No	Course Information (2019-2020)	
1	Unit name:	Computer Communication
2	Code:	EcE- 41002
3	Classification:	Engineering subject
4	Credit value:	3(2-1-1)
5	Semester/ Year Offered:	1/4
6	Pre-requisite:	Communication Principles, Analog and Digital Communication
7	Mode of delivery:	Lecture, Tutorial, Practical
8	Assessment system and breakdown of marks:	
	Practical	20%
	Tutorial	10%
	Mid-term/ final Examination	70%
9	Academic staff teaching unit:	
10	Course outcome of unit: After this course, students will be able 1. To identify the useful concepts of data communications 2. To describe the principles of data communications 3. To apply appropriate principles and techniques to solve problems in data communications 4. To identify the useful concepts of computer communications 5. To describe the principles of computer communications 6. To apply appropriate principles and techniques to solve problems in computer communications 7. To perform modulation and multiplexing using SystemView and simulate networks using packet tracer software	
11	Synopsis of unit: The course includes types of transmission media and signal encoding techniques. This course explains the fundamental techniques common to all data link control protocols, including flow control, error control and the most commonly used protocol, HDLC. This course describes the three most common types of multiplexing techniques. The course is to apply the switching techniques by the collective behavior	

	of the set of switches that make up a network. This course discusses the common routing algorithms used both in switched data networks, such as frame relay and ATM, and in the Internet. This course explains the important design issues related to cellular wireless networks. This course provides the topologies, transmission media, and MAC protocols of the most important LAN systems in current use and an overview wireless LAN technology and applications.
	Topic: **Chapter** **Title** 4 **Transmission Media** 4.1 Guided Transmission Media 4.2 Wireless Transmission 4.3 Wireless Propagation 4.4 Line-of-Sight Transmission 4.5 Recommended Reading and Web Sites 4.6 Key Terms, Review Questions, and Problems **5** **Signal Encoding Techniques** 5.1 Digital Data, Digital Signals 5.2 Digital Data, Analog Signals 5.3 Analog Data, Digital Signals 5.4 Analog Data, Analog Signals 5.5 Recommended Reading 5.6 Key Terms, Review Questions, and Problems **7** **Data Link Control Protocols** 7.1 Flow Control 7.2 Error Control 7.3 High-Level Data Link Control (HDLC) 7.4 Recommended Reading 7.5 Key Terms, Review Questions, and Problems **8** **Multiplexing** 8.1 Frequency-Division Multiplexing

		8.2 Synchronous Time-Division Multiplexing 8.3 Statistical Time-Division Multiplexing 8.4 Asymmetric Digital Subscriber Line 8.5 xDSL 8.6 Recommended Reading and Web Sites 8.7 Key Terms, Review Questions, and Problems
	10	**Circuit Switching and Packet Switching** 10.1 Switched Communications Networks 10.2 Circuit Switching Networks 10.3 Circuit Switching Concepts 10.4 Softswitch Architecture 10.5 Packet-Switching Principles 10.6 X.25 10.7 Frame Relay 10.8 Recommended Reading and Web Sites 10.9 Key Terms, Review Questions, and Problems
	12	**Routing in Switched Networks** 12.1 Routing in Packet-Switching Networks 12.2 Examples: Routing in ARPANET 12.3 Least-Cost Algorithms 12.4 Recommended Reading 12.5 Key Terms, Review Questions, and Problems
	14	**Cellular Wireless Networks** 14.1 Principles of Cellular Networks 14.2 First Generation Analog 14.3 Second Generation CDMA 14.4 Third Generation Systems 14.5 Recommended Reading and Web Sites 14.6 Key Terms, Review Questions, and Problems

	16	**High-Speed LANs** 16.1 The Emergence of High-Speed LANs 16.2 Ethernet 16.3 Fibre Channel 16.4 Recommended Reading and Web Sites 16.5 Key Terms, Review Questions, and Problems
	17	**Wireless LANs** 17.1 Overview 17.2 Wireless LAN Technology 17.3 IEEE 802.11 Architecture and Services 17.4 IEEE 802.11 Medium Access Control 17.5 IEEE 802.11Physical Layer 17.6 IEEE 802.11 Security Considerations 17.7 Recommended Reading and Web Sites 17.8 Key Terms, Review Questions, and Problems
14	**Main references:** Data and Computer Communications, Eight Edition, William Stallings, Upper Saddle River, New Jersey 07458. Wireless Local Area Networks, Bing, B., New York: Wiley, 2002 IP Routing Protocols: RIP, OSPF, BGP, PNNI & Cisco Routing Protocols, Black, U. Upper Saddle River, NJ: Prentice Hall, 2000.	
15	Additional references: https://store.elsevier.com/Computer-organization-and-design/David.Patter/isbn-9780080502571 https://books.google.com.mm/books?	

