Shri Vaishnav Vidyapeeth Vishwavidyalaya

Bachelor of Technology (Electrical & Electronics Engineering)

SEMESTER VII

Name of Program: B. Tech. (Electrical and Electronics Engineering)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 701		Electric Drives	3	1	2	5	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
The students develop ablility to select a drive for a particular application. They will familiarize with the various control techniques employed for controlling drives with ac and dc motors.

Course Outcomes (COs): Upon completion of this course students will be able to:

1. Demonstrate fundamental knowledge in dynamics and control of Electric Drives.
2. Demonstrate knowledge of the selection of Drives for various applications.
3. Familiarize the various semiconductor controlled drives employing various motors

Syllabus

UNIT I **[7 Hrs]**

Fundamental of Electric Drives: Basic concepts, Characteristics and operating modes of drive motors, Starting, braking and speed control of motors, Four quadrant drives, Nature and classification of load torque and associated controls used in process industries, Selection of motors and ratings

UNIT II **[9 Hrs]**

Controlled converter based DC Motor Drives: Starting, braking and speed control, Analysis of separately excited dc motor with continuous armature current and discontinuous armature current, Analysis of dc series motor drives, Comparative evaluation of phase angle control, Semi-converter operation of full converter, Single phase half controlled and fully controlled rectifier fed dc motors, Sequence control, Three phase half controlled and fully controlled rectifier fed dc motors, Dual converter with circulating and non-circulating current controlled drives

UNIT III **[9 Hrs]**

Chopper DC drives: Closed loop control system of dc motor drives, Reversible drives, Analysis and performance characteristics of chopper fed dc motors, Motoring and braking operations, Multi phase chopper, Phase locked loop control of dc drive.

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UNIT IV **[9 Hrs]**

Induction Motor Drives: Operation with unbalanced source voltages and unbalanced rotor impedances, Effect of time harmonics on the motor performance, Braking, Stator voltage control of induction motor, Variable voltage variable frequency (VVVF) operation, Voltage source inverter (VSI) fed induction motor drive, Static rotor resistance control, Slip power recovery systems, closed loop control of ac drives, Introduction to field oriented control of ac motors

UNIT V **[9 Hrs]**

Synchronous Motor Drives: Synchronous motor drives, introduction to v/f control. Permanent Magnet synchronous motor drives, different types-control requirements, converter circuits, modes of operation, Microcontroller based permanent magnet synchronous motor drives

Text Books:

1. G.K. Dubey, Fundamental of Electrical Drives, Narosa Publication.

Reference Books:

1. Dewan S.B. , G. R. Slemon, A. Strauvhen, "Power semiconductor drives", John Wiley and sons
2. Dr. P. S. Bimbra "Power electronics", Khanna publishers
3. J. M. D. Murphy "Thyristor control of AC drives"
4. N. K. De, P. K. Sen "Electric drives" Prentice Hall of India 2002
5. Ned Mohan, Tore m Undeland, William P Robbins, "Power electronics converters applications and design", John Wiley and Sons.
6. Pillai S. K. "A first course on electric drives", Wieley Eastern Ltd, New Delhi
7. Vedam Subrahmanyam, "Electric Drives", MC Graw Hill Education, New Delhi
8. W. Shepherd, L. N. Hulley and D. T. Liang, "Power Electronics and motor control", Second Edition, Cambridge University Press, 1995.

List of Practicals: Experiments can cover any of the above topics, following is a suggestive list:

1. Introduction of Electrical Drives
2. To design and simulate single phase semi controlled full wave converter fed separately excited DC motor drive
3. To design and simulate single phase semi controlled full wave converter fed DC series motor drive.
4. To design and simulate single phase fully controlled rectifier fed separately excited DC motor drive.
5. To design and simulate single phase fully controlled converter fed DC series motor drive.
6. To design and simulate Class A chopper controlled separately excited DC motor drive
7. To design and simulate Class A chopper controlled DC series motor drive
8. To design and simulate Class C chopper controlled separately excited DC motor drive
9. To design and simulate voltage control induction motor drive
10. To design and simulate voltage frequency control PWM inverter induction motor drive

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 702		**ELECTRICAL MACHINE DESIGN**	3	1	2	5	60	20	20	30	20

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):
To prepare the students to Ability to model and analyze electrical apparatus and their application to power system

Course Outcomes (COs): Upon completion of this course students will be able to:

