VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

Scheme of Teaching and Examination and Syllabus
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
V SEMESER

(Effective from Academic year 2015-16)

BOARD OF STUDIES IN ELECTRICAL AND ELECTRONICS ENGINEERING

July 2017

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

SCHEME OF TEACHING AND EXAMINATION - 2015-16

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CHOICE BASED CREDIT SYSTEM (CBCS)

V SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ES51	Core Subject	Management and Entrepreneurship	EEE	04	--	03	80	20	100	4
2	15EE52	Core Subject	Microcontroller	EEE	04	--	03	80	20	100	4
3	15EE53	Core Subject	Power Electronics	EEE	04	--	03	80	20	100	4
4	15EE54	Core Subject	Signals and Systems	EEE	04	--	03	80	20	100	4
5	15EE55X	Professional Elective	Professional Elective – I	EEE	03	--	03	80	20	100	3
6	15EE56Y	Open Elective	Open Elective - I	EEE	03	--	03	80	20	100	3
7	15EEL57	Laboratory	Microcontroller Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	80	20	100	2
8	15EEL58	Laboratory	Power Electronics Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	80	20	100	2
			TOTAL		**Theory:24 hours Practical: 06 hours**		**24**	**160**	**640**	**800**	**26**

Elective

Professional Elective		**Open Elective*** Offered by the Department of Electrical and Electronics Engineering**	
Courses under Code 15EE55X	**Title**	**Courses under Code 15EE55X**	**Title**
15EE551	Introduction to Nuclear Power	15EE561	Electronic Communication systems
15EE552	Electrical Engineering Materials	15EE562	Programmable Logic controllers
15EE553	Estimating and Costing	15EE563	Renewable Energy Sources
15EE554	Special Electrical Machines	15EE564	Business Communication

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives). Selection of an open elective is not allowed provided;

- The candidate has pre – requisite knowledge.
- The candidate has not studied during I and II year of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters.

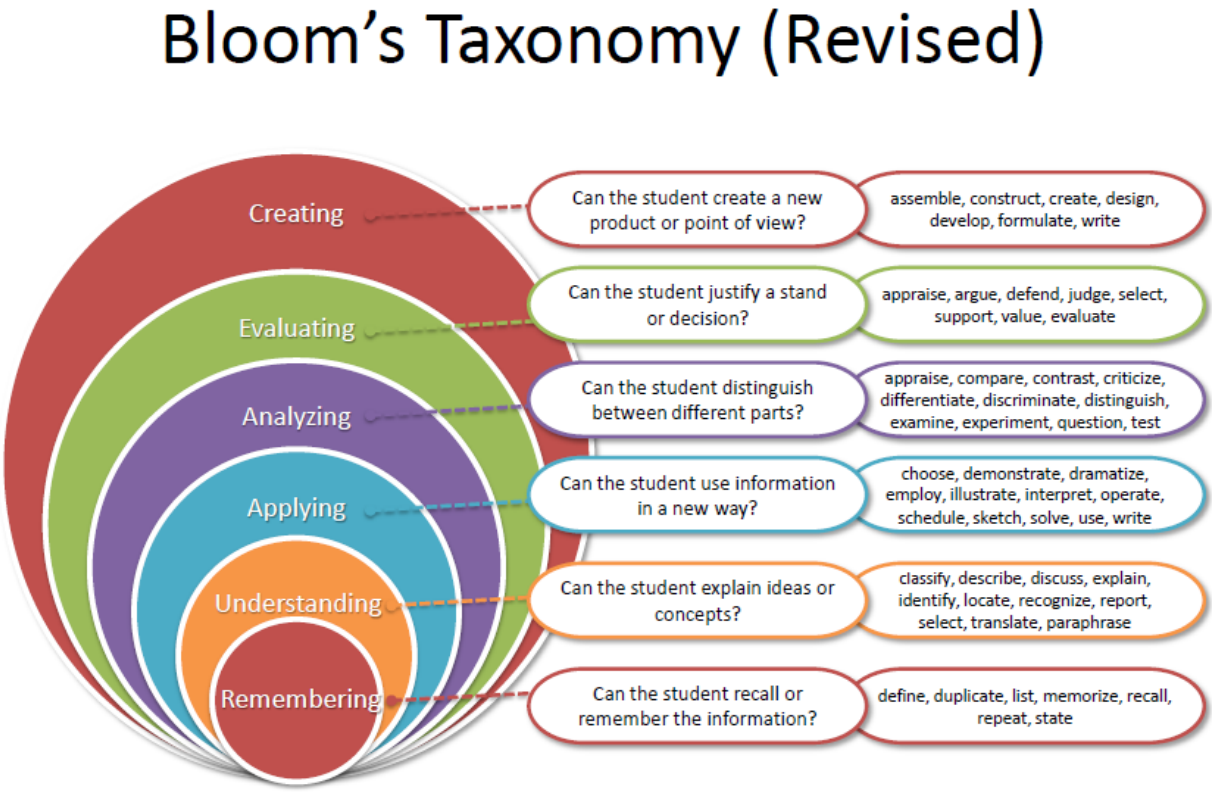
Registration to electives shall be documented under the guidance of Programme Coordinator and Adviser.

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Electives relevant to chosen specialization/ branch.

3. Open Elective: Electives from other technical and/ or emerging subject areas.

CATEGORIZATION FOR THE THINKING PROCESS



Bloom's Revised Taxonomy
Levels, Level Definitions and attributes levels
along with action verbs that can be used when developing learning outcomes.