No	Course Information	
1	Unit name:	Computer Communication I
2	Code:	EcE- 41002
3	Classification:	Engineering subject
4	Credit value:	3(2-1-1)
5	Semester/ Year Offered:	1/4
6	Pre-requisite:	Communication Principles, Analog and Digital Communication
7	Mode of delivery:	Lecture, Tutorial, Practical
8	Assessment system and breakdown of marks:	
	Practical	20%
	Tutorial	10%
	Mid-term/ final Examination	70%
9	Academic staff teaching unit:	
10	Course outcome of unit: After this course, students will be able 1. To identify the useful concepts of data communications 2. To describe the principles of data communications 3. To apply appropriate principle and techniques to solve problems in data communications 4. To perform modulation and multiplexing using SystemView software	
11	Synopsis of unit: The course includes types of transmission media and signal encoding techniques. This course explains the fundamental techniques common to all data link control protocols, including flow control, error control and the most commonly used protocol, HDLC. This course describes the three most common types of multiplexing techniques.	
	Topic: **Chapter** **Title** 4 **Transmission Media**	

		4.1 Guided Transmission Media 4.2 Wireless Transmission 4.3 Wireless Propagation 4.4 Line-of-Sight Transmission 4.5 Recommended Reading and Web Sites 4.6 Key Terms, Review Questions, and Problems
	5	**Signal Encoding Techniques** 5.1 Digital Data, Digital Signals 5.2 Digital Data, Analog Signals 5.3 Analog Data, Digital Signals 5.4 Analog Data, Analog Signals 5.5 Recommended Reading 5.6 Key Terms, Review Questions, and Problems
	7	**Data Link Control Protocols** 7.1 Flow Control 7.2 Error Control 7.3 High-Level Data Link Control (HDLC) 7.4 Recommended Reading 7.5 Key Terms, Review Questions, and Problems
	8	**Multiplexing** 8.1 Frequency-Division Multiplexing 8.2 Synchronous Time-Division Multiplexing 8.3 Statistical Time-Division Multiplexing 8.4 Asymmetric Digital Subscriber Line 8.5 xDSL 8.6 Recommended Reading and Web Sites 8.7 Key Terms, Review Questions, and Problems
14	**Main references:** Data and Computer Communications, Eight Edition, William Stallings, Upper Saddle River, New Jersey 07458.	

	Wireless Local Area Networks, Bing, B., New York: Wiley, 2002 IP Routing Protocols: RIP, OSPF, BGP, PNNI & Cisco Routing Protocols, Black, U. Upper Saddle River, NJ: Prentice Hall, 2000.
15	Additional references: https://store.elsevier.com/Computer-organization-and-design/David.Patter/isbn-9780080502571 https://books.google.com.mm/books?

Information on Lab Practical (Computer Communication I) 2019-2020

Lab	Activity
1	**Experiment I: Amplitude Modulation** **Objectives:** ➢ To generate the amplitude modulated signal (AM wave) **Equipment Required:** ➢ Computer, SystemView software
2	**Experiment II: Frequency Modulation** **Objectives:** ➢ To generate frequency modulated signal **Equipment Required:** ➢ Computer, SystemView software
3	**Experiment III: Amplitude Shift Keying (ASK)** **Objectives:** ➢ To generate ASK signal **Equipment Required:** ➢ Computer, SystemView software
4	**Experiment IV: Frequency Shift Keying (FSK)** **Objectives:** ➢ To generate FSK signal **Equipment Required:** ➢ Computer, SystemView software
5	**Experiment V: Time Division Multiplexing** **Objectives:** ➢ To perform the Time Division Multiplexing **Equipment Required:** ➢ Computer, SystemView software

Information on Lab Practical (Computer Communication II) 2019-2020

Lab	Activity
1	**Experiment VI: Configuration of a LAN** **Objectives:** ➢ To connect a wired LAN according to a given topology ➢ To test and verify configuration using packet tracer software **Equipment Required:** ➢ Computers, switches, twisted pair cables (UTP), Packet tracer software
2	**Experiment VII: Configuration of Wired and Wireless network** **Objectives:** ➢ To be able to configure wired and wireless network **Equipment Required:** ➢ Computers, switch, wireless router, wireless devices, network cables, Packet tracer software
3	**Experiment VIII: Configuration of VLAN** **Objectives:** ➢ To install and configure VLAN network **Equipment Required:** ➢ Computers, Network cables (UTP), Switches, Packet tracer software
4	**Experiment IX: Configuration of DHCP Service for Different Networks** **Objectives:** ➢ To assign IP addresses using DHCP **Equipment Required:** ➢ Computers, Switches, Router, Network cables, Packet tracer software
5	**Experiment X: Configuration of a Routed Network** **Objectives:** ➢ To install and configure a routed network **Equipment Required:** ➢ Computers, Network cables (UTP), Switches, Router, Packet tracer software