1. Demonstrate basic concept of design using computers.
2. Design constructional details of DC machine, armature, windings et.
3. Design transformer, magnetic circuit, windings and applications
4. Design stator and rotor of induction machines.
5. Design stator and rotor of synchronous machines

Syllabus

UNIT I **[7 Hrs]**

Computer Aided Design of Electrical Machines: Basic Concept of Design-Digital Computers Advantage –Optimization in CAD-Various Optimization Methods (Linear and Non-Linear, Constraint and Unconstraint)-General Design Procedure of CAD

UNIT II **[9 Hrs]**

DC Machine Design : Output Equations – Main Dimensions – Choice of Specific Electric and Magnetic Loading – selection of numbers of poles – core length – armature diameter –pole proportions –Design of Armature – Design of commutator and brushes – performance prediction using design values.

UNIT III **[9 Hrs]**

Transformer Design: Output Equations – Main Dimensions – kVA output for single and three phase transformers – Window space factor – Design of core and winding – Overall dimensions – Operating characteristics – No load current – Temperature rise in Transformers – Design of Tank – Methods of cooling of Transformers.

UNIT IV **[9 Hrs]**

Induction Machine Design: Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor

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UNIT V **[9 Hrs]**

Synchronous Machines Design: Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

Text Books:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, reprint 2013.
2. M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.

Reference Books:

1. A.Shanmuga Sundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint, 2007.
2. R.K.Agarwal " Principles of Electrical Machine Design" Esskay Publications, Delhi, 2002.
3. Dr.N.K Datta,"Theory and practice of Electrical Machines design", Kataria and Sons,2016
4. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

List of Practicals: Experiments can cover any of the above topics, following is a suggestive list:

1. Computer aided design of dc machine in matlab.
   a) Main dimensions
   b) Armature winding
   c) Number of slots
   d) Design of slots
   e) Check the flux density
   f) Length of air gap
   g) Armature core
   h) Pole section
   i) Tentative design of field winding
   j) Magnetic circuit
   k) Design of field winding
2. Computer aided design of transformer.
   Make program in Matlab to find

a) Core design
b) Window Dimension Design
c) Yoke Design
d) Overall Dimensions

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e) L.V winding
f) H.V Winding
g) Resistance calculation

3. Computer aided design of synchronous machine.
programming in MATLAB to find

a) Main dimensions
b) Length of air gap
c) Stator
d) Number of slots
e) Magnetic circuit
f) Stator core
g) Stator dimensions
h) Rotor designs

4. Computer aided design of induction machine in matlab
Make program in MATLAB to find
a) Main dimensions
b) Stator design
c) Rotor design

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 704		**SOFTWARE SIMULATION LAB**	0	0	2	1	0	0	0	30	20

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):

1. Simulate and design various power electronic, network and control circuits.
2. Familiarize the students by introducing software MATLAB Simulink and help them to simulate and analyze different basic electrical circuits.
3. Be able to verify the laws and principles of electrical circuits, understand the relationships and differences between theory and practice.

Course Outcomes (COs):

At the end of the course, the students will be able to:

a. Design and conduct simulation and experiments.
b. Use the techniques, skills and modern engineering tools necessary for engineering practice.
c. Identify, formulate & solve engineering problems with simulation in power system, control system and electric network.
d. Simulate controlled and uncontrolled rectifier circuits.
e. Acquire expertise in usage of modern tools.
f. Learn programming in MATLAB.

List of Practicals:

1. Transient Responses of Series RLC, RL, And RC circuits with sine and step inputs using MATLAB Simulink.
2. Measurement of active Power of three phase circuit for balanced and unbalanced load.
3. Simulate Buck and Boost Converter with Open Loop Operation.
4. Construct the simulation of Z source inverter using MATLAB-Simulink.
5. Construct six pulse cycloconverter simulation using MATLAB
6. Create a model in Simulink to simulate various faults on transmission system.
7. With the help of MATLAB, find the transient stability when there is sudden increase in power input and on occurrence of fault.
8. Obtain the symmetrical components of set of unbalanced currents.
9. Study the simulation of static voltage compensator using MATLAB- Simulink.
10. Design of PD, PI and PID controller using MATLAB Software.