	Level	Level Definitions and attributes	Verbs(not comprehensive)
Lower order thinking skills (LOTS)	Remembering (Knowledge) $L_1 - Rembr$	Students exhibit memory/rote memorization of previously learnt materials by recognition,recalling facts, terms, basic concepts, and simple answers. Able to remember, but not necessarily fully understanding the material.	Copy, Choose, Define, Discover, Describe, Duplicate, Enumerate, Find, How, Identify, Label, List, Locate, Listen, Memorize, Match, Name, Omit, Quote, Recall, Relate, Reproduce, Recognize, Select, Show, Spell, Tell, Tabulate, Who, When, Where etc.
	Understanding (Comprehension) $L_2 - Undrst$	Students demonstrate understanding of facts and ideas by interpreting, exemplifying, classifying, inferring, summarizing, comparing and explaining main ideas with own words.	Ask, Classify, Compare, Contrast, Demonstrate, Describe, Extend, Differentiate, Distinguish, Discuss, Express, Explain, Group, Illustrate, Infer, Interpret, Outline, Paraphrase, Rephrase, Relate, Show, Summarize, Select, Translate, Restate etc.
	Applying (Application) $L_3 - Apply$	Students solve problems in new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Build, Construct, Develop, Experiment With, Identify, Make Use Of, Organize, Plan, Select etc.
Higher order thinking skills (HOTS)	Analysing (Analysis) $L_4 - Anlyse$	Students are able to examine and break information into componentparts by identifying motives, causes arrangement, logic and semantics. They can make inferences and find evidence to support generalization.	Analyse, Assume, Break Down, Classify, Categorize, Conclusion, Compare, Contrast, Diagram, Discover, Dissect, Distinguish, Divide, Examine, Function, Illustrate, Inference, Inspect, List,Motive, Outline,Relationships, Simplify, Survey, Take Part In, Test For etc.
	Evaluating (Evaluation) $L_5 - Evlute$	Students are able to present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. They can justify a decision or course of action.	Agree, Appraise, Assess, Award, Build, Create, Compose, Choose, Compare, Conclude, Criteria, Criticize, Design, Derive, Develop, Decide, Deduct, Determine, Disprove, Defend, Estimate, Formulate, Generate, Invent, Modify, Evaluate, Explain, Influence, Judge, Interpret, Justify, Mark, Measure, Perceive, Rate, Prioritize, Recommend, Rule On, Select, Support, Value etc.
	Creating (Synthesis) $L_6 - Create$	Students are able to compile, generate or view information,ideas or products together in a different way by combining elements in a new pattern or by proposing alternative solutions. Also, use information to form a unique product. This requires creativity and originality.	Assemble, Adapt, Anticipate, Build, Change, Choose, Combine, Collaborate, Collect, Create, Compile, Compose, Construct, Delete, Design, Develop, Discuss, Develop, Devise, Elaborate, Estimate, Formulate, Happen, Hypothesize, Imagine, Improve, Invent, Imagine, Intervene, Make Up, Maximize, Modify, Originate, Plan, Predict, Propose, Rearrange, Solve, Suppose, Substitute, Test etc.

Graduate attributes: Graduate attributes are the qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. They are qualities that also prepare graduates as agents of social good in an unknown future.

Bowden, Hart, King, Trigwell& Watts (2000)

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER–V

MANAGEMENT AND ENTREPRENEURSHIP(Core Course)
(Common to EC/TC/EE/EI/BM/ML Programmes)

Subject Code	15ES51	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits – 04

Course objectives:

- To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.
- To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business.
- To explain need of coordination between the manager and staff, the social responsibility of business and leadership.
- To explain the role and importance of the entrepreneur in economic development and the concepts of entrepreneurship.
- To explain various types of entrepreneurs and their functions, the myths of entrepreneurship and the factors required for capacity building for entrepreneurs
- To discuss the importance of Small Scale Industries and the related terms and problems involved.
- To discuss methods for generating new business ideas and business opportunities in India and the importance of business plan.
- To introduce the concepts of project management and discuss capitol building process.
- To explain project feasibility study and project appraisal and discuss project financing
- To discuss about different institutions at state and central levels supporting business enterprises. ■

Module-1		**Teaching Hours**
Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art & Profession **.** **Planning:** Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_4 – Analysing.	
Module-2		
Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalisation, Committees –meaning, Types of Committees, Centralization Vs Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment. **Directing and Controlling:** Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling.		**10**
Revised Bloom's Taxonomy Level	L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3		
Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. **Entrepreneurship**: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.		**10**

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

15EE51 MANAGEMENT AND ENTREPRENEURSHIP(Core Course) (continued)
(Common to EC/TC/EE/EI/BM/ML Programmes)

Revised Bloom's Taxonomy Level	L_3 – Applying.	
Module-4		
Modern Small Business Enterprises: Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only). **Institutional Support for Business Enterprises:** Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions.■		**10**
Revised Bloom's Taxonomy Level	L_3 – Applying.	
Module-5		
Project Management: Meaning of Project, Project Objectives & Characteristics, Project Identification-Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation. New Control Techniques- PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM **.**■		**10**
Revised Bloom's Taxonomy Level	L_3 – Applying, L_4 – Analysing. L_2 – Understanding, L_4 – Analysing.	

Course outcomes:
At the end of the course the student will be able to:

- Explain the field of management, task of the manager, planning and the need of proper staff, recruitment and selection process.
- Discuss work allocation, the structure of organization, the modes of communication and importance of managerial control in business.
- To explain need of coordination between the manager and staff in exercising the authority and delegating duties.
- To explain the social responsibility of business and leadership
- Explain the concepts of entrepreneurship and the role and importance of the entrepreneur in economic development.
- Show an understanding of the role and importance of Small Scale Industries, business plan and its presentation.
- Discuss the concepts of project management, capitol building process, project feasibility study, project appraisal and project financing.
- Discuss the state /central level institutions / agencies supporting business enterprises.■

Graduate Attributes (As per NBA)
Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.

Question paper pattern:

- The question paper will have TEN questions.
- Each full question carries 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE51 MANAGEMENT AND ENTREPRENEURSHIP(Core Course) (continued) (Common to EC/TC/EE/EI/BM/ML Programmes)				
Textbooks				
1	Principles of Management	P.C. Tripathi, P.N.Reddy	McGraw Hill,	6th Edition, 2017
2	Entrepreneurship Development and Small Business Enterprises	Poornima M. Charanthimath	Pearson	2nd Edition,2014
Reference Books				
1	Dynamics of Entrepreneurial Development and Management	Vasant Desai	Himalaya Publishing House	2007
2	Essentials of Management: An International, Innovation and Leadership perspective	Harold Koontz, Heinz Weihrich	McGraw Hill	10th Edition 2016

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

MICROCONTROLLER(Core Course)

Subject Code	15EE52	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits – 04

Course objectives:

- To explain the internal organization and working of Computers, microcontrollers and embedded processors.
- Compare and contrast the various members of the 8051 family.
- To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions.
- To explain in detail the execution of 8051 Assembly language instructions and data types
- To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions.
- To explain different addressing modes of 8051, arithmetic, logic instructions, and programs.
- To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation ,logic, arithmetic operations and data conversion. ■

Module-1		**Teaching Hours**
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Typesof Special Function Registers and their usesin 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM.8051 Addressing Modes. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-2		
Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3		
8051 programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C **8051 Timer programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.■		**10**
Revised Bloom's Taxonomy Level	L_2 – Understanding, L_3 – Applying,L_4 – Analysing, L_5 – Evaluating.	
Module-4		
8051 serial port programming in assembly and C: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C. **8051 Interrupt programming in assembly and C:** 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

15EE52 MICROCONTROLLER(Core Course) (continued)

Module-5	**Teaching Hours**
Interfacing: LCD interfacing, Keyboard interfacing. **ADC, DAC and sensor interfacing:** ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning. **Motor control: Relay, PWM, DC and stepper motor:** Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM. **8051 interfacing with 8255:** Programming the 8255, 8255 interfacing, C programming for 8255.■	**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.

