should be numbered and referred to appropriate places just as in the case of chapters.

Page numbering: The preliminary parts (Acknowledgement, Executive Summary, Table of Contents, List of symbols, List of figures, List of tables) are numbered in roman numerals (i, ii, etc). The first page of the first chapter (Introduction) onwards will be numbered in Arabic numerals 1 2 3 etc at the bottom.

Figure and Table numbering: It is useful and convenient to number the figures also chapter-wise. The figures in chapter 4 will be numbered as Figure 4.1: Figure Name. This helps you in assembling the figures and putting it in proper order. Similarly, the tables are also numbered as Table 4.1: Table Name. All figures and tables should have proper captions. Usually the figure captions are written below the figure and table captions on top of the table.

Evaluation Scheme:
The marks should be evaluated by project teachers as well as other teachers in the related field on the basis of:

S.N.	Topic	Marks Distribution
1	Proposal Defense	10
2	Mid-term progress report/presentation	20
3	Final project report/presentation	70 (project coordinator =10 supervisor =20 external examiner =40)
	Total	**100**

Detailed evaluation scheme:

S.N.	Topic	Marks Distribution
1	Presentation skill	20%
2	Team work	10%
3	Understanding of project work and related theory	20%
4	Project demonstration	20%
5	Project Applications	10%
6	Documentation	20%
	Total	**100%**