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11. Obtain zeros and poles from a given transfer function using MATLAB.
12. Design of lag, lead and lag-lead compensators using MATLAB Software.
13. Obtain the time response of a given second order system with its damping frequency using MATLAB.
14. Create the simulation of low pass and high pass Filter using MATLAB - Simulink.
15. Permanent Magnet DC motor simulation using MATLAB / Simulink
16. MATLAB / Simulink Simulation of Induction Motor

Text Books:

1. Rudra Pratap, "Getting Started with MATLAB 7", Oxford University Press (Indian Edition) 2006.
2. Dr. Shailendra Jain, "Modeling and Simulation Using MATLAB – Simulink: For EEE", 2nd edition, Wiley India Pvt. Ltd.

Reference Books:

1. Dingyu Xue, YangQuan Chen, "System Simulation Techniques with MATLAB / Simulink", John Wiley & Sons, Inc, 2013.
2. O. Beucher and M. Weeks, "Introduction to MATLAB and Simulink: A Project Approach", Second Edition, 2007, Jones & Bartlett Publishers.
3. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.
4. Control Systems Engineering-I.J. Nagrath & M.Gopal- New Age International Pub. Co

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 705		**ELECTRICAL ENGINEERING DRAWING**	0	0	2	1	0	0	0	0	50

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs): This subject will help the students in knowing the general working and faults occurring in the various common appliances.

Course Outcomes: Upon completion of the course, the students shall be able to demonstrate following knowledge, skills and attitudes

1) Identify the various parts of common household gadgets.
2) Explain the principle of operation of these gadgets.
3) Draw assembled view of dissembled parts of electrical machines and transformers.
4) Identify different parts of electrical machines and prepare list of materials for various parts.

List of Practicals:

1. Draw various type of Supply.
2. Draw the winding diagram of a Single Layer Lap & Single Layer Wave connected D.C Machine
3. Draw different core sections of a Transformer.
4. Draw the wiring diagram of Power Supply arrangement in Residential System.
5. Draw the wiring diagram of Residential Building Distribution System.
6. Draw the wiring diagram of Soft starter.
7. Draw the wiring diagram of Automatic star/delta starter.
8. Draw a Line diagram of Chiller & Boiler MCC Panel.
9. Draw a Line diagram of Kitchen Switchboard.
10. Draw a Line diagram of Electrical System for a Warehouse.
11. Draw a Line diagram of Industrial Electrical System.
12. Single Bus-Bar & Double Bus-Bar Layout.
13. Pole Mounted Substation Layout.

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Text Books:

1. Hemant Joshi"Residential, Commercial & Industrial Electricals Systems" Mc Graw Hill, vol. 1& 2, Third edition, 2014.
2. Surjit singh "Electrical Engineering Drawing", S.K. Kataria & Sons, Reprint 2013 edition (2013).

References:

1. Dargon.-"Electrical Engineering Drawing", Computech Publications Ltd; ENLARGED edition (2010). 2. S.L.Uppal ,"Electrical wiring, Estimation and Costing", Khanna Publisher 6th Edition.
2. Kl Narang " Electrical Engineering Drawing" Satya Prakashan, 2016.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 711		**HIGH VOLTAGE ENGINEERING**	3	0	0	3	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):

1. To understand high voltage (HV) technology, advantages, problem associated with it and its applications.
2. To explain basic breakdown phenomena and properties of gas, solid, and liquid dielectrics.
3. To discuss the generation of high d.c. and a.c. voltages and high impulse voltages and currents.
4. To deal with the high voltage testing of electrical apparatus and measurement of high voltage and current.

Course Outcomes (COs):

At the end of the course, the students will be able to:

a. To understand fundamental concepts of high AC and DC and its importance in electrical engineering.
b. To identify the techniques employed in high voltage measurements.
c. Apply analytical and numerical techniques for electric field calculations in high voltage systems.
d. Learn the fundamental concept of electric breakdown in liquids, gases, and solids.
e. Come to know about the testing of HV electrical apparatus.

Syllabus

UNIT I

Introduction to High Voltage Technology and Applications: Advantages of transmitting electrical power at high voltages, perspectives of high voltage technology, need for generating high voltages in laboratory.

UNIT II

Break Down in Solid Dielectrics, Gaseous and Liquid Dielectrics: High voltage insulating materials- Properties of important HV insulating media, Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

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Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, Breakdown of liquids dielectric dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown (bubble's theory), electro convection breakdown.