Course outcomes:
At the end of the course the student will be able to:

- Discuss the history of the 8051 and features of other 8051 family members andthe internal architecture of the 8051.
- Explains the use of an 8051 assembler, the stack and the flag register, loop, jump, and call instructions.
- Discuss 8051 addressing modes, accessing data and I/O port programming, arithmetic, logic instructions, and programs.
- Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and data serialization
- Discuss the hardware connection of the 8051 chip, its timers, serial data communication and its interfacing of 8051to the RS232.
- Discuss in detail 8051 interrupts and writing interrupt handler programs.
- Interface 8051 with real-world devices such as LCDs and keyboards, ADC, DAC chips and sensors.
- Interface 8031/51 with external memories, 8255 chip to add ports and relays, optisolators and motors.■

Graduate Attributes (As per NBA)
Engineering Knowledge, Problem analysis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.Each full question consisting of 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbook

1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazadi	Pearson	2nd Edition, 2008.

ReferenceBooks

1	The 8051 Microcontroller	Kenneth Ayala	Cengage Learning	3rd Edition, 2005
2	The 8051 Microcontroller and Embedded Systems	Manish K Patel	McGraw Hill	2014
3	Microcontrollers: Architecture, Programming, Interfacing and System Design	Raj Kamal	Pearson	1st Edition, 2012

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER–V

POWER ELECTRONICS(Core Course)

Subject Code	15EE53	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits – 04

Course objectives:

- To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics.
- To explain power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
- To explain the techniques for design and analysis of single phase diode rectifier circuits.
- To explain different power transistors, their steady state and switching characteristics and limitations.
- To explain different types of Thyristors, their gate characteristics and gate control requirements.
- To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.

Module-1		**Teaching Hours**
Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches. **Power Diodes:** Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Diode Switched *RL* Load, Freewheeling Diodes with Switched RL Load. **Diode Rectifiers:**Introduction, Single-Phase Full-Wave Rectifiers, Single-Phase Full-Wave Rectifier with RL Load, Single-Phase Full-Wave Rectifier with a Highly Inductive Load.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering,L_2 – Understanding,L_3 – Applying,L_4 – Analysing	
Module-2		
Power Transistors: Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering,L_2 – Understanding,L_3 – Applying,L_4 – Analysing	
Module-3		
Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, *di/dt*Protection, *dv/dt*Protection, DIACs, Thyristor Firing Circuits, Unijunction Transistor.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering,L_2 – Understanding,L_3 – Applying,L_4 – Analysing	
Module-4		
Controlled Rectifiers: Introduction, Single-Phase Full Converters, Single-Phase Dual Converters, Three-Phase Full Converters, Three-Phase Dual Converters, **AC Voltage Controllers:** Introduction, Single-Phase Full-Wave Controllers with Resistive Loads, Single-Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

15EE53 POWER ELECTRONICS(Core Course) (continued)

Module-5		**Teaching Hours**
DC-DC Converters: Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification**.** **DC-AC converters**: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single phase inverters, Harmonic reductions,Current source inverters. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

Course outcomes:
At the end of the course the student will be able to:

- Explain application area of power electronics, types of power electronic circuits and switches their characteristics and specifications.
- Explain types of power diodes, their characteristics, and the effects of power diodes on RL circuits.
- Explain the techniques for design, operation and analysis of single phase diode rectifier circuits.
- Explain steady state, switching characteristics and gate control requirements of different power transistors and their limitations.
- Discuss different types of Thyristors, their operation, gate characteristics and gate control requirements.
- Explain designing, analysis techniques and characteristics of thyristor controlled rectifiers.
- Discuss the principle of operation of single phase and three phase DC - DC, DC –AC converters and AC voltage controllers

Graduate Attributes (As per NBA)
Engineering Knowledge, Problem analysis.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook

1	Power Electronics: Circuits Devices and Applications	Mohammad H Rashid,	Pearson	4th Edition, 2014

Reference Books

1	Power Electronics: Converters, Applications and Design	Ned Mohan et al	Wiley	3rd Edition, 2014
2	Power Electronics	Daniel W Hart	McGraw Hill	1st Edition, 2011
3	Elements of Power Electronics	Philip T Krein	Oxford	Indian Edition, 2008

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER–V

SIGNALS AND SYSTEMS(Core Course)

Subject Code	15EE54	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits – 04

Course objectives:

- To discuss arising of signals in different systems.
- To classify the signals and define certain elementary signals.
- To explain basic operations on signals and properties of systems.
- To explain the use of convolution integral and convolution summation in analyzing the response of linear time invariant systems in continuous and discrete time domains.
- To explain the properties of linear time invariant systems in terms of impulse response description.
- To explain determination of response of a given linear time invariant system and to provide a block diagram representation to it.
- To explain Fourier transform representation of continuous time and discrete time non –periodic signals and the properties of Fourier Transforms.
- To explain the applications of Fourier transform representation to study signals and linear time invariant systems.
- To explain the use of Z-transform in the complex exponential representation of discrete time signals and the analysis of systems. ■

Module-1		**Teaching Hours**
Introduction: Definitions of signals and a system, classification of signals, basic operations on signals. Elementary signals viewed as interconnections of operations, properties of systems. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering,L_2 – Understanding,L_3 – Applying, L – 4 Analysing, L_5 – Evaluating.	
Module-2		
Time – Domain Representations For LTI Systems: Convolution, impulse response, properties, solution of differential and difference equations, block diagram representation.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering,L_2 – Understanding,L_3 – Applying,L_4 – Analysing, L_5 – Evaluating.	
Module-3		
The Continuous-Time Fourier Transform: Representation of a non -periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform, Applications. Frequency response of LTI systems, Solutions of differential equations■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating.	
Module-4		
The Discrete-Time Fourier Transform: Representations of non-periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT and applications. Frequency response of LTI system, Solutions of differential equations.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating..	
Module-5		
Z- Transforms: Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

15EE54 SIGNALS AND SYSTEMS(Core Subject) (continued)

Course outcomes:

At the end of the course the student will be able to:

- Classify the signals and systems.
- Explain basic operations on signals and properties of systems.
- Use convolution in both continuous and discrete domain for the analysis of systems given the impulse response of a system.
- Evaluate response of a given linear time invariant system.
- Provide block diagram representation of a linear time invariant system.
- Apply continuous time Fourier transform representation to study signals and linear time invariant systems.
- Apply discrete time Fourier transform representation to study signals and linear time invariant systems. Use Z-transform and properties of Z transform for the analysis of discrete time systems.■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Modern tool usage,Ethics.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

