SRI VASAVI ENGINEERING COLLEGE

(AUTONOMOUS)

(Sponsored by Sri Vasavi Educational Society)

(Approved by AICTE, New Delhi &Recognized by UGC under section 2(f) & 12(B))

(Permanently affiliated to JNTUK, Kakinada, Accredited by NAAC with 'A' Grade)

Pedatadepalli, **TADEPALLIGUDEM–534 101.**W.G.Dist. **(A.P)**

Department of Electrical & Electronics Engineering (Accredited by NBA)

Date: 25-06-2020

The third meeting of Board of Studies in Department of Electrical and Electronics Engineering is held at 11.30 AM on 30-05-2020 though online mode using gotomeeting tool (Meeting ID: 661-077-229).

The following members are attended the meeting.

S.No.	Name	Designation	Role
1.	Dr. Sudha Rani Donepudi	Associate Professor, Head, Dept. of EEE, SVEC, Pedatadepalli.	Chairperson
2.	Dr. R. SrinivasaRao	Professor, Dept. of EEE, UCEK, JNTUK, Kakinada	Subject Expert Nominated By V.C.
3.	Dr. M. Sydulu	Professor, Dept. of EE, NITW, Warangal	Subject Expert Nominated By A.C.
4.	Dr. Y.P. Obulesu	Profcssor, School of EE, VIT, Vellore	Subject Expert Nominated By A.C.
5.	Er. B.N.V.R.C. Suresh Kumar	Retired AGM, PGCI, Hyderabad	Industry Expert Nominated By A.C
6.	Er. Ch. Vinay Kumar	Assistant Engineer, EHT Lines, APTRANSCO, Eluru.	Alumni
7.	Dr. Ch. Rambabu	Professor	Member
8.	Dr. P.V.V. Rama Rao	Professor	Member
9.	U. Chandra Rao	Sr. Asst. Professor	Member
10.	N. Sri Harish	Asst. Professor	Member
11.	Ch. V.S.R. Gopala Krishna	Sr. Asst. Professor	Member
12.	P.S.V.N. Sudhakar	Asst. Professor	Member
13.	V. Rama Narayana	Asst. Professor	Member
14.	K. Venkata Reddy	Asst. Professor	Member
15.	Mr. V.S. Aditya	Asst. Professor	Member

The following are the minutes of the meeting

Item No. 1: Welcome note by the Chairperson BOS

The HOD extended a formal welcome and introduced the members.

Item No. 2: Review of course structure for V & VI semesters of B. Tech under V18 Regulation.

Reviewed the course structure of V & VI semesters for UG (B.Tech-EEE) Programme of V18 Regulation and the following modifications have been done.

V Semester

- **Power System Protection**course (Course Code:V18EET11) is renamed as **Switchgear & Protection** (Course Code:V18EET12)
- **Renewable Energy Systems** course (Course Code:V18EET20) is move to Professional Elective-I in VI Semester and the same is replaced with **Power System Analysis** (Course Code:V18EET14)
- **Intellectual Property Rights & Patents** course is removed from MNC.
- Employability Skills– III is renamed as **Professional Communication Skills – III** (Course Code: V18ENT05)

VI Semester

- **JAVA Programming** course is move to open elective course offered by BoS of CSE and same is replaced with **Electrical Drives**(Course Code:V18EET17)
- **Power System Analysis** course is moved to V Semester and the same is replaced with **Professional Elective-II**
- **JAVA Programming Laboratory** course is replaced with **Electrical Simulation Laboratory**(Course Code:V18EEL09)
- **Technical Seminar**(V18EES01) is moved to VII Semester
- **Courses approved in Professional Elective I:**
  - Utilization of Electrical Energy
  - Advanced Control Systems
  - Renewable Energy Systems
  - Advanced Power Electronics
- **Courses approved in Professional Elective II:**
  - HVAC & HVDC Transmission
  - Programmable Logic Controllers &its Applications
  - Electrical Energy Conservation, Management & Auditing
  - Special Electrical Machines
- Employability Skills – IV is renamed as **Professional Communication Skills – IV** (Course Code: V18ENT06)

The details of the course structure for V & VI semesters of UG (B.Tech) Programme (EEE) are given in Annexure-I

Item No. 3: Approval of syllabi for the courses offered in V & VI semesters B. Tech under V18 Regulation.

Approved the syllabi for the courses offered in V & VI semesters B. Tech under V18 Regulation.

The syllabi for the courses offered in V and VI semesters of B.Tech Programme of under V18 Regulation is attached in Annexure-II.

Item No. 4: Approval of list of courses offering under Open Elective- I in VI semester B. Tech under V18 Regulation for all other branches and the approval of their detailed syllabi.

Approved the list of courses and syllabi for the courses offered as Open Elective in VI semester B. Tech for all other branches under V18 Regulation and the details are given in Annexure III.

Item No. 5: Approval for offering minor degree in DATA SCIENCE offered by Department of Computer Science and Engineering for B. Tech Electrical and Electronics Engineering students under V18 Regulation

Approved to offer the minor degree in DATA SCIENCE for B. Tech Electrical and Electronics Engineering students under V18 Regulation.

Dr. Sudha Rani Donepudi

(BOS Chairperson)

Dr. Sudha Rani Donepudi, M.E., Ph.D
Head of the Department
Electrical & Electronics Engineering
SRI VASAVI ENGINEERING COLLEGE
(Autonomous)

Annexure I
Course Structure Approved in BOS Meetings

Course Structure of Electrical and Electronics Engineering - V18 Regulation

V Semester						
S.No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**Credits**
1.	V18EET12	Switchgear & Protection	3	-	-	3
2.	V18EET13	Power Electronics	3	1	-	4
3.	V18EET14	Power System Analysis	3	1	-	4
4.	V18EET15	Control Systems	3	1	-	4
5.	V18EET16	Signals and Systems	3	1	-	4
6.	V18MBT51	Managerial Economics and Financial Analysis	3	-	-	3
7.	V18EEL06	Electrical Machines Laboratory - II	-	-	2	1
8.	V18EEL07	Control Systems Laboratory	-	-	2	1
9.	V18ENT05	Professional Communication Skills– III	3	-	-	MNC
		Total Contact Hours(29)	**21**	**4**	**4**	**24**

Certification Course – Enrolment of Certification Course will be initiated during V Semester.

VI Semester						
S.No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**Credits**
1.	V18EET17	Electrical Drives	3	1	-	4
2.	V18ECT23	Fundamentals of Microprocessors & Microcontrollers	3	1	-	4
3.	V18EET18 V18EET19 V18EET20 V18EET21	Professional Elective - I ➢ Utilization of Electrical Energy ➢ Advanced Control Systems ➢ Renewable Energy Systems ➢ Advanced Power Electronics	3		-	3
4.	V18EET22 V18EET23 V18EET24 V18EET25	Professional Elective – II ➢ HVAC & HVDC Transmission ➢ Programmable Logic Controllers &its Applications ➢ Electrical Energy Conservation, Management & Auditing ➢ Special Electrical Machines	3	-	-	3
5.		Open Elective – I	3	-	-	3
6.	V18EEL08	Power Electronics Laboratory	-	-	2	1
7.	V18EEL09	Electrical Simulation Laboratory	-	-	2	1
8.	V18ECL10	Microprocessors & Microcontrollers Laboratory	-	-	2	1
9.	V18ENT06	Professional Communication Skills– IV	3	-	-	MNC
		Total Contact Hours(26)	**18**	**2**	**6**	**20**

Annexure II

Syllabi for the courses offered in V & VI semesters B. Tech under V18 Regulation.

Programme : B. Tech - Electrical & Electronics Engineering Semester: V
Course Code : V18EET12
Course Name : Switchgear & Protection **[L : 3; T:0; P : 0 (3 credits)]**
Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C301.1	Understand the arc interruption phenomenon in circuit breakers of oil, air, vacuum, SF6 gas type.	(K2)
C301.2	Extract the constructional features and working of different types of electromagnetic relays	(K2)
C301.3	Use suitable relay for different types of protection	(K3)
C301.4	Relate protective schemes of generators and transformers against different faults	(K3)
C301.5	Apply suitable protective scheme for the protection of feeders & bus bars	(K3)
C301.6	Illustrate the operation of static & digital relays and the concept of grounding	(K2)

UNIT–I:CIRCUIT BREAKERS

Miniature Circuit Breaker(MCB)– Elementary principles of arc interruption– Restriking Voltage and Recovery voltages– Restriking phenomenon - RRRV– Average and Max. RRRV– Current chopping and Resistance switching– Introduction to oil circuit breakers– Description and operation of Air Blast– Vacuum and SF6 circuit breakers– CB ratings and specifications– Concept of Auto reclosing.

UNIT–II:ELECTROMAGNETIC PROTECTION

Relay connection – Balanced beam type attracted armature relay - induction disc and induction cup relays– Torque equation - Relays classification–Instantaneous– DMT and IDMT types.

UNIT-III: APPLICATIONS OF RELAYS

Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation– Distance relays: Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.

UNIT–IV:

GENERATOR PROTECTION

Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples.

TRANSFORMER PROTECTION

Percentage differential protection– Design of CT's ratio– Buchholz relay protection–Numerical examples.

UNIT–V:FEEDER AND BUS BAR PROTECTION

Protection of lines: Over current Protection schemes – PSM,TMS - Numerical examples - Carrier current and three zone distance relay using impedance relays–Protection of bus bars by using Differential protection.

UNIT–VI:

STATIC AND DIGITAL RELAYS

Static relays: Static relay components– Static over current relays– Static distance relay– Micro Processor based digital relays.

NEUTRAL GROUNDING

Effects of ungrounded neutral on system performance– Methods of neutral grounding: Solid–resistance– Reactance–Arcing grounds and grounding Practices.