UNIT III

Generation of High Voltages and Currents: Generation of High Direct Current Voltages, half and full wave rectifier circuits, voltage multiplier circuits, Van de Graff generators, electrostatic generators, Generation of High alternating voltages, testing transformers, cascaded transformers, resonant transformers, examples - impulse voltages, Standard lightning and switching surge and associated parameters and their corrections, Generation of Impulse Voltages, impulse voltage generator circuits, Marx circuit, operation, design and construction of impulse generators Generation of Impulse currents, impulse current generator, Tripping and control of impulse generators.

UNIT IV

Measurement of High Voltages and Currents: Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

UNIT V

High Voltage Testing of Electrical Apparatus: Testing of insulators and bushings, testing of isolators and circuit breakers Testing of cables, testing of transformers - testing of surge diverters - radio interference measurements - design, planning and layout of high voltage laboratory

Text Books:

1. M.S.Naidu and Kamaraju, "High Voltage Engineering", 3rd edition, THM, 2007.
2. E. Kuffel and W.S. Zaengl, "High voltage engineering fundamentals", 2nd edition, Elsevier, press, 2005.
3. C.L.Wadhwa, High voltage engineering, New Age International Private limited, 1995.

Reference Books:

1. L. L. Alston, "High Voltage technology", BSB Publication, 2007..
2. Rakosh Das Begamudre, Extra High voltage AC transmission engineering, Wiley Easternlimited, 1987.
3. Dieter Kind, Kurt Feser, "High Voltage Test Techniques", Reed educational and professional publishing ltd. (Indian edition), New Delhi-2001
4. M. Khalifa, "High Voltage Engineering-Theory and Practice", Marcel Dekker, Inc. New York and Basel, 1990.
5. Hugh M. Ryan, "High Voltage Engineering and Testing", 2nd edition, The Institution of Electrical Engineers, London, United Kingdom, 2001.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 712		EXTRA HIGH VOLTAGE ALTERNATING CURRENT AND DIRECT CURRENT TRANSMISSION	3	0	0	3	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):

The objective of the course is to elicit the advantages of EHV AC transmission systems. Mould students to acquire knowledge about HVDC Transmission systems. This course gives idea about modern trends in HVDC Transmission and its application, Understand about the overvoltage and its effects on power system. Complete analysis of harmonics and basis of protection for HVDC Systems.

Course Outcomes (COs):

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

1. To understand the basic concepts of EHV AC and HVDC transmission.
2. To identify the electrical requirements for HVDC lines.
3. To understand the operation of HVDC conversion technology.
4. To understand the fundamental requirements of HVDC transmission line design.

Syllabus

UNIT – I

Introduction to EHV Transmission Comparison of AC and DC Transmission Systems: Limitations and advantages of AC and DC Transmission, Principal application of AC and DC Transmission, trends EHV AC and DC Transmission, Power-handling capacity, Converter analysis, Graetz circuits.

UNIT-II

Compensation of lines, series and shunt compensation, FACTS devices, basic types of controller, series controller, static synchronous series compensator(SSSC), thyristor-controlled series capacitor(TCSC),thyristor controlled series reactor(TCSR), shunt controller (STATCOM), static VAR compensator(SVC), series-series controller, combined series-shunt controller, unified power flow controller(UPFC), thyristor controlled phase shifting transformer(TCPST).

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UNIT-III

Components of EHV dc system, Kind of DC Links, converter circuits, rectifier and inverter valves, , harmonics generation, adverse effects, Classification, Remedial measures to suppress, filters, Ground return, Converter faults & protection harmonics misoperation, Commutation failure, Multi-terminal D.C. lines.

UNIT-IV

Control of HVDC link, Converter control characteristics, Firing angle control and extinction angle control, constant current control, parallel operation of HVAC & DC system, Problems and advantages. Multi-terminal D.C. lines.

UNIT-V

Traveling waves on transmission systems, Their shape, attenuation and distortion, effect of junction and termination on propagation of traveling waves, Over voltages in transmission system, Lightning, switching and temporary over voltage: Control of lighting and switching over voltages.

Text Books

1. Kimbark,-" HVDC Transmission" john willy & sons pub.
2. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
3. J.Arrillaga, "HVDC Transmission", IEE power and energy series.