No	Course Information (2019-2020)	
1	Unit name:	Modern Control System
2	Code:	EcE – 41003
3	Classification:	Engineering subject
4	Credit value:	3 (2-1-1)
5	Semester/ Year Offered:	1/4
6	Pre-requisite:	Fundamental of Electronic Circuits, Electronic Engineering Circuits, Microelectronics, Digital Electronics, Modeling and Control, Integrated Electronics
7	Mode of delivery:	Lecture, Practical, tutorial
8	Assessment system and breakdown of marks:	
	Tutorial	10%
	Practical	20%
	Mid-term/ final Examination	70%
9	Academic staff teaching unit:	Electronic Engineering
10	Course outcome of unit: In this course students will be able ➢ To identify powerful basic concepts of modern control system ➢ To design controllers to meet desired specifications using root locus method, frequency response method ➢ To simulate performance of feedback control system by using MATLAB and simulation of PID control by using Simulink software	
11	Synopsis of unit: The course covers the techniques of analysis of linear control system and control design. The course introduces students to apply the root locus method. In addition, the locus of roots in the s-plane can be determined by a graphical method, the roots of the characteristics equation move around the s-plane by changing one parameter. Frequency response method, the polar plot of the frequency response of a system, stability in the frequency domain, stability considerations using Nyquist diagram, design using compensation networks and optimization, the bode diagram of a transfer function, the design of feedback control systems, and the design of state	

	variable feedback systems will be learned.
	Topic: **Chapter Title** **7. The Root locus Method** 7.1 Introduction 7.2 The Root Locus Concept 7.3 The Root Locus Procedure 7.4 Parameter design by the Root locus Method 7.5 Sensitivity and the Root locus 7.6 PID Controllers 7.7 Laser Manipulator Control System 7.8 The Design of a Robot Control System 7.8.1 The Root locus Using MATLAB 7.9 Disk Drive Read System 7.10 Summary **8. Frequency Response Methods** 8.1 Introduction 8.2 Frequency Response Plot 8.3 An Example of Drawing the Bode Diagram 8.4 Frequency Response Measurements 8.5 Performance Specifications in the Frequency Domain 8.6 Log Magnitude and Phase Diagram 8.7 Engraving Machine Control System 8.8 Frequency response Methods using MATLAB 8.9 Disk Drive read System 8.10 Summary
14	Main references: Modern Control Systems, 12th Edition, Richard C. Dorf, Robert H. Bishop
15	Additional references: Note by Modern Control Systems, 11st Edition, Richard C. Dorf, Robert H. Bishop, Prentice-Hall, Upper Saddle…., (http://www.Mypearsonstore.com>bookstore) Modern Control Engineering,5th edition 2010, Ogata, Katsuhiko, by Prentice-Hall, Inc

Information on Lab Practical (EcE-41003 Modern Control System)

Lab	Activities
1	**Experiment I**: **The Root Locus using Control Design Software** **Objectives**: • To design controllers to meet desired specifications using root locus method, frequency response method • To simulate performance of feedback control system and simulation of PID control by using MATLAB/Simulink software **Equipment required:** ▪ MATLAB software, Personal computer
2	**Experiment II**: **PID Control System for a DC Motor** **Objectives**: • To simulate performance of feedback control system and simulation of PID control by using MATLAB/Simulink software **Equipment required:** • MATLAB software, Personal computer
3	**Experiment III: Polar Plot by using MATLAB** **Objectives:** • To design controllers to meet desired specifications using root locus method, frequency response method • To simulate performance of feedback control system and simulation of PID control by using MATLAB/Simulink software **Equipment required:** • MATLAB software, Personal computer

4	**Experiment IV**: **Stability analysis with Polar Plot using MATLAB** **Objectives**: • To design controllers to meet desired specifications using root locus method, frequency response method • To simulate performance of feedback control system and simulation of PID control by using MATLAB/Simulink software **Equipment required:** • MATLAB Software, Personal computer
5	**Experiment V**: **Stability analysis with bode diagram by using MATLAB** **Objectives**: • To design controllers to meet desired specifications using root locus method, frequency response method • To simulate performance of feedback control system and simulation of PID control by using MATLAB/Simulink software **Equipment required:** • MATLAB software, Personal computer