Textbook

1	Signals and Systems	Simon Haykin, Berry Van Veen	Wiley	2nd Edition,2002

Reference Books

2	Fundamentals of Signals and Systems	Michael J. Roberts, Govind K Sharma	McGraw Hill	2nd Edition 2010
3	Signals and Systems	NagoorKani	McGraw Hill	1st Edition 2010
4	Signals and Systems A Primer with MATLAB	Matthew N.O.Sadiku Warsame H.Ali	CRC Press	1st Edition, 2016
5	Signals and Systems	Anand Kumar	PHI	3rd Edition, 2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER –V

INTRODUCTION TO NUCLEAR POWER(Professional Elective)

Subject Code	15EE551	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80

Credits – 03

Course objectives:

- To explain the fission process in nuclear materials and how the nuclear reactors work and the basic components of nuclear reactors and their types.
- Explanation about cooling of reactors, features of coolant, different types of coolants used in the reactors and the losses of cooling.
- Discussion on loss of cooling accidents in different reactors.
- Discussion on postulated severe accidents in water cooled reactors and other reactors and cooling of reactor during removal and processing.
- Discussion on cooling and disposing the nuclear waste and prospect of fusion energy in the future. ■

Module-1		**Teaching Hours**
The Earth and Nuclear Power: Sources and Resources: Introduction, Earth's Internal Heat Generation, The Earth's Energy Flow, The Fission Process, Thermal Energy Resources. **How Reactors Work:** Introduction, The Fission Process, Basic Components of a Nuclear Reactor, Thermal Reactors, Fast Reactors. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	
Module-2		
Cooling Reactors: Introduction, General Features of a Reactor Coolant, Principles of Heat Transfer, Gaseous Coolants, Liquid Coolants, Boiling Coolants. **Loss of Cooling:** Introduction, The Electric Kettle, Pressurized-Water Reactor, Boiling-Water Reactor, CANDU Reactor, Gas-Cooled Reactors, Sodium- Cooled Fast Reactor. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3		
Loss-of-Cooling Accidents: Introduction, Incidents in light Water-Cooled Reactors, Heavy Water-Moderated Reactors, Gas-Cooled Reactors, Liquid Metal-Cooled Fast Reactors.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-4		
Postulated Severe Accidents Introduction: Introduction, Postulated Severe Accidents in Water-Cooled Reactors, Specific Phenomena relating to Severe Accidents, Severe Accidents in other Reactor Types, Fission Product Dispersion following Containment Failure. **Cooling during Fuel Removal and Processing**: Introduction, Refuelling, Spent Fuel Storage and Transport, Reprocessing Plant. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-5		
Cooling and Disposing of the Waste: Introduction, Classification of Waste Products, Fission Products and Their Biological Significance, Options for Nuclear Waste Disposal, Long-Term Storage and Disposal of Spent Nuclear Fuel, Storage and Disposal of Fission Products from Reprocessing Plants, Disposal of other Materials. **Fusion Energy -Prospect for the Future:** Introduction, The Fusion Process, Confinement, Current Technical Position, Conclusions. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER –V

15EE551INTRODUCTION TO NUCLEAR POWER (Professional Elective)

Course outcomes:

At the end of the course the student will be able to:

- Explain the fission process in nuclear materials, basic components of nuclear reactors, types of nuclear reactors and their working.
- Discuss different types of coolants, their features, and cooling of reactors,
- Discuss loss of cooling accidents in different reactors.
- Discuss postulated severe accidents in reactors and cooling of reactor during removal of spent fuel.
- Discuss cooling and disposing the nuclear waste and prospect of fusion energy in the future.■

Graduate Attributes (As per NBA)

Engineering Knowledge, Design/ Development of Solutions, The Engineer and Society, Environment and Sustainability, Ethics, Project Management and Finance.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

Textbook

1	Introduction to Nuclear Power	Geoffrey F. Hewitt	Taylor & Francis	1st Edition, 2000

Reference Books

1	Nuclear Reactor Engineering	G.Vaidyanathan	S.Chand	1st Edition, 2013
2	Introduction to NuclearEngineering	John R Lamarsh Anthony J Baratta	Pearson	3rd Edition, 2016

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER –V

ELECTRICAL ENGINEERING MATERIALS(Professional Elective)

Subject Code	15EE552	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80

Credits – 03

Course objectives:

- To impart the knowledge of conducting, dielectric, insulating and magnetic materials and their applications.
- To impart the knowledge of superconducting materials and their applications
- To impart the knowledge of plastics and materials for Opto - Electronic devices. ■

Module-1	**Teaching Hours**
Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials. **Conductors:** Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems .■	**08**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding.	
Module-2	
Conductive Materials and Applications: Introduction**,** Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing. **Dielectrics:** Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behaviour of polarization under impulse and frequency switching.■	**08**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding.	
Module-3	
Insulating Materials: Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum. **Magnetic Materials:** Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Ant ferromagnetism and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss. ■	**08**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding.	
Module-4	
Magnetic Materials (continued): Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, magnetostriction. **Superconductive Materials:**Concept of superconductors, Meaning of phenomenon of superconductivity, Properties of superconductors, Types of superconductors, Critical magnetic field	**08**

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

15EE552 ELECTRICAL ENGINEERING MATERIALS (Professional Elective) (continued)

Module-4 (continued)		**Teaching Hours**
Superconductive Materials (continued):and critical temperature, Effects of Isotopic mass on critical temperature, Silsbee rule, Depth of penetration and coherence length. Ideal and Hard superconductors, Mechanism of superconduction, London's theory for Type I superconductors, GLAG theory for Type I superconductors, BCS theory. Applications and limitations■		
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	
Module-5		
Plastics: Introduction, Thermoplastics, Rubbers, Thermosets, DC and AC properties, Mechanical properties and processing of plastic. **Materials for Opto – Electronic Devices:** Introduction, Optical phenomena, Reflection, Refraction, Transmittivity, Scattering, Optical absorption, Optical properties of non-metals, Optical properties of metals, Optical properties of semiconductors, Optical properties of insulators. Luminescence, Opto – Electronic devices, Photoconductivity, Photoconductive cell.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	

Course outcomes:

At the end of the course the student will be able to:

- Discuss electrical and electronics materials, their importance, classification and operational requirement
- Discuss conducting materials used in engineering, their properties and classification.
- Discuss dielectric materials used in engineering, their properties and classification.
- Discuss insulating materials used in engineering, their properties and classification.
- Discuss magnetic materials used in engineering, their properties and classification
- Explain the phenomenon superconductivity, super conducting materials and their application in engineering.
- Explain the plastic and its properties and applications.
- Discuss materials used for Opto electronic devices.■