TEXT BOOKS:

1. Power System Protection and Switchgear by Badari Ram and D.N Viswakarma, TMH Publications, 2007
2. Power System Protection and Switchgear by B. Ravindranath, M. Chander, New Age International, 1977
3. Power system protection- Static Relays with microprocessor applications by T. S. Madhava Rao, TMH, 2017

REFERENCE BOOKS:

1. Fundamentals of Power System Protection by Paithankar and S. R. Bhide., PHI, 2003.
2. Art & Science of Protective Relaying – by C R Mason, Wiley Eastern Ltd, 1956.
3. Protection and Switch Gear by Bhavesh Bhalja, R.P. Maheshwari, Nilesh G.Chothani, Oxford University Press, 2013

Programme : **B. Tech - Electrical & Electronics Engineering** **Semester: V**

Course Code : V18EET13
Course Name : Power Electronics **[L : 3; T:1; P : 0 (4 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C302.1	Sketch the characteristics of various power semiconductor devices and Illustrate various firing circuits for SCR.	(K3)
C302.2	Operate various 1-phase AC-DC Controlled rectifiers for R and RL Loads and compare their performances.	(K3)
C302.3	Operate various 3-phase AC-DC Controlled rectifiers for R and RL Loads and compare their performances.	(K3)
C302.4	Understand the operation of various DC-DC Converters.	(K2)
C302.5	Explain the working of AC-AC Regulators and Estimate their output voltages.	(K3)
C302.6	Understand the operation of various DC-AC Converters for R & RL Loads.	(K2)

UNIT–I:POWER SEMICONDUCTOR DEVICES

Thyristors–Silicon Controlled Rectifiers (SCR's) –Characteristics of Power MOSFET and Power IGBT– Basic theory of operation of SCR–Static characteristics– Turn on and turn off methods–Dynamic characteristics of SCR– Snubber circuit design– Triggering circuits for SCR (R & RC).

UNIT–II:AC-DC SINGLE-PHASE CONVERTERS

1-phase half wave controlled rectifiers for R load and RL load with and without freewheeling diode;1-phase full wave controlled rectifiers: Center tapped and bridge configurations for R load and RL load with and without freewheeling diode under continuous and discontinuous conduction modes; Effect of source inductance in 1-phase fully controlled bridge rectifier with continuous conduction.

UNIT–III:AC-DC 3-PHASE CONVERTERS

3-phase half wave controlled rectifier with R and RL loads; 3-phase semi controlled rectifier with R and RL loads; 3-phase fully controlled rectifier with R and RL loads.

UNIT–IV:DC–DC CONVERTERS

Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) – Output voltage equations using volt- sec balance in CCM & DCM output voltage ripple & inductor current, ripple for CCM only – Principle operation of forward and fly back converters in CCM.

UNIT – V:AC – AC REGULATORS

Static V-I characteristics of TRIAC and modes of operation; 1-phase AC-AC regulator: Phase angle control and integrated cycle control with R and RL loads for continuous and discontinuous conduction modes; 3-Phase AC-AC regulators with R load only; Transformer tap changing using antiparallel Thyristors.

UNIT – VI:DC–AC CONVERTERS

1-phase half and full bridge inverters with R and RL loads; 3-phase square wave inverters: 120 degree conduction and 180 degree conduction modes of operation; PWM inverters: Quasi-square wave, pulse width modulation, Sinusoidal pulse width modulation, Prevention of shoot through fault in Voltage Source Inverter (VSI); Current Source Inverter (CSI): Introduction to Auto Sequential Commutated Current Source Inverter (ASCCSI)

TEXT BOOKS:

1. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
2. Power Electronics – by P.S. Bhimbra, Khanna Publishers, 2014
3. Power Electronics: Essentials & Applications by L. Umanand, Wiley, Pvt. Limited, India, 2009

REFERENCE BOOKS:

1. Elements of Power Electronics–Philip T. Krein, Oxford, 2015.
2. Power Electronics by M. D. Singh, Tata McGraw Hill India, 2006
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.
4. Power Electronics handbook by Muhammad H.Rashid, Elsevier, 2018.
5. Power Electronics: converters, applications & design -by Nedmohan, Tore M. Undeland, Robbins by Wiley India Pvt. Ltd., 2018
6. Power Converter Circuits -by William Shepherd, Li zhang, CRC Taylor & Francis Group, 2017

Programme : B. Tech - Electrical & Electronics Engineering Semester: V

Course Code : V18EET14
Course Name : Power System Analysis **[L : 3; T:1; P : 0 (4 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C303.1	Compute Y_{BUS} matrix for a power system network	(K3)
C303.2	Find the load flow solution of a power system network using load flow methods	(K3)
C303.3	Develop the Z_{BUS} for a power system network	(K3)
C303.4	Calculate the fault currents for symmetrical faults	(K3)
C303.5	Compute the sequence components of currents for unbalanced power system network	(K3)
C303.6	Understand the concepts of power system stability	(K2)

UNIT –I:PER UNIT REPRESENTATION & TOPOLOGY

Per Unit Quantities–Single line diagram– Impedance diagram of a power system–Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y_{BUS} matrix by singular transformation and direct inspection methods.

UNIT –II: POWER FLOW STUDIES

Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) –Decoupled and Fast Decoupled methods – Algorithmic approach – Problems on 3–bus system only.

UNIT –III:Z_{BUS} FORMULATION

Formation of Z_{BUS}: Partial network– Algorithm for the Modification of Z_{BUS} Matrix for addition element for the following cases: Addition of element from a new bus to reference– Addition of element from a new bus to an old bus– Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).– Modification of Z_{BUS} for the changes in network (Problems).

UNIT – IV:SYMMETRICAL FAULT ANALYSIS

Transients on a Transmission line-Short circuit of synchronous machine(on no-load) - 3– Phase short circuit currents and reactances of synchronous machine–Short circuit MVA calculations -Series reactors – selection of reactors.

UNIT –V:SYMMETRICAL COMPONENTS & FAULT ANALYSIS

Definition of symmetrical components - symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances – Synchronous generator – Transmission line and

transformers – Sequence networks –Various types of faults LG– LL– LLG and LLL on unloaded alternator– unsymmetrical faults on power system.

UNIT – VI:POWER SYSTEM STABILITY ANALYSIS

Elementary concepts of Steady state– Dynamic and Transient Stabilities– Description of Steady State Stability Power Limit–Transfer Reactance–Synchronizing Power Coefficient – Power Angle Curve and Determination of Steady State Stability –Derivation of Swing Equation–Determination of Transient Stability by Equal Area Criterion–Applications of Equal Area Criterion–Methods to improve steady state and transient stability.

TEXT BOOKS:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill, 1994.
2. Modern Power system Analysis – by I. J. Nagrath& D. P. Kothari: Tata McGraw–Hill Publishing Company, 2nd edition,2011.

REFERENCE BOOKS:

1. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc, 1999.
2. Power System Analysis by HadiSaadat – TMH Edition, 2002.
3. Power System Analysis by B.R.Gupta, Wheeler Publications, 1998.
4. Power System Analysis and Design by J.Duncan Glover, M.S.Sarma, T.J.Overbye –Cengage Learning publications, 2017.

Programme : B. Tech - Electrical & Electronics Engineering, Semester: V
Electronics & Communication Engineering&
Electronics & Communication Technology

Course Code : V18EET15
Course Name : Control Systems **[L : 3; T:1; P : 0 (4 credits)]**
Course Outcomes
After successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C304.1	Determine the mathematical modelling of physical systems	(K3)
C304.2	Calculation of Time Domain Specification of first and second order systems and understand the effect of Controllers	(K3)
C304.3	Investigate the stability of closed loop systems using Routh's stability criterion and root locus method.	(K3)
C304.4	Find the stability of control systems using frequency response approaches.	(K3)
C304.5	Discuss the basic aspects of design and compensation of linear control systems using bode plot.	(K3)
C304.6	Analyze physical systems using state space approach.	(K4)

UNIT – I:MATHEMATICAL MODELING OF CONTROL SYSTEMS

Classification of control systems, Open Loop and closed loop control systems and their differences, Feed-Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Transfer Function of DC Servo motor - AC Servo motor-Synchro, transmitter and receiver - Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT-II:TIME RESPONSE ANALYSIS

Standard test signals - Time response of first and second order systems - Time domain specifications - Steady state errors and error constants – Effects of various controllers

UNIT – III:STABILITY AND ROOT LOCUS TECHNIQUE

The concept of stability – Routh's stability criterion –limitations of Routh's stability –Root locus concept - construction of root loci (Simple problems)

UNIT–IV:FREQUENCY RESPONSE ANALYSIS

Introduction to Frequency domain specifications-Bode diagrams- transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots, Nyquist Stability criterion.

UNIT–V:CLASSICAL CONTROL DESIGN TECHNIQUES

Lag, Lead, Lag-Lead compensators, design of compensators – using Bode plots.

UNIT–VI:STATE SPACE ANALYSIS OF LTI SYSTEMS

Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- Solving the time invariant state equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

TEXT BOOKS:

1. Control Systems principles and design, M. Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition, 2014.
2. Automatic control systems, Benjamin C. Kuo, Prentice Hall of India,2ndEdition, 2014.

REFERENCE BOOKS:

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India, 2002.
2. Control Systems, ManikDhanesh N, Cengage Publications, 2012.
3. Control Systems Engineering, I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition, 2007.
4. Control Systems Engineering, S.Palani, Tata McGraw Hill Publications, 2009.

Programme : B. Tech - Electrical & Electronics Engineering Semester: V

Course Code : V18EET16
Course Name : Signals and Systems **[L : 3; T:1; P : 0 (4 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C305.1	Understand and estimate various types of signals and systems.	(K2)
C305.2	Understand the basic principles of Sampling Theorem.	(K2)
C305.3	Understand the characteristics of LTI and LTV Systems and Determine the Transfer Function of LTI.	(K3)
C305.4	Understand the concepts of Cross-Correlation and Auto-Correlation of Functions	(K2)
C305.5	Differentiate Laplace Transform, Fourier Transform and apply the concept of Laplace Transform to certain signals using waveform synthesis.	(K4)
C305.6	Distinguish Laplace Transform, Fourier Transform and Z-Transforms by understanding the principles and properties of Z-Transform and its Inverse Transform.	(K4)

UNIT- I:INTRODUCTION

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions.

UNIT –II:SAMPLING THEOREM

Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling.

UNIT-III:ANALYSIS OF LINEAR SYSTEMS

Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

UNIT-IV:CROSS-CORRELATION AND AUTO-CORRELATION OF FUNCTIONS

Properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

UNIT –V:LAPLACE TRANSFORMS

Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

UNIT –VI:Z–TRANSFORMS

Fundamental difference between continuous-time and discrete-time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms.