No	Course Information (2019-2020)	
1	Unit name:	Digital Design with HDL
2	Code:	EcE 41021
3	Classification:	Engineering subject
4	Credit value:	3
5	Semester/ Year Offered:	1/4
6	Pre-requisite:	EcE 21021 & 22021 Digital Electronic EcE 21014 & 22014 Technical Programming
7	Mode of delivery:	Presentation, computer application
8	Assessment system and breakdown of marks:	Tutorial, Lab report
	Assignment / Tutorial	10%
	Lab Report	20 %
	Exam Q & A	70%
9	Academic staff teaching unit:	Department of Electronic Engineering
10	Course outcome of unit: After completion of this course, students will be able to 1. Describe the configuration of logic circuits, the design process for digital hardware implementation and implementation technology for CPLD and FPGA 2. Examine the various logic circuit problems and the number representation problems (by applying the Boolean Algebra, Karnaugh Map and signed number and unsigned number representation) 3. Design the digital circuits by using logic gates or blocks or VHDL code 4. Investigate VHDL code and operations of digital circuits using Quartus II software and DE2-115 FPGA Board and analyze the results with the digital waveforms	
11	Synopsis of unit: This course provides a systematic introduction to the topic of VHDL programming for designing embedded digital system .It emphasizes the basic ideas of design concepts of digital hardware and the practical aspects of implementing technology for CPLD and FPGA devices. It also presents the optimized implementation of logic circuit, arithmetic circuit and combinational circuit, synchronize and asynchronize circuit using VHDL code. Digital systems are also designed by using building blocks and clock synchronization. In addition , this course includes the data flow Design Concepts, Introduction to Logic	

	Circuit, Implementation Technology, Optimized Implementation of Logic Function, Number Representation and Arithmetic Circuits, Combinational – Circuit Building Blocks, Flip-Flops, Registers, Counters, Simple Processors, Synchronous and Asynchronous Sequential Circuits and Digital System Design.
12	Topic: **Chapter 1 Design Concepts** 1.1 Digital Hardware 1.2 The Design Process 1.3 Design of Digital Hardware 1.4 Logic Circuit Design in This Book 1.5 Theory and Practice 1.6 Binary Numbers **Chapter 2 Introduction to Logic Circuits** 2.1 Variables and Functions 2.2 Inversion 2.3 Truth Tables 2.4 Logic Gates and Networks 2.5 Boolean Algebra 2.6 Synthesis Using AND, OR, and NOT Gates 2.7 NANDand NOR Logic Networks 2.8 Design Examples 2.9 Introduction to CADTools 2.10 Introduction to VHDL **Chapter 3 Implementation Technology** 3.1 Transistor Switches 3.2 NMOS Logic Gates 3.3 CMOS Logic Gates 3.4 Negative Logic System 3.5 Standard Chips 3.6 Programmable Logic Devices 3.7 Custom Chips, Standard Cells, and Gate Arrays 3.8 Practical Aspects 3.9 Transmission Gates

	3.10 Implementation Details for SPLDs, CPLDs, and FPGAs **Chapter 4 Optimized Implementation of Logic Functions** 4.1 Karnaugh Map 4.2 Strategy for Minimization 4.3 Minimization of Product-of-Sums Forms 4.4 Incompletely Specified Functions 4.5 Multiple-Output Circuits 4.6 Multilevel Synthesis 4.7 Analysis of Multilevel Circuits 4.8 Cubical Representation 4.9 A Tabular Method for Minimization 4.10 A Cubical Technique for Minimization 4.11 Practical Considerations 4.12 Examples of Circuits Synthesized from VHDL Code **Chapter 5 Number Representation and Arithmetic Circuits** 5.1 Number Representations in Digital 5.2 Addition of Unsigned Numbers 5.3 Signed Numbers 5.4 Fast 5.5 Design of Arithmetic Circuits Using CAD Tools 5.6 Multiplication 5.9 Examples of Solved Problems Problems **Chapter 6 Combinational-Circuit Building Blocks** 6.1 Multiplexers 6.2 Decoders 6.3 Encoders 6.4 Code Converters 6.5 Arithmetic Comparison Circuits 6.6 VHDL for Combinational Circuits 6.7 Concluding Remarks 6.8 Examples of Solved Problems

14	Main reference: 1. VHDL Programming by Example, Douglas L. Perry, 4th Edition 2. Fundamentals of Digital Logic with VHDL Design 3. http://www.fpga4students.com
15	Additional references: 1. Digital System Design using VHDL, 2. http://www.freebookcentre.net/electronics-ebooks-download/VHDL-Language-Guide.html

Information on Practical (Digital Design with HDL)

Lab	Activity
1	**Topic**: **Logic Gates** **Objectives:** i. To apply the logic gate operations ii. To design the VHDL codes for logic gates **Resources**: i. Quartus II Software ii. DE2-115 or DE1 FPGA Education and Development Kit iii. Personal Computer
2	**Topic**: **Lighting Control System** **Objectives:** i. To design the lighting control system ii. To design of the VHDL codes iii. To analyze the operation of this system with timing diagram **Resources**: i. Quartus II Software ii. DE2-115 or DE1 FPGA Education and Development Kit iii. Personal Computer
3	**Topic**: **Four Inputs Control System** **Objectives:** i. To design the control system with various inputs ii. To design the VHDL code for this control system iii. To analyze the system operation with timing diagram **Resources**: i. Quartus II Software ii. DE2-115 or DE1 FPGA Education and Development Kit iii. Personal Computer