Graduate Attributes (As per NBA)

Engineering Knowledge

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

Textbooks

1	Advanced Electrical and Electronics Materials; Processes and Applications	K.M. Gupta Nishu Gupta	Wiley	First Edition, 2015
Reference Books				
1	Electronic Engineering Materials	R.K. Shukla Archana Singh	McGraw Hill	2012
2	Electrical Properties of Materials	L Solymar et al	Oxford	9th Edition, 2014
3	Electrical Engineering Materials	A.J. Dekker	Pearson	2016
4	Principle of Electronic Materials and Devices	S.O. Kasap	McGraw Hill	3rd Edition 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -V

ELECTRICAL ESTMATION AND COSTING (Professional Elective)

Subject Code	15EE553	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80

Credits - 03

Course objectives:

- To discuss the purpose of estimation and costing.
- To discuss market survey, estimates, purchase enquiries, tenders, comparative statement and payment of bills and Indian electricity act and some of the rules.
- To discuss distribution of energy in a building, wiring and methods of wiring, cables used in internal wiring, wiring accessories, fittings and fuses.
- To discuss design of lighting points and its number, total load, sub-circuits, size of conductor.
- To discuss different types of service mains and estimation of power circuits.
- To discuss estimation of overhead transmission and distribution system and its components.
  To discuss main components of a substation, their graphical representation and preparation of single line diagram of a substation. ■

Module-1		**Teaching Hours**
Principles of Estimation: Introduction to Estimation and Costing, Electrical Schedule, Catalogues, Market Survey and Source Selection, Recording of Estimates, Determination of Required Quantity of Material, LabourConditions, Determination of Cost Material and Labour, Contingencies, Overhead Charges, Profit, Purchase System, Purchase Enquiry and Selection of Appropriate Purchase Mode, Comparative Statement, Purchase Orders, Payment Of Bills, Tender Form, General Idea about IE Rule, Indian Electricity(IE) Act and IE Rules -29,30,45,46,47,50,51,54,55,77 and79.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	
Module-2		
Wiring: Introduction, Distribution of energy in a Building, PVC Casing and Capping, Conduit Wiring, Desirabilities of Wiring. Types of cables used in Internal Wiring, Multi St`rand Cables, Voltage Grading and Specification of Cables **Wiring (continued):** Main Switch and Distribution Board, Conduits and its accessories and Fittings. Lighting Accessories and Fittings, Types of Fuses, Size of Fuse, Fuse Units, Earthing Conductor. **Internal Wiring:** General rules for wiring, Design of Lighting Points (Refer to Seventh Chapter of the Textbook), Number of Points, Determination of Total Load, Number of Sub –Circuits, Ratings Main Switch and Distribution Board and Size of Conductor. Current Density, Layout. ..■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3		
Service Mains: Introduction, Types, Estimation of Underground and Overhead Service Connections. **Design and Estimation of Power Circuits:** Introduction, Important Considerations Regarding Motor Installation Wiring, Input Power, Input Current to Motors, Rating of Cables, Rating of Fuse, Size of Condit, Distribution Board Main Switch and Starter. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-4		
Estimation of Overhead Transmission and Distribution Lines: (Review of Line Supports, Conductor Materials, Size of Conductor for Overhead Transmission Line, Types of Insulators)[No Question Shall be Set From the Review Portion]. Cross Arms, Pole Brackets and Clamps, Guys and Stays, Conductors Configuration Spacing and Clearances, Span Lengths, Lightning Arrestors, Phase Plates, Danger Plates, Anti Climbing Devices, Bird Guards, Beads of Jumpers, Muffs, Points to be Considered at the Time of Erection of Overhead Lines, Erection of Supports, Setting of Stays, Fixing of Cross Arms, Fixing of Insulators, Conductor Erection,		**08**

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -V

15EE553 ELECTRICAL ESTMATION AND COSTING (Professional Elective)

Module-4 (continued)		**Teaching Hours**
Estimation of Overhead Transmission and Distribution Lines (continued): Repairing and Jointing of Conductors, Dead End Clamps, Positioning of Conductors and Attachment to Insulators, Jumpers, Tee-Offs, Earthing of Transmission Lines, Guarding of Overhead Lines, Clearances of Conductor From Ground, Spacing Between Conductors, Important Specifications. ■		
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding. L_3 – Applying, L_4 – Analysing	
Module-5		
Estimation of Substations: Main Electrical connection, Graphical Symbols for Various Types of Apparatus and Circuit Elements on Substation main Connection Diagram, Single Line Diagram of Typical Substations, Equipment for Substation, Substation Auxiliaries Supply, Substation Earthing.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	

Course outcomes:

At the end of the course the student will be able to:

- Explain the purpose of estimation and costing.
- Discuss market survey, estimates, purchase enquiries, preparation of tenders, comparative statements and payment of bills.
- Discuss Indian Electricity act and Indian Electricity rules.
- Discuss distribution of energy in a building, wiring and methods of wiring, cables used in internal wiring, wiring accessories and fittings, fuses and types of fuses.
- Discuss design of lighting points and its number, total load, sub-circuits, size of conductor.
- Discuss types of service mains and estimation of service mains and power circuits.
- Discuss estimation of overhead transmission and distribution system and its components.
- Discuss main components of a substation, preparation of single line diagram of a substation and earthing of a substation.■

Graduate Attributes (As per NBA)

Engineering Knowledge,

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

Textbook

1	A Course in Electrical Installation Estimating and Costing	J. B. Gupta	Katson Books,	9th Edition, 2012

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

SPECIAL ELECTRICAL MACHINES(Professional Elective)

Subject Code	15EE554	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80

Credits – 03

Course objectives:

- To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
- To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors and permanent magnet brushless D.C. motors.
- To impart knowledge on the Construction, principle of operation and performance of permanent magnet synchronous motors and synchronous reluctance motor.
- To impart knowledge on single phase special machines and servo motors.
- To impart knowledge on Linear electrical machine and permanent magnet axial flux machines. ■