TEXT BOOKS:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn, 1996.
3. Signals & Systems- Narayan Iyer and K Satya Prasad, Cenage Publications, 1996.

REFERENCE BOOKS:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition, 2017.
2. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press, 2015
3. Signals and Systems – K Raja Rajeswari, B VisweswaraRao, PHI, 2009
4. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.
5. Signals and Systems – T K Rawat , Oxford University press, 2011

Programme : B. Tech - Electrical & Electronics Engineering Semester: V

Course Code : V18MBT51
Course Name : Managerial Economics and Financial Analysis **[L : 3; T:0; P : 0 (3 credits)]**
(Already Approved by BOS of MBA)

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C306.1	Understand the basic concepts of managerial economics, demand, and elasticity of demand and methods of demand forecasting.	(K2)
C306.2	Estimate the production function with one, two and infinite variables. Understand various cost concepts and calculating breakeven point	(K2)
C306.3	Understand and showing a price output determination in different types of market structures and knowing various pricing methods	(K2)
C306.4	Understand various forms of business organizations	(K2)
C306.5	Prepare financial statements and its analysis.	(K3)
C306.6	Appraise the projects by using various capital budgeting methods	(K4)

UNIT-I:INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS:

Definition of Managerial Economics -Scope of Managerial Economics and its relationship with other subjects - Concept of Demand, Types of Demand, Determinants of Demand, Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting.

UNIT-II: **PRODUCTION AND COST ANALYSES**

Concept of Production function- Cobb Douglas Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs and Total Cost-Cost-Volume-Profit analysis Determination of Breakeven point(simple problems)Managerial significance and limitations of Breakeven point.

UNIT-III: INTRODUCTION TO MARKETS, & PRICING POLICIES

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly - Features - Price and Output Determination- Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing, Flat Rate Pricing, Usage sensitive pricing and Priority Pricing.

UNIT-IV:TYPES OF BUSINESS ORGANIZATION AND BUSINESS CYCLES

Features and Evaluation of Sole Trader, Partnership, Joint Stock Company ñ State/Public Enterprises and their forms - Business Cycles : Meaning and Features - Phases of Business Cycle.

UNIT-V:INTRODUCTION TO ACCOUNTING & FINANCING ANALYSIS

Introduction to Double Entry Systems- Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis

UNIT-VI: **CAPITAL AND CAPITAL BUDGETING**

Capital Budgeting: Meaning of Capital Capitalization-Meaning of Capital Budgeting-Time value of money-Methods of appraising Project profitability: Traditional Methods and modern methods (simple problems)

TEXT BOOKS:

1. eManagerial Economics and Financial Analysisí by Dr. N. Appa Rao, Dr. P. Vijay Kumar, Cengage Publications, New Delhi ñ 2011
2. Managerial Economics and Financial Analysis by Dr. A. R. Aryasri, TMH 2011
3. Managerial Economics and Financial Analysis, Prof. J.V. Prabhakararao, Prof. P. Venkatarao, Ravindra Publication.

REFERENCE BOOKS:

1. Managerial Economics & Financial Analysis by Dr. B. Kuberudu and Dr. T. V. Ramana, Himalaya Publishing House, 2014.
2. Managerial Economics by V. Maheswari, Sultan Chand 2014.
3. Managerial Economics by Suma Damodaran, Oxford 2011.
4. Managerial Economics by Vanitha Agarwal, Pearson Publications 2011.
5. Financial Accounting for Managers by Sanjay Dhameja, Pearson.
6. Financial Accounting by Maheswari, Vikas Publications.
7. Managerial Economics and Financial Analysis by S. A. Siddiqui & A. S. Siddiqui, New Age International Publishers, 2012.
8. Indian Economy by Ramesh Singh, 7th Edn, TMH2015.
9. A Text Book of Microeconomic Theory by Pankaj Tandon, Sage Publishers, 2015.

Programme : **B. Tech - Electrical & Electronics Engineering** **Semester: V**
Course Code : V18EEL06
Course Name : Electrical Machines Laboratory - II **[L : 0; T:0; P : 2 (1 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C307.1	Pre-determine the performance parameters of 3-phase induction motor by conducting no-load and blocked rotor tests.	(K3)
C307.2	Sketch the performance characteristics of 3-phase induction motor by conducting brake test.	(K3)
C307.3	Pre-determine the performance parameters of cylindrical pole synchronous machine by conducting OC and SC tests.	(K3)
C307.4	Determine the direct and quadrature axis reactances by conducting slip test.	(K3)
C307.5	Determine V and inverted V curves through synchronization of synchronous machine to mains.	(K3)
C307.6	Calculate the equivalent circuit parameters of a 1-phase transformer by conducting OC and SC Tests.	(K3)

The following experiments are required to be conducted as compulsory experiments:

1. Brake test on three phase Induction Motor
2. No–load & Blocked rotor tests on three phase Squirrel Cage Induction motor
3. Load test on three phase slip ring induction motor
4. No–load & Blocked rotor tests on three phase Slip Ring Induction motor
5. Regulation of a three –phase alternator by synchronous impedance &m.m.f. Methods
6. Regulation of three–phase alternator by Potier triangle method
7. V and Inverted V curves of a three—phase synchronous motor.
8. Determination of Xd and Xq of a salient pole synchronous machine
9. Equivalent circuit of single phase induction motor
10. Speed control of induction motor by V/f method.
11. Determination of efficiency of three phase alternator by loading with three phase induction motor.
12. Power factor improvement of single phase induction motor by using capacitors and load test on single phase induction motor.
13. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers.

Programme : B. Tech - Electrical & Electronics Engineering Semester: V

Course Code : V18EEL07
Course Name : Control Systems Laboratory [L : 0; T:0; P : 2 (1 credits)]

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C308.1	Find time response of given control system model.	(K3)
C308.2	Analyze the performance and working of Magnetic amplifier, D.C. servo motors, A.C. Servo motors and synchronous motors.	(K4)
C308.3	Analyze PID controllers for given control system model.	(K4)
C308.4	Analyze lead, lag and lead-lag systems in control system	(K4)
C308.5	Determine the transfer function of D.C. motor and D.C Generator.	(K4)
C308.6	Examine the control of temperature using PID controller.	(K3)

Any 10 of the following experiments are to be conducted:

1. Time response of Second order system

2. Characteristics of Synchros

3. Programmable logic controller – characteristics of stepper motor

4. Effect of feedback on DC servo motor

5. Effect of P, PD, PI, PID Controller on a second order systems

6. Lag and lead compensation – Magnitude and phase plot

7. DC position control system

8. Transfer function of DC motor

9. Temperature controller using PID

10. Characteristics of magnetic amplifiers

11. Characteristics of AC servo motor

12. Characteristics of DC servo motor

13. Potentiometer as an error detector

Programme : B. Tech - Electrical & Electronics Engineering Semester: VI

Course Code : V18EET17
Course Name : Electrical Drives **[L : 3; T:1; P : 0 (4 credits)]**
Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C311.1	Understand the fundamentals concept about an electric drive and different electric braking methods	(K2)
C311.2	Operate Chopper fed DC motor drives in various quadrants	(K4)
C311.3	Understand the closed loop operation of chopper fed dc motor drives	(K2)
C311.4	Compute the change in speed of three phase induction motor using solid state converters	(K3)
C311.5	Illustrate the speed control of induction motor using scalar control methods	(K3)
C311.6	Analyze the speed control of induction motor using rotor resistance control and various slip power recovery schemes	(K4)

UNIT-I: DC MOTOR CHARACTERISTICS

Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation.

UNIT-II: CHOPPER FED DC DRIVES

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple calculation. Single-quadrant, two-quadrant and four-quadrant choppers fed dc drive; steady-state operation of multi-quadrant chopper fed dc drives, regenerative braking.

UNIT-III: CLOSED-LOOP CONTROL OF DC DRIVES

Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design.

UNIT-IV: INDUCTION MOTOR CHARACTERISTICS

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque- speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

UNIT-V: SCALAR CONTROL OR CONSTANT V/F CONTROL OF INDUCTION MOTOR

Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation.

UNIT-VI: CONTROL OF SLIP RING INDUCTION MOTOR

Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.

TEXT BOOKS

1. Power Semiconductor Controlled Drives by G. K. Dubey, Prentice Hall, 1989.
2. Electric Motor Drives: Modeling, Analysis and Control by R. Krishnan, Prentice Hall, 2001.

REFERENCE BOOKS

1. Fundamentals of Electrical Drives by G. K. Dubey, CRC Press, 2002.
2. Control of Electric Drives by W. Leonhard, Springer Science & Business Media, 2001.

Programme : **B. Tech - Electrical & Electronics Engineering** **Semester: VI**

Course Code : V18EET18
Course Name : Utilization of Electrical Energy **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C311.1	Choose a suitable motor for electric drives and industrial applications	(K3)
C311.2	Identify appropriate heating techniques for different applications	(K3)
C311.3	Identify appropriate welding techniques for different applications	(K3)
C311.4	Recognise lightning system for particular inputs and constraints in view	(K2)
C311.5	Determine the speed-time characteristics of traction motors	(K3)
C311.6	Estimate energy consumption levels at various modes of operation	(K3)

UNIT – I: SELECTION OF MOTORS

Choice of motor, type of electric drives, starting and running characteristics – Speed control – Temperature rise – Applications of electric drives – Types of industrial loads – Continuous, Intermittent and variable loads – Load equalization.

UNIT – II: ELECTRIC HEATING

Advantages and methods of electric heating–Resistance heating, induction heating and dielectric heating – Arc furnaces – Direct and indirect arc furnaces.

UNIT – III: ELECTRIC WELDING

Classification - Resistance welding and types - Arc welding and types – Electric welding equipment– Comparison between AC and DC Welding

UNIT – IV: ILLUMINATION

Basic terms used in illumination – Laws of illumination – MHCP and MSCP - Polar curves – Sources of light: Working of Filament lamps, Arc lamps and Discharge lamps.

Basic principles of light control – Types of lighting schemes – Street, Flood and LED lighting – Lumen or flux method of lighting calculation – Numerical Examples.

UNIT – V: ELECTRIC TRACTION – I

Review of existing electric traction systems in India – System of electric traction and track electrification– Special features of traction motor – Mechanics of train movement – Speed-time curves for different services – Trapezoidal and quadrilateral speed time curves – High speed transportation trains.