4	**Topic**: **Half Adder** **Objectives:** i. To test the operation of half adder logic circuit ii. To design the VHDL code for half adder circuit iii. To analyze the operation of the half adder circuit **Resources**: i. Quartus II Software ii. DE2-115 FPGA or DE1 Education and Development Kit iii. Personal Computer
5	**Topic**: **Full Adder** **Objectives:** i. To test the operation of full adder logic circuit ii. To design the VHDL code for full adder circuit iii. To analyze the operation of the full adder circuit **Resources**: iv. Quartus II Software v. DE2-115 or DE1 FPGA Education and Development Kit vi. Personal Computer

Approved By

Prepared By
Dr. San San Naing
Lecturer
Department of Electronic Engineering

No	Course Information (2019-2020)	
1	Unit name:	Computer Science
2	Code:	EcE-41024
3	Classification:	Engineering subject
4	Credit value:	3(2-0-2)
5	Semester/ Year Offered:	1/4
6	Pre-requisite:	NA
7	Mode of delivery:	Lecture, Tutorial, Practical
8	Assessment system and breakdown of marks:	Practical, Tutorial
	Practical	20%
	Tutorial	10%
	Mid-term/ final Examination	70%
9	Academic staff teaching unit:	Department of Electronic Engineering
10	Course outcome of unit: After this course, students will be able CO1. To explain the structure of the computer system. CO2. To write the programs using decision making and looping statements, functions, arrays, strings, pointers and file with C programming languages CO3. To write the C programs using simple class, arrays, overloading operators, drives class, pointers, friend functions and file in OOP programming languages CO4. To write the C programs using Turbo C++ software	
	Synopsis of unit: The course introduces students to the study of computer system and programming language. Course covers the various structures and statements in the programming language. The course is designed to familiarize the student with C programming language. Computer Science is a comprehensive course in electrical engineering and can be applied in the field of industrial control, communication and any other various applications.	
	Topic: **Chapter Title** **1. Computer Science**	

		1.1 Computer in Your World
		1.2 The Central Processing Unit (CPU)
		1.3 Data Representation
		1.4 Input and Output
		1.5 Secondary Storage and File Organization
	1.	**Logic Description in Pseudo Code**
		1.1 Introduction
		1.2 Problem Solving and the Computer
		1.3 Pseudo-code in Use
		1.4 Symbols of Flowchart
		1.5 Type of Data
		1.6 Operators
	2.	**Control Structures**
		2.1 Control Structures
		2.2 Sequence Logic
		2.3 Selection Logic
		2.4 Iteration Logic
	3.	**Sub-Algorithm**
		3.1 Introduction
		3.2 Function Sub-Algorithm
		3.3 Procedure Sub-Algorithm
	4.	**Introduction to Turbo C Programming**
		4.1 What is computer Programming
		4.2 Starting Turbo C
		4.3 Turbo Editor Commands
	5.	**Elementary C**
		5.1 Program Layout
		5.2 Data Types
		5.3 Operators
		5.4 Name
	6.	**Standard Header File and their Functions**
		6.1 Basic I/O Header File
		6.2 Standard I/O Header File

	6.3	Console I/O Header File
	6.4	Standard Library Header File
	6.5	Character Type Header File
	6.6	Mathematical Header File
7.	**Conditional Branching Statements**	
	7.1	Types of Conditional Branching Statements
	7.2	The 'if ' Statement
	7.3	The "if-else " Statements
	7.4	The "if-else-if " Statements
	7.5	The "switch" Statements
	7.6	Multiple Conditions
8.	**Iteration (looping) Statements**	
	8.1	Types of Iteration (looping) Statements
	8.2	For Loop
	8.3	While Loop
	8.4	Do - While Loop
	8.5	Nested Loop
	8.6	Existing from loops
9.	**Functions**	
	9.1	Introduction
	9.2	Function Declarations
	9.3	Function Definitions
	9.4	Scope
	9.5	Reference
10.	**Arrays, Pointer and String**	
	10.1	Array
	10.2	Pointer
	10.3	Dynamics Arrays
	10.4	Sorting
	10.5	Searching
11.	**Format File**	
	1.1	File Declaration
	1.2	File Opening