Module-1		**Teaching Hours**
Stepper Motor: Introduction, Variable Reluctance Stepper Motor, Permanent Magnet Stepper Motor, Hybrid Stepper Motor, Other Types of Stepper Motor, Windings in Stepper Motors, Torque Equation, Characteristics of Stepper Motor, Open – loop Control of Stepper Motor, Closed – loop Control of Stepper Motor, Microprocessor – Based Control of Stepper Motor, Applications of Stepper Motor. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	
Module-2		
Switched Reluctance Motor (SRM): Construction, Principle of Working, Basics of SRM Analysis, Constraints on Pole Arc and Tooth Arc, Torque Equation and Characteristics, Power Converter Circuits, Control of SRM, Rotor Position Sensors, Current Regulators, Microprocessor – Based Control of SRM, Sensorless Control of SRM. **Permanent Magnet DC Motor and Brushless Permanent Magnet DC Motor:** Permanent Magnet DC (PMDC) motor, Brushless Permanent Magnet DC (BLDC) Motors. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	
Module-3		
Permanent Magnet Synchronous Motor (PMSM): Construction, Principle of Operation, EMF Equation, Torque Equation, Phasor Diagram, Circle Diagram, Comparison of Conventional and PMSM, Control of PMSM, Applications. **Synchronous Reluctance Motor (SyRM):** Constructional of SyRM, Working, Phasor Diagram and Torque Equation, Control of SyRM, Advantages and Applications. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	
Module-4		
Single Phase Special Electrical Machines: AC series Motor, Repulsion Motor, Hysteresis Motor, Single Phase Reluctance Motor, Universal Motor. **Servo Motors:** DC Servo Motors, AC Servo Motors. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	
Module-5		
Linear Electric Machines: Linear Induction Motor, Linear Synchronous Motor, DC Linear Motor, Linear Reluctance Motor, Linear Levitation Machines. **Permanent Magnet Axial Flux (PMAF) Machines:** Comparison of Permanent Radial and Axial Flux Machines, Construction of PMAF Machines, Armature Windings, torque and EMF Equations of PMAF, Phasor Diagram, Output Equation, Pulsating Torque And its Minimisation, Control and Applications of PMAF. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

15EE554 SPECIAL ELECTRICAL MACHINES (Professional Elective)

Course outcomes:

At the end of the course the student will be able to:

- Explain the performance and control of stepper motors, and their applications.
- Explain theory of operation and control of switched reluctance motor and permanent magnet brushless D.C. motors.
- Explain theory of operation and control of permanent magnet synchronous motors and synchronous reluctance motor.
- Explain operation of single phase special machines and servo motors.
- Explain operation of linear electrical machine and permanent magnet axial flux machines. ■

Graduate Attributes (As per NBA):

Engineering Knowledge, Problem analysis.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbooks

2	Special Electrical Machines	K Venkataratham	University Press	2009

Reference Books

1	Special Electrical Machines	E.G. Janardanan	PHI	1st Edition 2014.
3	Brushless Permanent Magnet and Reluctance Motor Drives	T J E Miller	Clerendon Press, Oxford	1989
4	Permanent Magnet and Brushless DC Motors	Kenjo T and Nagamori S	Clerendon Press, Oxford	1985
5	Stepping Motors and their Microprocessor Control	KenjoT	Clerendon Press Oxford	1984
6	Switched Reluctance Motor Drives Modeling, Simulation Design and Applications	Krishan R	CRC	2001

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

ELECTRONIC COMMUNICATION SYSTEMS(Open Elective)

Subject Code	15EE561	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80

Credits - 03

Course objectives:

- To explain elements of communication system, noise and its effects.
- To describe the theory of amplitude, angle, pulse and digital modulation techniques
- To explain principles of radio communication, transmitters and receivers
- To explain basics of Television Broadcasting
- To explain basic principles of radar systems.
- To discuss multiplexing used in broadband communications.
- To explainthe basic routing process used for long-distance telephony
- To explainfiber optic technology used for communication and its components and systems and their installation.
- To discuss basics of information theory, coding and data communication**.**

Module-1		**Teaching Hours**
Introduction to Communication: Elements of a Communication System, Need for Modulation, Electromagnetic Spectrum and Typical Applications, Terminologies in Communication Systems, Basics of Signal Representation and Analysis. **Noise:** ExternalNoise, internal Noise, Noise Calculations, Noise Figure, Noise Temperature. **Amplitude Modulation Techniques:** Elements of Analog Communication, Theory of Amplitude Modulation Techniques, Generation of Amplitude Modulated Signals.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-2		
Angle Modulation Techniques: Theory of Angle Modulation Techniques, Practical Issues in Frequency Modulation, Generation of Frequency Modulation. **Pulse Modulation Techniques:** Introduction, Pulse Analog Modulation Techniques, Pulse Digital Modulation Techniques. **Digital Modulation Techniques:** Introduction, Basic Digital Modulation Schemes, M-ary Digital Modulation Techniques.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3		
Radio Transmitters and Receivers: Introduction lo Radio Communication, Radio Transmitters, Receiver Types, AM Receivers, FM Receivers, Single- and Independent-Sideband Receivers. **Television Broadcasting:** Requirements and Standards, Black-and-White Transmission, Black-and-White Reception, Colour Transmission and Reception.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-4		
Radar Systems: Basic Principles, Pulsed Systems, Other Radar Systems. **Broadband Communication Systems:**Multiplexing, Short-and Medium-Haul Systems, Long-Haul Systems, Elements of Long-Distance Telephony.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V

15EE561 ELECTRONIC COMMUNICATION SYSTEMS(Open Elective) (continued)

Module-5	**Teaching Hours**
Introduction to Fiber Optic Technology: History of Fiber Optics, Need of Optical Fibers, Introduction to Light, The Optical Fiber and Fiber Cables, Fiber Optic Components and Systems, Installation, Testing, and Repair. **Information Theory, Coding and Data Communication:** Information Theory, Digital Codes, Error Detection and Correction, Fundamentals of Data Communication System, Data Sets and Interconnection Requirements, Network and Control Considerations.■	**08**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing	

Course outcomes:

At the end of the course the student will be able to:

- Understand communication systems and its terminologies.
- Explain noise, computation of noise level in communication systems.
- Describe the theory of amplitude, angle, pulse and digital modulation techniques
- Explain principles of radio communication, transmitters and receivers
- Show understanding of the basic TV system and process transmission and reception
- Explain basic principles of radar systems and multiplexing broadband communication systems.
- Show understanding of fiber optic technology.
- Show understanding of information theory, coding and data communication

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations, Life-long Learning.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

Textbook

1	Electronic Communication Systems	George Kennedy	McGraw Hill	5th Edition, 2011

Reference Books

1	Electronic Communications Systems: Fundamentals Through Advanced	Wayne Tomasi	Pearson	5th Edition, 2009
2	Communication Systems	V. Chandrasekar	Oxford	1st Edition, 2012
3	Communication Systems	P Ramakrishna Rao	McGraw Hill	1st Edition, 2013