UNIT – VI: ELECTRIC TRACTION – II

Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking, retardation adhesive weight and coefficient of adhesion–Modern traction motors.

TEXT BOOKS:

1. Utilization of Electric Energy by E. Openshaw Taylor, SI Edition, Orient Longman, 1971.
2. Art and Science of Utilization of Electrical Energy by H. Partab, DhanpatRai& Sons, 2006.

REFERENCE BOOKS:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N. V. Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Generation, Distribution and Utilization of electrical Energy – by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1997.

Programme : B. Tech - Electrical & Electronics Engineering Semester: VI

Course Code : V18EET19
Course Name : Advanced Control Systems **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C311.1	Understand the concepts of State Space Analysis	(K2)
C311.2	Find the concepts of Controllability, Observability and development of pole placement techniques	(K3)
C311.3	Demonstrate the non-linear systems behaviour by Phase Plane and describing function analysis	(K3)
C311.4	Compute the stability of linear and non-linear systems by Lypunov's Method	(K3)
C311.5	Illustrate the principle of Calculus of Variation, Optimality and its Applicants	(K3)
C311.6	Develop the Linear quadratic Regulator (LQR) and Optimal regulator design by using Lypunov's Method	(K3)

UNIT – I: STATE SPACE ANALYSIS

Introduction to State Space Analysis, State Space Representation using physical, phase and Canonical variables.

UNIT – II: CONTROLLABILITY, OBSERVABILITY AND DESIGN OF POLE PLACEMENT

Tests for controllability and observability for continuous time systems – Time varying case – Minimum energy control – Time invariant case – Principle of duality – Controllability and observability form Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement.

UNIT – III: DESCRIBING FUNCTION ANALYSIS

Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane analysis.

UNIT–IV: STABILITY ANALYSIS

Stability in the sense of Lyapunov – Lyapunov's stability and Lypanov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

UNIT–V: CALCULUS OF VARIATIONS

Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints – Euler lagrangine equation.

UNIT –VI: OPTIMAL CONTROL

Linear Quadratic Optimal Regulator (LQR) problem formulation – Optimal regulator design by parameter adjustment (Lyapunov method) – Optimal regulator design by Continuous Time Algebraic Riccatti equation (CARE) - Optimal controller design using LQG framework.

TEXT BOOKS:

1. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998.
2. Automatic Control Systems by B.C. Kuo, Prentice Hall Publication, 9th edition, 2014.

REFERENCE BOOKS:

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition,1996.
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd, 6th edition, 2018.
3. Digital Control and State Variable Methods – by M. Gopal, Tata McGraw–Hill Companies, 4th Edition, 2017.
4. Systems and Control by Stainslaw H. Zak , Oxford Press, 1st Edition, 2003.
5. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications,1st Edition, 2004.

Programme : B. Tech - Electrical & Electronics Engineering Semester: VI

Course Code : V18EET20
Course Name : Renewable Energy Systems **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C311.1	Understand the solar radiation and calculate geometric angle	(K3)
C311.2	Understand the working of solar thermal collectors	(K2)
C311.3	Understand the working of solar photo voltaic systems and develop the maximum power point techniques	(K3)
C311.4	Understand the wind energy conversion systems ,Betz coefficient and tip speed ratio	(K2)
C311.5	Understand the basic principle and working of hydro and tidal systems.	(K2)
C311.6	Understand the basic principle and working of, biomass, fuel cell and geothermal systems.	(K2)

UNIT–I: FUNDAMENTALS OF ENERGY SYSTEMS AND SOLAR ENERGY ENERGY CONSERVATION PRINCIPLE

Energy scenario (world and India) – various forms of renewable energy - Solar radiation: Outside earth's atmosphere – Earth surface – Analysis of solar radiation data – Geometry – Radiation on tilted surfaces – Numerical problems.

UNIT–II: SOLAR THERMAL SYSTEMS

Liquid flat plate collectors: Performance analysis –Transmissivity– Absorptivity product collector efficiency factor – Collector heat removal factor – Numerical problems. Introduction to solar air heaters – Concentrating collectors, solar pond and solar still – solar thermal plants.

UNIT–III: SOLAR PHOTOVOLTAIC SYSTEMS

Solar photovoltaic cell, module, array – construction – Efficiency of solar cells – Developing technologies – Cell I-V characteristics – Equivalent circuit of solar cell – Series resistance – Shunt resistance – Applications and systems – Balance of system components - System design: storage sizing – PV system sizing – Maximum power point techniques: Perturb and observe (P&O) technique – Hill climbing technique.

UNIT–IV: WIND ENERGY

Sources of wind energy - Wind patterns – Types of turbines –Horizontal axis and vertical axis machines - Kinetic energy of wind – Betz coefficient – Tip–speed ratio – Efficiency – Power output of wind turbine –

Selection of generator(synchronous, induction) – Maximum power point tracking – wind farms – Power generation for utility grids.

UNIT–V: HYDRO AND TIDAL POWER SYSTEMS

Basic working principle – Classification of hydro systems: Large, small, micro – measurement of head and flow – Energy equation – Types of turbines – Numerical problems. Tidal power – Basics – Kinetic energy equation – Turbines for tidal power - Numerical problems – Wave power – Basics – Kinetic energy equation – Wave power devices – Linear generators.

UNIT–VI: BIOMASS, FUEL CELLS AND GEOTHERMAL SYSTEMS BIOMASS ENERGY

Fuel classification – Pyrolysis – Direct combustion of heat – Different digesters and sizing. Fuel cell: Classification of fuel for fuel cells – Fuel cell voltage– Efficiency – V-I characteristics. Geothermal: Classification – Dry rock and hot acquifer – Energy analysis – Geothermal based electric power generation

TEXT BOOKS:

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition, 2013.
2. Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis - second edition,2013.

REFERENCE BOOKS:

1. Energy Science: Principles, Technologies and Impacts, John Andrews and Nick Jelly, Oxford University Press, 2nd edition, 2013.
2. Renewable Energy- Edited by Godfrey Boyle-oxford university.press,3rd edition,2013.
3. Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore, 2011.
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa.
5. Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI, 2008.
6. Non conventional energy source –B.H.khan- TMH-2nd edition, 2017.

7. **Programme : B. Tech - Electrical & Electronics Engineering** **Semester: VI**

Course Code : V18EET21
Course Name : Advanced Power Electronics **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C309.1	Analyze and design power converter configurations for specific applications	(K3)
C309.2	Design power electronic converters to improve power quality	(K3)
C309.3	Analyze and design resonant converters	(K3)
C309.4	Develop power converter models under steady state and small signal conditions	(K3)
C309.5	Determine duty cycle and transfer functions for buck, boost and buck-boost converters	(K3)
C309.6	Synthesize and design magnetic components for power converters	(K4)

UNIT-I: DC-DC CONVERTERS

Non-isolated DC-DC converters: buck, boost, buck-boost, CUK converters under continuous and discontinuous conduction operation - Isolated DC-DC converters: forward, fly-back, push-pull, half-bridge and full-bridge converters - Relationship between I/P and O/P voltages – design of filter inductor and capacitors.

UNIT-II: FRONT-END (AC-DC) CONVERTERS

Conventional methods of power factor improvements: Semi converter, extinction angle control, symmetrical angle control – active front-end converters-Single phase: Boost, voltage doubler and PWM rectifiers –voltage and current controlled three-phase PWM rectifiers

UNIT-III: RESONANT CONVERTERS

Introduction, Basic resonant circuit concepts, Classification - Load resonant converters, resonant switch converters, Zero voltage switching clamped voltage converters, Resonant DC link inverters High frequency link integral half cycle converters, Phase modulated resonant converters, Dual active bridge converters, High gain converters.

UNIT-IV: MODELLING OF DC-DC CONVERTERS

Basic ac modelling approach, State space averaging, Circuit averaging and averaged switch modelling, Canonical circuit modelling, Converter transfer functions for buck, boost and buck-boost topologies.

UNIT-V: CURRENT MODE CONTROL

Introduction, types, advantages and disadvantages, Slope compensation, Determination of duty cycle and transfer functions for buck, boost and buck-boost converters.

UNIT-VI: DESIGN OF POWER CONVERTERS COMPONENTS

Design of magnetic components - design of transformer, design of inductor and current transformer - Selection of filter capacitors, Selection of ratings for devices, input filter design, Thermal design.

TEXT BOOKS:

1. Power Electronics-Circuits, Devices & Applications by M.H. Rashid, Pearson, 4thedition, 2013.
2. Power Electronics: Converters, Applications & Design by N. Mohan, T.M. Undeland, W.P. Robbins, J.Wiley & Sons, 3rd Edition, 2003.
3. Power Electronics by Daniel W. Hart, McGraw-Hill, 2011.

REFERENCES BOOKS:

1. Switching Power Supply Design by Abraham I. Pressman, Keith Billings & Taylor Morey, McGraw Hill International, 3rd Edition, 2009.
2. Fundamentals of Power Electronics by R.W. Erickson and Dragan Maksimonic, Springer, 2nd Edition, 2001.
3. Power Electronics: Essentials and Applications by Umanand.L, John Wiley India, 1st Edition, 2009.

Programme : B. Tech - Electrical & Electronics Engineering Semester: VI

Course Code : V18EET22
Course Name : HVAC & HVDC Transmission **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C312.1	Calculate electrical parameters of EHVAC lines	(K3)
C312.2	Compute corona loss , radio interference and excitation function	(K3)
C312.3	Understand the phenomena of HVDC transmission systems	(K2)
C312.4	Choose suitable converter configuration for HVDC converters and system control	(K4)
C312.5	Understand the requirements of reactive power control in HVDC systems	(K2)
C312.6	Calculate various parameters required for designing filters	(K3)

UNIT – I: INTRODUCTION OF EHV AC TRANSMISSION

Necessity of EHV AC transmission – Advantages and problems – Power handling capacity and line losses – Mechanical considerations – Resistance of conductors –Electrostatics – Field of sphere gap – Field of line charges and properties – Charge ~ potential relations for multi–conductors – Surface voltage gradient on conductors – Bundle spacing and bundle radius – Examples – Distribution of voltage gradient on sub conductors of bundle – Examples.