		1.3 Writing to the File
		1.4 Reading from the File
		1.5 File Closing
		1.6 Format File Creating
		1.7 Accessing File
	1.	**Introduction**
		1.1 Advantages of OOP
		1.2 Software and Hardware Requirements
	2.	**Objects and Classes**
		2.1 A Simple Class
		2.2 Constructors and Destructors
	3.	**Arrays and Strings**
		3.1 Arrays as Class Member Data
		3.2 Arrays of Objects
		3.3 Strings
		3.4 Arrays of Strings
	4.	**Operator Overloading and Data Type Conversion**
		4.1 Overloading Unary Operators
		4.2 Overloading Binary Operators
		4.3 Data Type Conversion
	5.	**Inheritance**
		5.1 Drives Class Constructors
		5.2 Overriding Member Functions
		5.3 Class Hierarchies
	6.	**Pointers**
		6.1 Pointers to Objects
		6.2 An Array of Pointers to Objects
		6.3 Linked List using Pointers
		6.4 Pointers to Pointers
	7.	**Virtual and Friend functions**
		7.1 Virtual Functions
		7.2 Pure Virtual Functions
		7.3 Friend Functions

	7.4 Friend Classes **8. File and Streams** 8.1 Object Input / Output
14	Main references: Programming and problem solving Using C,instructional software research and development(ISRD Group),Application Programming in ANSI C, third edition, Richard Johnsonbaugh & Martin Kalin at library.
15	Additional references: http:// www.cms.montgomery college .edu/…/computing, http://www.web.cerritos.edu/…/cis https://www.cs.auckland.ac.nz/.../L12.pdf,https://www.universityefcalicut.info/../BscC.Science.pdf

Information on Lab Practical (2019-2020)

Lab	Activity
1	Topic : Conditional Branching Statements Outcomes: ➢ To write the C program using conditional branching statements Resources: Turbo C++ Software, PC
2	Topic : Looping statement Outcomes: ➢ To write the C program using the looping statements Resources: Turbo C++ Software, PC
3	Topic : Function Outcomes: ➢ To write the C program using functions Resources: Turbo C++ Software, PC
4	Topic : Array Outcomes: ➢ To write C program using array Resources: Turbo C++ Software, PC
5	Topic : File Outcomes: ➢ To write C program using file Resources: Turbo C++ Software, PC
6	Topic : Array and Pointer Outcomes: ➢ To write C++ program using array Resources: Turbo C Software, PC
7	Topic : Overloaded Operator Outcomes: ➢ To write C++ program using overloaded operators Resources: Turbo C++ Software, PC
8	Topic : Derived Class Function Outcomes: ➢ To write C++ program using derived class Resources: Turbo C Software, PC

9	Topic : Pointer Outcomes: ➢ To write C++ program using pointers Resources: Turbo C Software, PC
10	Topic : Friend Function and File Outcomes: ➢ To write C++ program using friend function ➢ To write C++ program using files Resources: Turbo C Software, PC

Daw Khin San

ကထိက၊ ECဌာန

NO	Course Information (2019-2020)	
1	Unite name	Industrial Electronics and Control I
2	Code	EcE-41031
3	Classification:	Engineering Subject
4	Credit value	3 (2-0-2)
5	Semester/ Year Offered	1/4
6	Pre-requisite:	Fundamental of Electronic Circuits, Electronic Engineering Circuits, Microelectronics, Integrated Electronics
7	Method of Delivery	Lecture, Discussion, demonstration
8	Assessment System and Breakdown of Marks:	Tutorial, Assignment, Lab report
	Tutorial and Assignment	10%
	Lab Report	20%
	Mid-term Examination	70%
9	Academic Staff: teaching unit:	Department of Electronic Engineering
10	Course outcome of unit: After completion of this course, students will be able to: 1. describe basic operation and compare performance of various semiconductor devices, passive components and switching circuits 2. determine the power circuit configuration needed to fulfill the required power conversion with applicable constraints 3. design and analyze power converter circuits by selecting the appropriate power semiconductor devices for the required application 4. design the control circuits and power circuits for a given power converter for the required application 5. perform the basic electronics troubleshooting by using tools/test equipment to analyze electronic components 6. develop skills to build and troubleshoot power electronics circuits	
	Synopsis of unit: The course covers the power electronics devices with their operation and applications. The course introduces to the students to the types of Thyristor, SCR, its terminology, turning ON and OFF of SCR, triggering SCR, forced commutation methods, characteristic and SCR operation, line commutation methods, Triacs, Diacs, Quadracs, Power diodes, Power transistor , Power MOSFET, IGBT, unijunction transistor. And heating and welding control, induction heating, dielectric heating and welding. And the next introduces to the students to the types of inverters, dual converters, choppers, cycloconverters, and motor control methods.	