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - V

PROGRAMMABLE LOGIC CONTROLLERS (Open Elective)

Subject Code	15EE562	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80

Credits - 03

Course objectives:

- To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
- To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
- To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
- To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs.
- To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays.
- To explain conversion of relay schematics into PLC ladder logic programs and writing PLC programs directly from narrative descriptions.
- To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems.
- To describe the function of selectable timed interrupt and fault routine files and use of temporary end instruction.
- To explain the execution of data transfer instructions, interruption of data transfer and data compare instructions.
- To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations.
- To describe the operation of bit and word shift registers and develop programs that use shift registers.
- To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes. ■

Module-1	**Teaching Hours**
Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application. **PLC Hardware Components:** The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs). **Basics of PLC Programming:** Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation■	**08**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding,	

Module-2	
Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description. **Programming Timers:** Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.■	**08**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding,.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - V

15EE562 PROGRAMMABLE LOGIC CONTROLLERS (Open Elective)

Module-3		**Teaching Hours**
Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions. **Program Control Instructions:** Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, SafetyCircuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding,.	
Module-4		
Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control. **Math Instructions:** Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	
Module-5		
Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations. **Process Control, Network Systems, and SCADA:** Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA). ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	

Course outcomes:

At the end of the course the student will be able to:

- Discuss history of PLC, its sequence of operation, advantages and disadvantages, main parts and their functions.
- Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
- Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
- Convert relay schematics and narrative descriptions into PLC ladder logic programs
- Analyze PLC timer and counter ladder logic programs
- Describe the operation of different program control instructions
- Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system.
- Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes. ■

Graduate Attributes (As per NBA)

Engineering Knowledge

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.

Students will have to answer 5 full questions, selecting one full question from each module. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V				
15EE562 PROGRAMMABLE LOGIC CONTROLLERS (Open Elective)				
Textbook				
1	ProgrammableLogic Controllers	Frank D Petruzella,	McGraw Hill,	4th Edition, 2011
Reference Book				
1	ProgrammableLogic Controllers an Engineer's Guide,	E A Parr	Newnes	3rd Edition, 2013
2	Introduction ProgrammableLogic Controllers	Gary Dunning	Cengage	3rd Edition, 2006

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - V

RENEWABLE ENERGY SOURCES(Open Elective)

Subject Code	15EE563	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80

Credits - 03

Course objectives:

- To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- To explain sun – earth geometric relationship, Earth – Sun Angles and their Relationships
- To discuss about solar energy reaching the Earth's surface and solar thermal energy applications.
- To discuss types of solar collectors, their configurations and their applications
- To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications.
- To discus benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages.
- To discuss wind turbines, wind resources, site selection for wind turbine
- To discuss geothermal systems, their classification and geothermal based electric power generation
- To discuss waste recovery management systems, advantages and disadvantages
- To discuss biomass production, types of biomass gasifiers, properties of producer gas.
- To discuss biogas, its composition, production, benefits.
- To discuss tidal energy resources, energy availability, power generation.
- To explain motion in the sea wave, power associated with sea wave and energy availability and the devices for harnessing wave energy.
- To discuss principles of ocean thermal energy conversion and production of electricity.■

Module-1	**Teaching Hours**
Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India. **Energy from Sun:**Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications. ■	**08**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	
Module-2	
Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects ofSolar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar pond. **Solar Cells:**Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems.■	**08**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3	
Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy. **Wind Energy:** Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection. **Geothermal Energy:** Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation,Associated Problems, environmental Effects.	**08**

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - V

15EE563 RENEWABLE ENERGY SOURCES(Open Elective) (continued)

Module-3 (continued)		**Teaching Hours**
Solid waste and Agricultural Refuse: Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste,Recycling of Plastics. ■		
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-4		
Biomass Energy: Biomass Production, Energy Plantation,Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers. **Biogas Energy:** Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics. **Tidal Energy:**Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy.■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-5		
Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power. **Ocean Thermal Energy:**Introduction,Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	

Course outcomes:

At the end of the course the student will be able to:

- Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- Discuss energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
- Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
- Discus generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
- Discuss production of energy from biomass, biogas.
- Discuss tidal energy resources, energy availability and power generation.
- Discuss power generation sea wave energy and ocean thermal energy.■

Graduate Attributes (As per NBA)

Engineering Knowledge,Problem Analysis,Modern tool usage,Ethics.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V				
15EE563 RENEWABLE ENERGY SOURCES(Open Elective) (continued)				
Textbook				
1	Nonconventional Energy Resources	ShobhNath Singh	Pearson	1st Edition, 2015
Reference Books				
1	Nonconventional Energy Resources	B.H. Khan	McGraw Hill	3rd Edition,
2	Renewable Energy; Power for a sustainable Future	Godfrey Boyle	Oxford	3rd Edition, 2012
3	Renewable Energy Sources: Their Impact on global Warming and Pollution	TasneemAbbasi S.A. Abbasi	PHI	1st Edition, 2011

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -V

BUSINESS COMMUNICATION (Open Elective)

Subject Code	15EE564	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80

Credits - 03

Course objectives:

- To discuss analysing audiences, and choose the most effective structure and style for delivering strategically sound written and spoken messages.
- To discuss how to organize the talk, handling audience response.
- To discuss how to communicate with managers, co-workers, customers and suppliers.
- To discuss how engineers can use written and oral skills, computer, graphics and other engineering tools to communicate with other engineers and management. ■