UNIT – II: CORONA EFFECTS

Power loss and audible noise (AN) – Corona loss formulae – Charge voltage diagram – Generation – Characteristics – Limits and measurements of AN – Relation between 1–phase and 3–phase AN levels – Examples – Radio interference (RI) – Corona pulses generation – Properties and limits – Frequency spectrum – Modes of propagation – Excitation function – Measurement of RI, RIV and excitation functions – Examples.

UNIT – III: BASIC CONCEPTS OF DC TRANSMISSION ECONOMICS & TERMINAL EQUIPMENT OF HVDC TRANSMISSION SYSTEMS

Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC transmission – Application of DC Transmission System – Planning & Modern trends in DC transmission.

UNIT – IV: ANALYSIS OF HVDC CONVERTERS AND SYSTEM CONTROL

Choice of Converter configuration – Analysis of Graetz – Characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in Star – Star mode and their performance – Principal of DC Link Control –

Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system – Starting and stopping of DC link – Power Control.

UNIT–V: REACTIVE POWER CONTROL IN HVDC

Reactive Power Requirements in steady state – Conventional control strategies –Alternate control strategies sources of reactive power – AC Filters – Shunt capacitors – Synchronous condensers.

UNIT – VI: HARMONICS AND FILTERS

Generation of Harmonics – Characteristics harmonics – Calculation of AC Harmonics – Non–Characteristics harmonics – Adverse effects of harmonics – Calculation of voltage & current harmonics – Effect of Pulse number on harmonics. Types of AC filters, Design of Single tuned filters – Design of High pass filters.

TEXT BOOKS:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited and Publishers, 2nd Edition, 2005.
2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons, Volume1, 1971.
3. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (P) Ltd, 3rd Edition, 2006.

REFERENCE BOOKS:

1. EHVAC and HVDC Transmission Engineering and Practice – S.Rao, Khanna Publishers, 3rd Edition, 1993.
2. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications, 2004.
3. HVDC Transmission – J. Arrillaga, IET Publishers, 1998.

Programme : **B. Tech - Electrical & Electronics Engineering** **Semester: VI**
Course Code : V18EET23
Course Name : Programmable Logic Controllers andits Applications **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C312.1	Understand working of PLC, I/O Modules of PLC and PLC Ladder design	(K2)
C312.2	Understand different types of devices to which PLC Input and Output modules are connected	(K2)
C312.3	Apply of PLC timers and counters for the control of Industrial process	(K3)
C312.4	Illustrate the program control instructions	(K3)
C312.5	Demonstrate the Data Manipulation, Arithmetic, Logical and Sequential Instructions of PLC's	(K3)
C312.6	Development of different Applications using PLC's	(K3)

UNIT I: INTRODUCTION

PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT II: PLC PROGRAMMING

PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams and sequence listings, ladder diagram construction.

UNIT III: PROGRAMMABLE TIMERS AND COUNTERS

Timer instructions – On delay time instruction – Off delay timer instruction – Retentive timer – Counter instructions – Up counter – Down counter - Cascading counters - Incremental encoder – Counter applications – Combining counter and timer functions.

UNIT IV: PROGRAM CONTROL INSTRUCTIONS

Master control reset instruction – Jump instructions and sub routines – Immediate input and output instructions.

UNIT V: OTHER INSTRUCTIONS

Data manipulation – Data transfer operation – Data compare instruction – Data manipulation programs – Numerical data I/O interfaces – Math instructions – Addition, subtraction, multiplication & division instruction – Sequential instructions – Sequence programs – Shift registers – Word shift registers.

UNIT VI: APPLICATIONS

Control of water level indicator – Alarm monitor - Conveyor motor control – Parking garage – Ladder diagram for process control – PID controller.

TEXT BOOKS:

1. Programmable logic controllers by Frank D. Petruzella- McGraw Hill – 3rd Edition, 2014.
2. Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI, 1999.

REFERENCE BOOKS:

1. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. – Pearson, 2004.
2. Introduction to Programmable Logic Controllers- Gary Dunning- Cengage Learning, 3rd Edition, 2005.
3. Programmable Logic Controllers –W. Bolton-Elsevier publisher, 6th Edition, 2015.

4. **Programme : B. Tech - Electrical & Electronics Engineering Semester: VI**
Course Code : V18EET24
Course Name : Electrical Energy Conservation, Management & Auditing **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C312.1	Describe the concepts and procedures for Energy Audit & Management	(K2)
C312.2	Understand the necessity of Energy efficient lighting systems	(K2)
C312.3	Understand the operation of Energy instruments and their use in energy audit	(K2)
C312.4	Explain Energy Conservation measures in HVAC system	(K2)
C312.5	Understand various economic aspects of Energy systems	(K2)
C312.6	Apply life cycle costing analysis for various system or organizations	(K3)

UNIT–I: BASIC PRINCIPLES OF ENERGY AUDIT AND MANAGEMENT ENERGY AUDIT

Definitions – Concept – Types of audit – Energy index – Cost index – Pie charts –Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions – Language – Questionnaire – Check list for top management.

UNIT–II: LIGHTING MODIFICATION OF EXISTING SYSTEMS – REPLACEMENT OF EXISTING SYSTEMS – PRIORITIES:

Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level – Illumination of inclined surface to beam – Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers – Energy conservation measures.

UNIT–III: POWER FACTOR AND ENERGY INSTRUMENTS

Power factor – Methods of improvement – Location of capacitors – Power factor with non linear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters – Tong testers – Power analyzer.

UNIT–IV: SPACE HEATING AND VENTILATION

Ventilation – Air–Conditioning (HVAC) and Water Heating: Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air–conditioning – Insulation–Cooling load – Electric water heating systems – Energy conservation methods.

UNIT–V ECONOMIC ASPECTS AND FINANCIAL ANALYSIS

Understanding energy cost - Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts) – Economics of energy efficient motors and systems.

UNIT–VI: COMPUTATION OF ECONOMIC ASPECTS

Need of investment, appraisal and criteria - Calculation of simple payback period–Return on investment – Net present value – Internal rate of return – numerical examples – Power factor correction – Lighting – Applications of life cycle costing analysis – Return on investment – Numerical examples.

TEXT BOOKS:

1. Hand Book of Energy Audit by Sonal Desai- Tata McGraw hill, 2015.
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd–2nd edition, 1995.

REFERENCE BOOKS:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications, 2012.
2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi, 1991.
3. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998.
4. Energy management hand book by W.C.Turner, John wiley and sons, 6th Edition, 2006.
5. Energy management and conservation –k v Sharma and pvenkataseshaiah-I K International Publishing House pvt.ltd,2011.
6. http://www.energymanagertraining.com/download/Gazette_of_IndiaPartIISecI- 37_25-08-2010.pdf

Programme : B. Tech - Electrical & Electronics Engineering Semester: VI

Course Code : V18EET25
Course Name : Special Electrical Machines **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C312.1	Describe the operation and characteristics of permanent magnet dc motor	(K2)
C312.2	Understand the operation and control of stepper motors	(K2)
C312.3	Understand the operation and control of switched reluctance motor	(K2)
C312.4	Describe the operation and characteristics of brush less dc motor	(K2)
C312.5	Distinguish between square wave and sine wave brush less dc motor	(K3)
C312.6	Understand the construction and operation of linear induction motors	(K2)

UNIT I: PERMANENT MAGNET MATERIALS AND PMDC MOTORS

Introduction-classification of permanent magnet materials used in electrical machines-minor hysteresis loop and recoil line-Stator frames of conventional dc machines-Development of electronically commutated dc motor from conventional dc motor-Permanent-magnet materials and characteristics-B-H loop and demagnetization characteristics-Temperature effects: reversible and irreversible losses-high temperature effects-reversible losses- Irreversible losses recoverable by magnetization-Mechanical properties, handling and magnetization-Application of permanent magnets in motors-power density-operating temperature range-severity of operation duty.

UNIT II: STEPPER MOTORS

Classification of stepper motors – Hybrid and Variable Reluctance Motor (VRM) - Construction and principle of hybrid type synchronous stepper motor – Different configuration for switching the phase windings control circuits for stepper motors – Open loop and closed loop control of 2-phase hybrid stepping motor. Construction and principle of operation of Variable Reluctance Motor (VRM) – Single stack and multiple stack – Open loop control of 3- phase VR Stepper Motor- Applications.

UNIT III: SWITCHED RELUCTANCE MOTORS

Construction – Comparison of conventional and switched reluctance motors – Design of stator and rotor pole arcs – Torque producing principle and torque expression – Different converter configurations for SRM – Drive and power circuits for SRM – Position sensing of rotor – Applications of SRM.

UNIT IV: SQUARE WAVE PERMANENT MAGNET BRUSHLESS DC MOTOR

Types of constructions – Surface mounted and interior type permanent magnet – Principle of operation of BLDC motor. Torque and EMF equations – Torque speed characteristics – Performance and efficiency- Square wave brushless motors with 1200 and 1800 magnetic areas commutation.

UNIT V: SINE WAVE PERMANENT MAGNET BRUSHLESS MOTOR

Torque and EMF equations – Phasor Diagram – Circle diagram – Torque/speed characteristics – Comparison between square wave and sine wave permanent magnet motors - Applications.

UNIT VI: LINEAR INDUCTION MOTORS (LIM)

Construction– principle of operation–Double sided LIM from rotating type Induction Motor – Schematic of LIM drive for traction – Development of one sided LIM with back iron- equivalent circuit of LIM.

TEXT BOOKS:

1. Brushless Permanent Magnet and Reluctance Motor Drives,T.J.E. Miller ,1989, Oxford University press.
2. Special Electrical Machines, K. Venkataratnam, University press, 2009, New Delhi.