Reference Books:

1. Narain.G. Hingorani, l. Gyugyi-"Understanding of FACTS concept and technology", john willy & sons pub.
2. P.Kundur- "H.V.D.C. Transmission" McGraw Hill Pub.
3. Rao S., "EHV AC & HVDC Transmission Systems" - Khanna Pub.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 713		POWER PLANT INSTRUMENTATION AND CONTROL	3	0	0	3	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):

To enable the students to learn in detail about the various instruments available for monitoring/controlling power plant electrical and non-electrical parameters.

Course Outcomes (COs):

1. Students get familiarize about different power generation process.
2. Understand and learn the different principles and instruments adopted for measurement of current, voltage, power, energy etc.
3. Understand important parameter for monitoring and controlling in power plant
4. Get detailed knowledge on power plant.

UNIT-I

Block Diagram of different parts of a Power Plant and scope of Instrumentation - Measurements on Boiler Plant, Turbo-generator Plant and Nuclear Reactors.

UNIT-II

Measurement: Fuel Measurement and various types of weighing systems.
Pressure Measurement - capsules; bellows; diaphragm gauges; bourdon tube pressure gauges; pressure transducers - capacitive type, piezo resistive type; Smart pressure transmitters.

UNIT-III

Temperature Measurement - resistance temperature detectors; thermocouples; radiation pyrometers.
Level Measurement - capacitive sensors; ultrasonic; DP transmitters.

UNIT-IV

Analytical: Gas Analysis - Oxygen - zirconium sensor, paramagnetic; SOx; NOx; CO, CO2
Liquid Analysis - pH; conductivity; dissolved oxygen

UNIT-V

Coal Analysis - moisture, carbon, ash Control
Boiler Control - Steam pressure control, combustion control, Furnace Draft control, Steam temperature control, Feed water control

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Test Books:

1. Deobelin E O: Measurement System - Application and Design; TMH.
2. Arora S C & Domkundwar S: Power Plant Engg.; Dhanpat Rai & Co. (P) Ltd.
3. Johnson C: Process Control Instrumentation Technology; PHI/Pearson Education
4. Shawney A K: The Electrical and Electronic Measurement and Instrumentation Dhanpat Rai & Co. Watt Boyes (Editor): Instrumentation Reference Book, 3rd ed.; Butterworth Heineman

Reference Books:

1. Douglas M. Considine: Process / Industrial Instruments & Controls Handbook, 4thEd.; McGraw Hill International Edition.
2. Modern Power Station Practice (Control & Instrumentation), Vol-F; Pergamon Press.

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 721		**DIGITAL SIGNAL PROCESSING**	3	0	0	3	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):
To introduce discrete Fourier transform and its applications.To teach the design of infinite and finite impulse response filters for filtering undesired signals.To introduce signal processing concepts in systems having more than one sampling frequency.

Course Outcomes (COs): Upon completion of this course students will be able to:

1. Perform frequency transforms for the signals.
2. Design IIR and FIR filters.
3. Finite word length effects in digital filters.

UNIT I **[8 Hrs]**

Classification of signals & systems
Introduction, Classification of Signals, Singularity Functions, Amplitude and Phase Spectra, Classification of Systems, Simple Manipulations of Discrete – time Signals, Representations of Systems, Analog to Digital Conversion of Signals.

UNIT II **[7 Hrs]**

Z-Transformers, Introduction, Definition of the z-transform, Properties of z-transform, Evaluation of the Inverse z-transform. Applications of z-transforms, one sided Z-transform and its applications.

UNIT III **[8 Hrs]**

Discrete and Fourier Transforms, Introduction, Discrete Convolution, Discrete -Time Fourier Transforms (DTFT), Fast Fourier Transform (FFT), Computing an Inverse DFT by Doing a Direct DFT, Composite – radix FFT, Fast (Sectioned) Convolution, Correlation.

UNIT IV **[8 Hrs]**

Finite Impulse Response (FIR) Filters, Introduction, Magnitude Response and Phase Response of Digital Filters, Frequency Response of Linear Phase FIR Filters, Design Techniques for FIR Filters, Design of Optimal Linear Phase FIR filters.

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UNIT V **[8 Hrs]**

Infinite Impulse Response (IIR) Filters, Introduction, IIR Filters Design by Approximation of Derivatives,IIR Filters Design by Impulse Invariant method, IIR Filters Design by the Bilinear Transformation, Butterworth Filters, Chebyshev Filters, Inverse Chebyshev Filters, Frequency Transformation.