12	Topic: 5. **Thyristors** 5.1 Introduction 5.2 Silicon Controlled Rectifier 5.2.1 Constructional features 5.2.2 Theory of operation of SCR with two transistor anology 5.2.3 Physical operation of SCR 5.3 SCR Terminology 5.3.1 Forward breakover voltage or forward breakdown voltage 5.3.2 Reverse breakdown voltage 5.3.3 ON – state voltage 5.3.4 Finger voltage 5.3.5 Average ON – state current 5.3.6 Holding current 5.3.7 Latching current 5.3.8 Forward current rating 5.3.9 Gate triggering current 5.3.11 Turn – on time 5.3.12 Turn – off time 5.4 Different Methods of Turning on of SCRs 5.4.1 Radiation triggering or light turn – on 5.4.2 Voltage triggering or breakover voltage turn – on 5.4.3 dv/dt turn – on 5.4.4 Gate turn – on or gate triggering 5.5 Different Methods of Turning off of SCRs 5.5.1 Natural commutation 5.5.2 Forced commutation 5.5.3 Gate turn – off 5.6 Different Methods of Triggering SCR Circuits 5.6.1 Pulse control by R – C network 5.6.2 Pulse triggering by saturable reactor 5.6.3 Composite triggering by PWM controller 5.6.4 Pulse triggering by discrete transistors 5.7 Different methods of Forced Commutation 5.7.1 Class A commutation (Series resonant commutation by an LC circuit) 5.7.2 Class B commutation (Parallel resonant commutation by an LC circuit) 5.7.3 Class C commutation (Complementary commutation or parallel capacitor turn – off) 5.7.4 Class D commutation (Auxiliary commutation) 5.7.5 Class E commutation (External pulse commutation) 5.7.6 Class F commutation (AC line commutation) 5.8 Comparison of SCRs and Transistors 5.9 Thermal Characteristics of SCRs 5.10 Causes of Damage to SCR 5.10.1 Preventing damage to SCRs 5.11 The SCR Crower or Overvoltage Protection Circuit 5.12 Series and Parallel Operation of SCRs 5.12.1 Series connected SCRs 5.12.2 Triggering of series connected SCRs 5.12.3 Parallel connection SCRs 5.12.4 Triggering of parallel connected SCRs 5.13 Line – commutated Converters or Rectifier Circuits

5.13.1 Half – wave rectifier (inductive load)
5.13.2 Half – wave rectifier (resistive load)
5.13.3 Full – wave control circuit
5.13.4 Single – phase full – wave controlled rectifier using center – tap transformer (M – 2 connection)
5.13.5 Single – phase bridge rectifier
5.13.6 Single – phase full – wave full – controlled bridge rectifier (B – 2 connection)
5.13.7 Single – phase full – wave half – controlled bridge rectifier (B – 2 connection)
5.13.8 Three – phase full – wave rectifier (M – 6 connection or six – pulse double – star circuit)
5.13.9 Three – phase full – wave full – controlled bridge rectifier (B – 6 connection)
5.13.10 Three – phase full – wave half – controlled bridge rectifier (B – 6 connection)
5.13.11 Three – phase half – wave diode rectifier with resistive load
5.13.12 Differences between full – controlled bridge and half – controlled bridge rectifiers

5.14 TRIACS
5.14.1 Gate triggering modes of the Triac
5.14.2 Choice between triacs and SCRs
5.14.3 Comparison of triacs with antiparallel SCRs
5.15 DIACS
5.16 QUADRACS
5.17 Recovery Characteristic
5.18 First Recovery Diodes
5.19 Power Diodes
5.19.1 Current ratings of power diodes
5.19.2 Voltage rating of power diodes
5.19.3 Protection of the power diode (Snubber circuit)
5.20 Power Transistors or Power BJTs
5.20.1 Snubber circuit (Switching – aid circuit) of the power BJT
5.20.2 Switching characteristic of the power transistor
5.21 Power MOSFETS
5.21.1 Snubber circuit (Switching – aid circuit) of the power MOSFET
5.21.2 Switching characteristics of the power MOSFET
5.22 Insulated Gate Bipolar Transistor (IGBT)
5.23 Loss of Power in Semiconductor Devices
5.24 Comparison between Power MOSFET, Power Transistor, and Power IGBT
5.25 Unijunction Transistor
5.26 Electron Tubes
5.26.1 Gas – filled diode
5.26.2 Thyratrons
5.26.3 Ignitron (Mercury – pool tube)

6 Inverters, Dual Converters, Choppers and Cycloconverters

6.1 Inverters
6.2 Line – commutated Inverters
6.2.1 Single – phase line – commutated full – controlled inverter
6.2.2 Three – phase line – commutated full – controlled inverter or six – pulse converter

6.3 Forced – commutated Inverters
- 6.3.1 Single – phase parallel – capacitor commutated inverter (Resistive load)
- 6.3.2 Single – phase parallel – inverter with feedback diodes
- 6.3.3 Single – phase series inverter