Programme : B. Tech - Electrical & Electronics Engineering Semester: VI

Course Code : V18EEL08
Course Name : Power Electronics Laboratory **[L : 0; T:0; P : 2 (1 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C313.1	Sketch the characteristics of various power electronics devices and analyse the firing circuits	(K4)
C313.2	Analyze the performance of 1-phase and 3-phase full converter and 1-phase dual converter for resistive and inductive loads	(K4)
C313.3	Experiment the single phase AC voltage controller and cyclo converter with resistive and inductive loads.	(K4)
C313.4	Operate the DC-DC buck converter and boost converter	(K3)
C313.5	Analyze the performance of the single phase bridge inverter	(K4)
C313.6	Analyze the performance of the PWM inverter	(K4)

Any 10 of the Following Experiments are to be conducted

1. Study of Characteristics of Thyristor, MOSFET & IGBT.
2. Design and development of a firing circuit for Thyristor.
3. Design and development of gate drive circuits for IGBT.
4. Single -Phase Half controlled converter with R and RL load
5. Single -Phase fully controlled bridge converter with R and RL loads
6. Single -Phase AC Voltage Regulator with R and RL Loads
7. Single -Phase square wave bridge inverter with R and RL Loads
8. Three- Phase fully controlled converter with RL–load.
9. Design and verification of voltages gain of Boost converter in Continuous Conduction Mode(CCM) and Discontinuous Conduction Mode(DCM).
10. Design and verification of voltages ripple in buck converter in CCM operation.
11. Single -phase PWM inverter with sine and triangle PWM techniques.
12. 3-phase AC-AC voltage regulator with R-load.

Programme : B. Tech - Electrical & Electronics Engineering Semester: VI

Course Code : V18EEL09
Course Name : Electrical Simulation Laboratory **[L : 0; T:0; P : 2 (1 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
C314.1	Simulate integrator circuit, differentiator circuit	(K3)
C314.2	Simulate Boost converter, Buck converter, full convertor and PWM inverter	(K3)
C314.3	Simulate transmission line by incorporating line, load and transformer models	(K3)
C314.4	Plot of Bode plots, root locus and nyquist plots	(K3)
C314.5	Perform transient analysis of RLC circuit	(K3)
C314.6	Perform transient analysis of single machine connected to infinite bus(SMIB)	(K4)

Any 10 of the Following Experiments are to be conducted

1. Simulation of transient response of RLC circuits a. Response to pulse input b. Response to step input c. Response to sinusoidal input
2. Analysis of three phase circuit representing the generator transmission line and load. Plot three phase currents & neutral current .
3. Simulation of single–phase full converter using RLE loads and single phase AC voltage controller using RL loads
4. Plotting of Bode plots, root locus and nyquist plots for the transfer functions of systems up to 5th order
5. Simulation of Boost and Buck converters.
6. Integrator & Differentiator circuits using op–amp.
7. Simulation of D.C separately excited motor using transfer function approach.
8. Modelling of transformer and simulation of lossy transmission line.
9. Simulation of single phase inverter with PWM control.
10. Simulation of three phase full converter using MOSFET and IGBTs.
11. Transient analysis of single machine connected to infinite bus(SMIB).

REFERENCE BOOKS:

1. Simulation of Power Electronic Circuit by M.B.Patil, V. Ramanarayan, V.T.Ranganathan Narosha,2009.
2. Pspice for circuits and electronics using PSPICE – by M.H.Rashid, M/s PHI Publications.
3. Pspice A/D user`s manual – Microsim, USA.

4. Pspice reference guide – Microsim, USA
5. MATLAB user`s manual – Mathworks, USA
6. MATLAB – control system tool box – Mathworks, USA
7. SIMULINK user`s manual – Mathworks, USA
8. EMTP User`s Manual.
9. SEQUEL– A public domain circuit simulator available at www.ee.iitb.ac.in/~sequel

Annexure III

List courses offered under Open Elective -I in VI semester under V18 Regulation for all other branches:

S.No.	Course Code	Name of the Course
1.	V18EEOE1	Energy Audit & Conservation
2.	V18EEOE2	Electrical Measuring Instruments
3.	V18EEOE3	Industrial Safety

Syllabi for the Courses offering under Open Elective - I

Programme: B. Tech - (ECE, CSE, ME, CE, ECT & CST) **Semester: VI**
Course Code : V18EEOE1
Course Name : Energy Audit & Conservation **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Describe the concepts and procedures for Energy Audit	(K2)
CO2	Explain the necessity of Energy efficient lighting systems	(K2)
CO3	Discuss the role of Energy instruments in Energy Audit	(K2)
CO4	Describe the impact of harmonics on electrical systems	(K2)
CO5	Discuss various space heating methods	(K2)
CO6	Explain the necessary steps to take for energy conservation	(K2)

UNIT–I: BASIC OF ENERGY AUDIT

Energy audit – Definitions – Concept – Types of audit-Preliminary audit -Main audit– Energy index – Cost index – Pie charts –Sankey diagrams – Load profiles — Numerical problems.

UNIT–II: LIGHTING

Definition of terms and units– Polar curve – Types of lamps - construction and working of-Incandescent lamp-Compact Florescent Lamp-sodium vapour lamp-Neon vapour lamp-LED - advantages and disadvantages – Types of lighting –Types of luminaries –- Replacement of existing lighting systems.

UNIT–III:ENERGY INSTRUMENTS

Energy Instruments – construction and working of -Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters – Tong testers – Power analyzer-advantages and disadvantages

UNIT–IV:POWER FACTOR AND HARMONICS

Power factor – Methods of improvement – Location of capacitors – Power factor with non-linear loads – harmonics-Sources of harmonics- Effect of harmonics.

UNIT–V: HEAT VENTILATION AND AIR CONDITIONING (HVAC)

Introduction –Transfer of Heat–Space heating methods – Water heating systems -Ventilation – Air Conditioner-construction and working principle–Cooling load

UNIT–VI: ENERGY CONSERVATION AND ENERGY POLICY

Energy conservation schemes and energy saving potential-Energy conservation in Domestics Buildings- Energy conservation in commercial Buildings –comparison of Standard motors and Energy efficient motors–Energy policy-Energy Policy of an Industry(case study)

Text Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012.
2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi, 1991.

Reference Books:

1. Hand Book of Energy Audit by Sonal Desai- Tata McGraw hill, 2015.
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd–2nd edition, 1995.

Programme : **B. Tech - (ECE, CSE, ME, CE, ECT & CST)** **Semester: VI**

Course Code : V18EEOE2
Course Name : Electrical Measuring Instruments **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	choose right type of instrument for measurement of voltage and current for ac and dc.	(K3)
CO2	choose right type of instrument for measurement of power and energy – able to calibrate energy meter by suitable method	(K3)
CO3	calibrate ammeter and potentiometer.	(K3)
CO4	select suitable bridge for measurement of electrical parameters	(K3)
CO5	use the ballistic galvanometer and flux meter for magnetic measuring instruments	(K3)
CO6	measure frequency and phase difference between signals using CRO. Able to use digital instruments in electrical measurements.	(K4)

UNIT–I: MEASURING INSTRUMENTS

Classification – Deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type, dynamometer and electrostatic instruments – Expression for the deflecting torque and control torque – Errors and compensations– Extension of range using shunts and series resistance – Numerical problems.

UNIT –II: MEASUREMENT OF POWER AND ENERGY

Single phase and three phase dynamometer wattmeter – LPF and UPF – Expression for deflecting and control torques - Single phase induction type energy meter – Driving and braking torques – errors and compensations – Three phase induction type energy meter.

UNIT – III: POTENTIOMETERS

Principle and operation of D.C. Crompton's potentiometer – Standardization – Measurement of unknown Resistance, Current and Voltage.AC Potentiometers: polar and coordinate types – Applications.

UNIT – IV: MEASUREMENTS OF PARAMETERS

Method of measuring low, medium and high resistance – Sensitivity of Wheat stone's bridge – Kelvin's double bridge for measuring low resistance– Megger– Measurement of earth resistance – Measurement of inductance and Quality Factor by Anderson's bridge–Measurement of capacitance and loss angle bySchering Bridge.

UNIT – V: MAGNETIC MEASUREMENTS

Ballistic galvanometer – Equation of motion – Flux meter – Constructional details–Determination of B–H Loop methods of reversals six point method – AC testing – Iron loss of bar samples– Core loss

measurements by bridges and potentiometers.

UNIT – VI: DIGITAL METERS

Digital Voltmeters: Successive approximation type – Measurement of phase difference and Frequency using lissajious patterns in CRO–Digital multimeter –Digital Tachometer.

TEXT BOOKS:

1. Electrical & Electronic Measurement & Instruments by A. K. Sawhney DhanpatRai& Co. Publications, 2013.
2. Modern Electronic Instrumentation and Measurement Techniques – A. D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.
3. Electrical Measurements and measuring Instruments – by E.W. Golding and F. C. Widdis, fifth Edition, Wheeler Publishing, 2011.

REFERENCE BOOKS:

1. Electrical and Electronic Measurements and instrumentation by R. K. Rajput, S. Chand, 2007.
2. Electrical Measurements – by Buckingham and Price, Prentice – Hall, 1988.
3. Electrical Measurements by Forest K. Harris. John Wiley and Sons,1952.
4. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers, 1967.

Programme : **B. Tech - (ECE, CSE, ME, CE, ECT & CST)** **Semester: VI**
Course Code : V18EEOE3
Course Name : Industrial Safety **[L : 3; T:0; P : 0 (3 credits)]**

Course Outcomes

After Successful completion of this course, students will be able to

CO No.	Course Outcome	Knowledge Level
CO1	Understand the overview of industrial safety	(K2)
CO2	Understand the importance and role of industrial safety	(K2)
CO3	Understand the industrial safety training methods	(K2)
CO4	Explain the role of management in industrial safety	(K2)
CO5	Choose proper design of electrical systems in order to control the Physical Hazards	(K2)
CO6	Describe the safety legalization	(K2)

UNIT-1: INTRODUCTION TO INDUSTRIAL SAFETY

Concept of Safety, Goals of safety engineering, Need for safety engineering, definitions of Accident, injury, unsafe actions & conditions. Responsibility of Safety - Society, Govt., Management, Duties of safety officer. Safety Committee -Membership, Functions & Scope of Safety committee.

UNIT -II: SAFETY AND HEALTH MANAGEMENT

Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety. Ergonomics - Introduction, Definition, Objectives, Advantages. Ergonomics Hazards, Importance of Industrial safety, role of safety department.

UNIT -III : SAFETY AWARENESS & TRAINING

Training for Safety: Assessment of needs. Design & development of training programme. Training methods and strategies. Human behaviour and safety: Human factors contributing to accidents.