Module-1	**Teaching Hours**
Analyse Communication Purpose and Audience: How to Learn, How Engineers ArePersuaded, Speak orWrite:Select the RightCommunicationChannel, ConsiderYourCommunicationPurposeandAudience. **Projecting the Image of the Engineering Profession:**OvercomeAnxiety, PrimaryImpact:NonverbalBodyLanguage, SecondaryImpact:ControlVocalQuality, Volume, AndPace, OptimizePresentationEnvironment. **Presentation Aids: Engineering:**TheRealdaVinciCode, SpeakingVisually—GuidelinesforUsingPresentationAids, Choosing among Options, CreatingVisualswithImpact, Deliveringwith Visuals. ■	**08**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	
Module-2	
Organize Your Talk: PlanningYourTalk, ConductinganAudience Analysis: 39Questions, OrganizingYourTalkinSevenEasyStages, GettingAttentionandKeepingInterest, FiveMinutesEarly - TimeManagementforYourPresentation, DeliveringYourIntroduction, PresentingYourConclusion. **Handling Audience Response:**CreatetheEnvironment, HandlewithC.A.R.E, Dealwith Hostile Questions, DealwithOtherTypesofQuestions, ControltheQ&ASession, ThinkingonYourFeet. **Organizing for Emphasis:**MakeourBottomLinethe Top Line, Purpose Statement and Blueprints, OpenLong Reports withaSummary, UseMoreTopicSentences, DevelopHeadings, Structure VerticalLists. ■	**08**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3	
Write As If Talking to Your Engineering Associates: UsePersonal Pronouns, RelyonEveryday Words, Use Short SpokenTransitions, KeepSentencesShort, ReachOuttoYourEngineeringReadersby AskingQuestions, 5Whys-ATechniqueforEngineeringProblemSolving. **Trim Your Expressions:**Introduction, PruneWordyExpressions, UseStrongVerbs, CutDoublingsandNounStrings, EliminateUnnecessaryDeterminersandModifiers, ChangePhrasesintoSingleWords, ChangeUnnecessaryClausesintoPhrasesorSingleWords, AvoidOverusing"Itis"and"Thereis", EightStepsforLeanWriting. **Write Actively—Engineering is about Actions:**ActiveVoice:"AlbertEinsteinWrotetheTheoryofRelativity", HowtoRecognizethePassiveVoice, HowtoWriteActively - UseThreeCures, WritePassivelyforGoodReasonsOnly, TheoryofCompletedStaffWork. ■	**08**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-4	
Every day Engineering Communications -E-Mails, Phone Calls, and Memos: Effective E-mailWriting:SevenThings to Remember, How toBe Productive on the Phone, "MemosSolve Problems".	**08**

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -V

15EE564 BUSINESS COMMUNICATION (Open Elective) (continued)

Module-4 (continued)		**Teaching Hours**
Visuals for Engineering Presentation - Engineers Think in Pictures: OptimizeSlideLayout, DisplayEngineeringDataEffectively, HowtoDevelopEffectiveGraphics. **Write Winning Grant Proposals:**KnowYourAudience, Understand YourGoaland Marketing Strategy, SelecttheCorrectWritingStyle, OrganizeYourProposalaround the FourPs, ABriefChecklistbeforeSubmittingYourProposal. ■		
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	

Module-5		
How to Effectively Prepare Engineering Reports: WritinganEffectiveProgressReport, DevelopInformativeDesignReports. **Listening Interactive Communication about Engineering Risk:** Listening – A Forgotten Risk Communication Skill Listening – Harder Than Speaking and Writing, How to Listento Voice of Customers about Risk, Listen Attentively: Understanding What Drives PerceivedRisk, Thirteen Questions about Risk Communication. ■		**08**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	

Course outcomes:

At the end of the course the student will be able to:

- Apply business communication strategies and principles to prepare effective communication for domestic and international business situations.
- Utilize analytical and problem solving skills appropriate to business communication.
- Participate in team activities that lead to the development of collaborative work skills.
- Select appropriate organizational formats and channels used in developing and presenting business messages.
- Compose and revise accurate business documents using computer technology.
- Communicate via electronic mail, Internet, and other technologies.
- Deliver an effective oral business presentation. ■

Graduate Attributes (As per NBA)

Engineering Knowledge

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

Text Book

1	What Every Engineer Should Know AboutBusinessCommunication	John X. Wang	CRC	2008

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -V

MICROCONTROLLER LABORATORY - 1

Subject Code	15EEL57	IA Marks	20
Number ofPracticalHours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80

Credits - 02

Course objectives:

- To explain writing assembly language programs for data transfer, arithmetic, Boolean and logical instructions.
- To explain writing assembly language programs for code conversions.
- To explain writing assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
- To perform interfacing of stepper motor and dc motor for controlling the speed.
- To explain generation of different waveforms using DAC interface. ■

Sl. NO	Experiments
Note: For the experiments 1 to 6, 8051 assembly programming is to be used.	
1	Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.
2	Arithmetic instructions: Addition, subtraction, multiplication and division. Square and cube operations for 16 bit numbers.
3	Counters
4	Boolean and logical instructions (bit manipulation).
5	Conditional call and return instructions.
6	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to ASCII, Hexa decimal to and Decimal to hexa.
7	Programs to generate delay, Programs using serial port and on-chip timer/counters.
Note: Single chip solution for interfacing 8051 is to be with C Programs for the following experiments.	
8	Stepper motor interface.
9	DC motor interface for direction and speed control using PWM.
10	Alphanumerical LCD panel interface.
11	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.
12	External ADC and Temperature control interface.
13	Elevator interface.

Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating, L_6 – Creating.

Course outcomes:

At the end of the course the student will be able to:

- Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions.
- Write ALP for code conversions.
- Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
- Perform interfacing of stepper motor and dc motor for controlling the speed.
- Generate different waveforms using DAC interface.
- Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work.■

Graduate Attributes (As per NBA)

Engineering Knowledge,Problem Analysis, Individual and Team work, Modern tool usage, Communication.

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
15EEL57 MICROCONTROLLER LABORATORY – 1
CHOICE BASED CREDIT SYSTEM (CBCS)

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.■

Learning beyond the syllabus: To acquire a wide variety of skills and to develop society friendly applications mini projects can be practiced by referring to "Microcontroller Based Projects" Second Edition, An EFY (Electronics For You) Enterprise Pvt Ltd, 2013.

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - V

POWER ELECTRONICS LABORATORY

Subject Code	15EEL58	IA Marks	20
Number ofPracticalHours/Week	03	Exam Hours	03
Total Number of PracticalHours	42	Exam Marks	80

Credits - 02

Course objectives:

- To conduct experiments on semiconductor devices to obtain their static characteristics.
- To study different methods of triggering the SCR
- To study the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
- To control the speed of a dc motor, universal motor and stepper motors.
- To study single phase full bridge inverter connected to resistive load.
- To study commutation of SCR. ■

Sl. No	Experiments
1	Static Characteristics of SCR.
2	Static Characteristics of MOSFET and IGBT.
3	Characteristic of TRIAC.
4	SCR turn on circuit using synchronized UJT relaxation oscillator.
5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.
6	Single phase controlled full wave rectifier with R and R –L loads.
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.
8	Speed control of dc motor using single semi converter.
9	Speed control of stepper motor.
10	Speed control of universal motor using ac voltage regulator.
11	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.
12	Design of Snubber circuit.
Revised Bloom's Taxonomy Level	L_3 – Applying, L_4 – Analysing, L_5 – Evaluating, L_6 – Creating

Course outcomes:

At the end of the course the student will be able to:

- Obtain static characteristics of semiconductor devices to discuss their performance.
- Trigger the SCR by different methods
- Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
- Control the speed of a dc motor, universal motor and stepper motors.
- Verify the performance of single phase full bridge inverter connected to resistive load.
- Perform commutation of SCR by different methods.■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.■

****** END ******