6.4 Voltage – source Inverter

6.5 Current – source Inverter
- 6.5.1 Differences between voltage – source and current – source inverters

6.6 Three – phase Forced – commutated Bridge Inverters

6.8 Dual Converters
- 6.8.1 The phase – controlled dual converter
- 6.8.2 Single – phase dual converter
- 6.8.3 Types of three – phase dual converters
- 6.8.4 Circulating current type dual converter (Mid – point configuration)
- 6.8.5 Circulating current type dual converter (Dual – bridge configuration)
- 6.8.6 The circulating current – free type or non – circulating type dual converter
- 6.8.7 Different configurations used for dual converters

6.9 Choppers
- 6.9.1 Principle of operation
- 6.9.2 Chopper control technique
- 6.9.3 Voltage step – down chopper
- 6.9.4 Voltage step – up chopper
- 6.9.5 Jones chopper
- 6.9.6 Two – quadrant chopper or reversible chopper
- 6.9.7 AC chopper

6.10 Cycloconverters
- 6.10.1 Types of cycloconverters
- 6.10.2 Single–phase/single–phase cycloconverter (Mid–point configuration)
- 6.10.3 Single–phase/single–phase cycloconverter (Bridge configuration)
- 6.10.4 Three – phase/single – phase cycloconverter
- 6.10.5 Types of three – phase/single – phase cycloconverters
- 6.10.6 Three – phase/single – phase cycloconverter (Circulating current type)
- 6.10.7 Three–phase/single–phase cycloconverter (Non – circulating current type)
- 6.10.8 Three – phase/three – phase cycloconverter

8 Heating and Welding Control

8.1 Introduction
- 8.1.1 Advantages of electrical heating

8.2 Induction Heating
- 8.2.1 Theory of induction heating
- 8.2.2 Principle of induction heating
- 8.2.3 Effects of supply frequency on induction heating
- 8.2.4 Effects of source voltage on induction heating
- 8.2.5 Choice of frequency for induction heating
- 8.2.6 Advantages of induction heating
- 8.2.7 Application of induction heating

	8.2.8 Surface hardening of steel or surface heating of a small cylindrical rod 8.2.9 Source of high frequency power supply for induction heating 8.3 Dielectric Heating 8.3.1 Electronic theory of dielectric heating 8.3.2 Principle of operation of dielectric heating 8.3.3 Dielectric heating in materials of irregular shapes 8.3.4 Limitations of the use of extremely high frequency for dielectric heating 8.3.5 Effect of vibration of voltage of the power supply on dielectric heating 8.3.6 Effect of vibration of frequency of the power supply on dielectric heating 8.3.7 Applications of dielectric heating 8.3.8 Source of high frequency power supply for dielectric heating 8.3.9 Differences between induction heating and dielectric heating 8.4 Welding 8.4.1 Theory of resistance welding 8.4.2 Classification of resistance welding 8.5 Scheme for AC Resistance Welding 8.6 Ignitron Contractor as Electronic Line Contractor 8.6.1 Heat control by the change of firing angles in ignitrons 8.6.2 Complete control in resistance welding by a sequence timer
13	**Main References:** Biswanath Paul, "Industrial Electronics and Control including Programmable Logic Controller," 3rd Edition, PHI learning Private Limited, Delhi-110092, 2014
14	**Additional references:**

Lab	**Information on Practical (Industrial Electronics and control)**
1	**Topic**: **Half wave rectifier (resistive load)** **Task**: • To **explian** the operation of an SCR connected as a gate-controlled ac rectifier • To **observe** the effects of varying gate current on the firing point of an

	SCR connected as an ac rectifier **Resources**: Multisim Software
2	**Topic**: **SINGLE PHASE FULL-WAVE CONVERTER** **Task**: • To **observe** the phase relations between the voltage waveforms in a single phase full-wave supply • To **observe** the load waveforms and their phase in a single phase full-wave rectifier with resistive load **Resources**: Multisim Software
3	**Topic**: **DC to DC Converter** **Task**: • To test DC to DC Converter Circuit **Resources**: Panel NO: P21 (Trainer)
4	**Topic**: **Light Dimmer Circuit using DIAC and SCR** **Task**: • To explain the operation of DIAC and SCR phase control • To control the lamp for arbitrary of light • To construct the **Light Dimmer Circuit using DIAC and SCR** **Resources:** Hardware • DIAC, SCR, Resistors, Capacitors, project Board, Printed circuit board, Connection wire, 9V Battery.
5	**Topic**: **DC motor control with SCR** **Task**: • To explain the operation of an SCR automatic-speed-control (ASC) circuit • To learn how the speed and direction of rotation of a dc motor may be controlled • To become familiar with some industrial control circuit schematic symbols and typical control circuits • To demonstrate the operation of a dc shunt motor **Resources:** Hardware • BT06 SCR, Resistors, Switch, project Board, Printed circuit board, Connection wire, 9V Battery and DC motor.