UNIT -IV : SAFETY ASSESSMENT AND CONTROL

Safety Management: Role of management in Industrial Safety. Safety Management- Principles & Practices. Safety Organization: Role of safety committee and its formation, Safety awareness programme: motivation, education and training, Appraisal of plant safety and measurement of safety performance, Total loss control concept, Introduction to productivity, Quality, Reliability, and Safety (PQRS) theory.

UNIT -V : INDUSTRIAL SAFETY AND CONTROL

Control of Physical Hazards: Purpose of lighting. Advantages of good illumination. Lighting and safety. Lighting and the work. Control of Chemical Hazards Hazardous properties of chemicals and appreciation of information provided in Material safety data sheets. Classification of dangerous materials with pictorial symbols, common hazard and common precautions for each class Control of Electrical Hazards Dangers from electricity. Safe limits of amperages, Voltages Safe distance from lines. Capacity and protection of conductors, Joints and connections, Means of cutting of power

overload and short circuit protection. Factors contributing towards fire. Chemistry of fire. Classification of fires. Common causes of industrial fires.

UNIT -VI : SAFETY LEGALISATION

Legal Provisions regarding safety, Accident prevention &Compensation to affected employees as under Factories Act-1948, Factories Act(Amendment)1987, The Workmen CompensationAct-1923, ESI Act, Public Liabilities Insurance Act-1991,Fatal Accident Act.

TEXT BOOKS

1. Industrial Safety, Health and Environment Management Systems by R.K.Jain and Sunil S.Rao, Khanna Publishers, New Delhi, 2006.
2. Safety Management by Grimaldi and Simonds, AITBS Publishers, New Delhi, 2001.
3. Industrial Safety -National Safety Council of India, 2000.

REFERENCE BOOKS

1. Loss of prevention in Process Industries , Vol. 1 and 2 by Frank P. Lees, Butterworth-Heinemann Ltd., London, 1991.
2. Handbook of Occupational Safety and Health by Slote.L, John Willey and Sons, New York,1987.

SRI VASAVI ENGINEERING COLLEGE

(AUTONOMOUS)

(Sponsored by Sri Vasavi Educational Society)

(Approved by AICTE, New Delhi &Recognized by UGC under section 2(f) & 12(B))

(Permanently affiliated to JNTUK, Kakinada, Accredited by NAAC with 'A' Grade)

Pedatadepalli, **TADEPALLIGUDEM–534 101.**W.G.Dist. **(A.P)**

Department of Electrical & Electronics Engineering (Accredited by NBA)

Date: 02-01-2021

The fourth meeting of Board of Studies in Department of Electrical and Electronics Engineering is held at 11.30 AM on 30-12-2020 though online mode using Zoom tool (Meeting ID: 84243075482).

The following members are attended the meeting.

S.No.	Name	Designation	Role
1.	Dr. Sudha Rani Donepudi	Associate Professor & Head, Dept. of EEE, SVEC, Pedatadepalli.	Chairperson
2.	Dr. R. SrinivasaRao	Professor, Dept. of EEE, UCEK, JNTUK, Kakinada	Subject Expert Nominated By V.C.
3.	Dr. M. Sydulu	Professor, Dept. of EE, NITW, Warangal	Subject Expert Nominated By A.C.
4.	Dr. Y.P. Obulesu	Professor, School of EE, VIT, Vellore	Subject Expert Nominated By A.C.
5.	Er. B.N.V.R.C. Suresh Kumar	Retired AGM, PGCI, Hyderabad	Industry Expert Nominated By A.C
6.	Er. Ch. Vinay Kumar	Assistant Engineer, EHT Lines, APTRANSCO, Eluru.	Alumni
7.	Dr. Ch. Rambabu	Professor	Member
8.	Mr. U. Chandra Rao	Sr. Asst. Professor	Member
9.	Mr. Ch. V.S.R. Gopala Krishna	Sr. Asst. Professor	Member
10.	Mr. N. Sri Harish	Asst. Professor	Member
11.	Mr. K. Ramesh Babu	Asst. Professor	Member
12.	Mr. P.S.V.N. Sudhakar	Asst. Professor	Member
13.	Mr. K. Suresh	Asst. Professor	Member
14.	Mr. V. Rama Narayana	Asst. Professor	Member
15.	Mr. G. Chandra Babu	Asst. Professor	Member
16.	Mr. G. Madhu Sagar Babu	Asst. Professor	Member
17.	Mr. P.K.S. Sarvesh	Asst. Professor	Member
18.	Mr. K. Venkata Reddy	Asst. Professor	Member
19.	Mr. G. Saveen	Asst. Professor	Member
20.	Mr. N. Madhusudhan Reddy	Asst. Professor	Member
21.	Mr. K. Amarendra	Asst. Professor	Member
22.	Mr. V.S. Aditya	Asst. Professor	Member
23.	Mr. S. Krishna	Asst. Professor	Member
24.	Mr. A.V.V.N. Phanindra	Asst. Professor	Member
25.	Mr. Pradeep V	Asst. Professor	Member
26.	Mr. P. Datta Sai	Asst. Professor	Member
27.	Mr. Ch. Srinivas	Asst. Professor	Member
28.	Ms. I. Meghana Krishna Durga	Asst. Professor	Member

The following are the minutes of the meeting

Item No. 1: Welcome note by the Chairperson BOS

The HOD extended a formal welcome and introduced the members.

Item No. 2: Review of course structure for I & II semesters of B. Tech under V20 Regulation.

Reviewed and approved the course structure of I & II semesters for UG (B.Tech-EEE) Programme of V20 Regulation.

The details of the course structure for I & II semesters of UG (B.Tech- EEE) Programme under V20 Regulation are given in Annexure-I

Item No. 3: Approval of syllabi for the courses offered by the department in I & II semesters of B. Tech under V20 Regulation.

Approved the syllabi for the courses offered by department in I & II B. Tech under V20 Regulation.

The syllabi for the courses offered by department in I & II B. Tech Programme of under V20 Regulation is attached in Annexure-II.

Dr. Sudha Rani Donepudi

(BOS Chairperson)

Dr. Sudha Rani Donepudi, M.E., Ph.D
Head of the Department
Electrical & Electronics Engineering
SRI VASAVI ENGINEERING COLLEGE
(Autonomous)

Annexure-I

Approved Course Structure for B.Tech-EEE Programme under V20 Regulation

I-Semester

S.No.	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	V20MAT01	Linear Algebra and Differential Equations	3	0	0	3
2	V20CHT01	Engineering Chemistry	3	0	0	3
3	V20ENT01	English for Professional Enhancement	3	0	0	3
4	V20MEL02	Engineering Workshop	1	0	4	3
5	V20CST01	Programming in C for problem solving	3	0	0	3
6	V20ENL01	Hone Your Communications Skills Lab-I	0	0	3	1.5
7	V20CHL01	Engineering Chemistry Lab	0	0	3	1.5
8	V20CSL01	Programming lab in C for problem solving	0	0	3	1.5

Total Contact Hours : 26 Total Credits : 19.5

II-Semester

S.No.	**Course Code**	**Course Title**	**Hours per Week**			**Credits**
			L	**T**	**P**	
1	V20MAT02	Numerical Methods and Vector Calculus	3	0	0	3
2	V20PHT01	Engineering Physics	3	0	0	3
3	V20ECT01	Switching Theory and Logic Design	3	0	0	3
4	V20EET03	Electrical Circuit Analysis-I	3	0	0	3
5	V20MEL01	Engineering Graphics	1	0	4	3
6	V20EEL03	Electrical Engineering Workshop	0	0	3	1.5
7	V20CSL01	Engineering Physics Lab	0	0	3	1.5
8	V20ENL02	Hone Your Communications Skills Lab-II	0	0	3	1.5
9	V20CHT02	Environmental Studies	2	0	0	0

Total Contact Hours : 28 Total Credits : 19.5

Annexure II
Syllabi for the courses offered by EEE Dept. in I & II semesters of B. Tech under V20 Regulation.

Semester	**I SEM**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	-	-	3	**V20EET01**
Name of the Course	**Basic Electrical Engineering**					
Branches	**Common to ECE & ECT**					

Course Outcomes:

After successful completion of this course, the students will be able to

CO No.	**Course Outcome**	**Knowledge Level**
C204.1	Understand and compute electrical quantities in DC excited circuits	K3
C204.2	Understand and compute electrical quantities in AC excited circuits	K3
C204.3	Study the working principles of DC machines	K2
C204.4	Study the working principles of transformers	K2
C204.5	Understand construction details and explain the working principles of AC machines	K2
C204.6	Understand the operation of electrical systems	K2

Unit 1 : DC Circuits

Electrical circuit elements (R, L and C), Kirchhoff's Laws, Mesh analysis of simple circuits with dc excitation.Superposition, Thevenin's, and Maximum Power Transfer Theorems, Simple problems.

Unit 2: AC Circuits

Basic Definitions, Peak and RMS values, Types of Powers, Power Factor.Analysis of Single-Phase AC series circuits consisting of RL, RC, RLC combinations, Simple problems.

Unit 3: DC Machines

Construction and operation of DC generator-EMF equation - Types of DC motors: shunt and series motors – applications – Speed control of DC shunt motor: field and armature controls, Simple Problems.

Unit 4: Transformers

Classification, Operation of ideal and practical transformers, EMF equation, losses in transformer, efficiency, OC and SC Test, Simple problems.

Unit 5: AC Machines

Construction and operation of a three-phase induction motor, Slip, torque equation, torque-slip characteristics. Construction and operation of Synchronous Generator, Simple problems.

Unit 6: Overview of Electrical System

Introduction-Single line representation of Electrical Power System–Layout and operation of Hydro, Solar and Wind Power Plants.

Text Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2018.
2. E. Hughes, "Electrical and Electronics Technology", Pearson Education India, 1st Edition, 2010.
3. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press, 3rd Edition, 2017.
4. M. L. Soni, P. V. Gupta, U. S. Bhatnagar and Chakrabarti, "Text Book on Power System Engineering", DhanpatRai& Co. Pvt. Ltd, 2013.
5. SmarajitGhosh, "Fundamentals of Electrical and Electronics Engineering", PHI Publishers, 2nd Edition, 2010.