Text Books:

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth edition, Pearson education / Prentice Hall, 2007.
2. S. Salivahanan, A. Vallavaraj , "Digital Signal Processing", Tata McGraw-Hill Education, 21st Reprint 2007.

Reference Books:

1. Emmanuel CIfeachor, & Barrie.W.Jervis, "Digital Signal Processing", Second edition, Pearson Education / Prentice Hall, 2002.
2. Alan V. Oppenheim, Ronald W. Schafer & Hohn. R. Back, "Discrete Time Signal Processing", Pearson Education, 2nd edition, 2005.

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SEMESTER VII

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 722		SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEMS AND APPLICATIONS	3	0	0	3	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):

The course provides an introduction to the role of Computers and Communication in Electrical Power Engineering. This course provides an introductory course material for power system automation and recent advances in technological aspects of computers and communications in networking.

Course Outcomes (COs):

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

1. List and summarize the architecture of modern SCADA system.
2. Create Human machine Interface using appropriate tools.
3. Explain the working principles of connection between SCADA software with control device
4. Understand various industrial communication technologies.

Syllabus

UNIT I

Introduction to SCADA

SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions.

UNIT II

SCADA system components: Schemes, Remote Terminal Unit, Intelligent Electronic Devices, Communication Network, SCADA server.

UNIT III

SCADA Architecture-Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems.

UNIT IV

SCADA Communication-Various industrial communication technologies-wired and wireless methods and

fiber optics, open standard communication protocols.

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UNIT V

Operation and control of interconnected power system-Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, state estimation, SCADA applications Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water. Case studies, implementation, simulation exercises.

Reference Books:

1. Stuart A Boyer: SCADA supervisory control and data acquisition.
2. Gordan Clark, Deem Reynders, Practical Modem SCADA Protocols.
3. Sunil S. Rao, Switchgear and Protections, Khanna Publication

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SEMESTER VII

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 723		**ARTIFICIAL NEURAL NETWORK**	3	0	0	3	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):
To enable the students to understand the concepts of artificial neural networks and its applications in power engineering.

Course Outcomes (COs): Upon completion of this course students will be able to:

1. To understand the fundamental concepts of ANN and different architectures and its learning methodologies.
2. To gain knowledge about different network architectures and its applications in power systems and power electronics.
3. To learn the concepts of the various training/learning algorithms and its use.
4. Control applications in AC and DC electric drives.
5. Fault Analysis and fault classification problems.

UNIT I - Introduction **(9 hours)**

Artificial neural networks – definition and fundamental concepts – engineering approaches to neural computing-biological neural networks – Artificial neuron- activation functions – setting of weights – typical architectures – biases and thresholds – learning and its methods – training algorithms.

UNIT II - Feed Forward Neural Nets **(9 hours)**

Perceptron – architectures, algorithm and applications – linear separability – ADALINE – feed forward networks – back propagation algorithm-applications – alternate activation functions-number of hidden layers – practical consideration – gradient decent algorithms- radial basis function networks[RBF].

UNIT III - Statistical Methods Based Neural Nets **(9 hours)**

Associate memory-Auto associative-hetero associative – bidirectional associative memory-Hopfield neural networks – discrete and continuous net-applications of Hopfield networks.

UNIT IV - Competitive Networks **(9 hours)**

Kohonen's self organizing maps [SOM]-learning vector quantization [LVQ] and its types-Adaptive resonance theory –ART1 & ART2 architecture, algorithms-applications.

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UNIT V - Applications of ANN **(9 hours)**

Applications of ANN in:

1. Power systems – load forecasting- unit commitment -load scheduling –Power flow studies.
2. Control applications in AC and DC electric drives.
3. Fault Analysis and fault classification problems.

Text Books

1. Simon Haykin, "Neural Networks and learning machines",Prentice Hall,third edition 2009.
2. Laurene fausett, "Fundamentals of Neural Network Architecture", algorithms and applications – pearsons education.2008 first edition and third reprint.

Reference Books

1. Yegnanarayana.B, "Artificial Neural Networks", Prentice Hall of India Private Ltd., New Delhi, 1999.
2. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, first edition,1997.
3. James a Freeman and David M.Sakapura, "Neural Network Algorithms applications and programming techniques" – pearsons education (2004).
4. Sivanandam.S.N,Deepa.S.N, "Principles of soft computing",2ndEdition, Wiley India Pvt Limited, 2011.

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