Reference Books

1. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, Asian Edition, 2013.
2. Vincent Del Toro, "Principles of Electrical Engineering", Prentice Hall, 2nd Edition, 1986.
3. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education India, 2nd Edition, 2017.
4. SK Sahdev, "Basic Electrical Engineering", Pearson Education India, 1st Edition, 2015.
5. J. B. Gupta, "A Course in Power Systems", S K Kataria& Sons Publishers,11th Edition, 2014.
6. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2nd Edition, 2019.

Semester	**I SEM**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	-	-	3	1.5	**V20EEL01**
Name of the Course	**Basic Electrical Engineering Lab**					
Branches	**Common to ECE & ECT**					

Course Outcomes:

After successful completion of this course, the students will be able to

CO No.	**Course Outcome**	**Knowledge Level**
C208.1	Determine the load currents by applying various laws and theorems	K3
C208.2	Find the maximum power delivered to the load	K3
C208.3	Analyze the steady state performance of series circuits	K4
C208.4	Plot the speed control characteristics of DC shunt motor	K3
C208.5	Find the losses and efficiency of a transformer	K3
C208.6	Calculate the energy bill for Domestic loads	K3

Any 10 of the following experiments are to be conducted

1. Verification of Kirchhoff's Laws.
2. Verification of Superposition theorem.
3. Verification of Thevenin's theorem.
4. Verification of Maximum Power Transfer theorem.
5. Analysis of Series RL and RC circuits.
6. Analysis of Series RLC circuit.
7. Speed control of D.C. Shunt motor by Armature control method.
8. Speed control of D.C. Shunt motor by field flux control method.
9. Brake test on DC shunt motor. Determination of performance characteristics.
10. Load Test on Single-Phase transformer
11. OC and SC test on Single-phase transformer (Measurement of Losses)
12. Energy Bill calculation for Domestic loads.

Semester	**II SEM**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	-	-	3	**V20EET02**
Name of the Course	**Basic Electrical & Electronics Engineering**					
Branches	**Common to ME & CE**					

Course Outcomes:

After successful completion of this course, the students will be able to

CO No.	**Course Outcome**	**Knowledge Level**
C113.1	Understand and compute electrical quantities in DC excited circuits	K3
C113.2	Understand and compute electrical quantities in AC excited circuits	K3
C113.3	Study the working principles of DC machines	K2
C113.4	Study the working principles of transformers	K2
C113.5	Understand construction details and explain the working principles of AC machines	K2
C113.6	Understand the basic operation of uninterrupted power supplies	K2

Unit 1 : DC Circuits

Electrical circuit elements (R, L and C), Kirchhoff's Laws, Mesh analysis of simple circuits with dc excitation.Superposition, Thevenin's, and Maximum Power Transfer Theorems, Simple problems.

Unit 2: AC Circuits

Basic Definitions, Peak and RMS values, Types of Powers, Power Factor.Analysis of Single-Phase AC series circuits consisting of RL, RC, RLC combinations, Simple problems.

Unit 3: DC Machines

Construction and operation of DC generator -EMF equation - Types of DC motors: shunt and series motors – applications – Speed control of DC shunt motor: field and armature controls, Simple Problems.

Unit 4: Transformers

Classification, Operation of ideal and practical transformers, EMF equation, losses in transformer, efficiency, OC and SC Test, Simple problems.

Unit 5: AC Machines

Construction and operation of a three-phase induction motor, Slip, torque equation, torque-slip characteristics. Construction and operation of Synchronous Generator, Simple problems.

Unit 6: Uninterrupted Power Supplies

Introduction –Basic operation of Rectifier, Inverter and UPS -On-line UPS, Off- line UPS and Line interactive UPS, Comparison between UPS and Inverter, Basic operation of SMPS.

Text Books

1. SmarajitGhosh, "Fundamentals of Electrical and Electronics Engineering", PHI Publishers, 2nd Edition, 2010.
2. S. K. Sahdev, "Fundamentals of Electrical Engineering & Electronics", DhanpatRai& Company, 2nd Re Edition, 2010.
3. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education India, 2nd Edition, 2017.
4. M. S. Sukhija,T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford University Press, 1st Edition, 2012.
5. Ned Mohan, T M Undeland and W P Robbins, "Power Electronics-Converters, Applications and Design", John Wiley & Sons, INC, 2nd Edition, 2008.

Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2018.
2. E. Hughes, "Electrical and Electronics Technology", Pearson Education India, 1st Edition, 2010.
3. R. K. Rajput, "Basic Electrical and Electronics Engineering", University Science Press, 2nd Edition, 2012.

Semester	**II SEM**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	-	-	3	1.5	**V20EEL02**
Name of the Course	**Basic Electrical & Electronics Engineering Lab**					
Branches	**Common to CE & ME**					

Course Outcomes:

After successful completion of this course, the students will be able to

CO No.	**Course Outcome**	**Knowledge Level**
C115.1	Determine the load currents by applying various laws and theorems	K3
C115.2	Analyze the steady state performance of series circuits	K3
C115.3	Plot the speed control characteristics of DC shunt motor	K3
C115.4	Find the losses and efficiency of a transformer	K3
C115.5	Calculate the energy bill for Domestic loads	K3
C115.6	Plot characteristics of full wave rectifier	K3

Any 10 of the following experiments are to be conducted

1. Verification of Kirchhoff's Laws.
2. Verification of Superposition theorem.
3. Verification of Thevenin's theorem.
4. Verification of Maximum Power Transfer theorem.
5. Analysis of Series RL and RC circuits.
6. Analysis of Series RLC circuit.
7. Speed control of D.C. Shunt motor by Armature control method.
8. Speed control of D.C. Shunt motor by field flux control method.
9. Brake test on DC shunt motor. Determination of performance characteristics.
10. Load Test on Single-Phase transformer
11. OC and SC test on Single-phase transformer (Measurement of Losses)
12. Energy Bill calculation for Domestic loads.
13. Full wave rectifier with and without filters.

Semester	**II SEM**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	3	-	-	3	**V20EET03**
Name of the Course	**Electrical Circuit Analysis-I**					
Branches	**EEE**					

Course Outcomes:

After successful completion of this course, the students will be able to

CO No.	**Course Outcome**	**Knowledge Level**
C112.1	Apply various network reduction techniques for solving electrical DC circuits.	K3
C112.2	Calculate different parameters of single phase alternating quantities.	K3
C112.3	Understand the concepts of different powers and apply network reduction techniques for solving electrical AC circuits.	K3
C112.4	Determine various parameters in series and parallel resonant circuits.	K3
C112.5	Apply the network theorems for solving electrical DC and AC circuits.	K3
C112.6	Compute electrical parameters for 3-phase balanced systems	K3

Unit-I: Introduction to Electrical Circuits

Classification of network elements, Basic terminology, Kirchhoff's laws; RLC Parameters - series and parallel combinations; Energy Sources; Source transformation; Y-Δ and Δ-Y transformation; Mesh analysis and Nodal analysis –Numerical problems

Unit-II: Single Phase A.C Systems - I

Basic terminology associated with alternating quantity- RMS value, Average value, form factor and peak factor; phase angle and phase difference –lagging, leading networks; steady state analysis of series and parallel combinations of R, L and C circuits, numerical problems.

Unit- III: Single Phase A.C Systems - II

Types of Powers; Power Factor and its significance; Power triangle, Mesh analysis and Nodal analysis of AC networks; Numerical problems.

Unit-IV: Resonance

Concept of Resonance **-** Series and parallel resonance, Bandwidth, quasi factor, selectivity; Numerical problems; Introduction to locus diagrams; Concept of Duality and Dual networks.

Unit-V: Magnetic Circuits

Basic definitions of MMF, Flux and Reluctance; Analogy between electrical and magnetic circuits; Analysis of series, parallel and composite magnetic circuits; Faraday's laws of electromagnetic induction; Concepts of self-inductance, mutual inductance and coefficient of coupling; Concept of Dot Convention and coupled coils.

Unit-VI: Balanced Three phase circuits

Generation of three phase voltages; Advantages of three phase system; Inter connection of three phase windings: Star and delta connection, Phase sequence, Relation between line, phase voltages and currents in balanced - Star and delta connected load.

Text Books:

1. Chakrabarthi ,"Circuit Theory (Analysis and Synthesis)",DhanpatRai& Co, 7th Re Edition, 2018.
2. William Hayt and Jack E. Kemmerley , "Engineering Circuit Analysis", McGraw Hill Company,8th edition, 2013.
3. Mac E. Van Valkenburg, "Network Analysis", Prentice-Hall of India Private Ltd., 3rd Edition, 2019.

Reference Books:

1. Charles K. Alexander and Mathew N.O. Sadiku, "Fundamentals of Electrical Circuits", McGraw Hill Education (India), 6th Edition, 2019.
2. C. L. Wadhwa, "Network Analysis", New Age International Publishers, 3rd Edition, 2018.
3. Sudhakar A. &Shyammohan S. Palli, "Electrical Circuit Analysis",McGraw Hill Publication, 5th Edition, 2017.
4. Robert L. Boylestad, "Introductory Circuit Analysis", Pearson Publications, 13th Edition, 2016.
5. Lawrence P. Huelsman, "Basic Circuit Theory", 3rd Ed Pearson Publications, 2015.

Semester	**II SEM**	**L**	**T**	**P**	**C**	**COURSE CODE**
Regulation	V20	-	-	3	1.5	**V20EEL03**
Name of the Course	**Electrical Engineering Workshop**					
Branches	**EEE**					

Course Outcomes:

After successful completion of this course, the students will be able to

CO No.	**Course Outcome**	**Knowledge Level**
C114.1	Design different wiring circuits	K4
C114.2	Use electrical parameter measuring instruments	K3
C114.3	Construct the circuits on PCB board	K4
C114.4	Test the domestic appliances	K4
C114.5	Identify the parts of the Machine	K3
C114.6	Analyze electrical circuits through simulation	K4

Any 12 of the following experiments are to be conducted

1. Wiring tools and Accessories
2. Electrical Wiring Joints
3. Lamp Circuits
4. Soldering Practice
5. AC and DC circuits
6. Resistance Measurement
7. Capacitance Measurement
8. Battery voltage measurement
9. Special Lamp Connections
10. Wiring Practice for Power Loads
11. Motor Connections
12. Practice on Motor winding
13. Earthing
14. Testing and repair of Domestic appliances
15. Verification of Kirchoff's Laws.
16. Measurement of Choke Coil Parameters.
17. Simulation of series RLC circuit.