परीक्षा नियंत्रण प्रकोष्ठ, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर (म.प्र.)

क्रमांक / प.नि.प्र. / 2020 / 219 जबलपुर, दिनांक 30/12/2020

सूचना

महाविद्यालय के B.E. / B.Tech. एवं B.E. (PTDC) कोर्स के अंतर्गत विभिन्न स्कीम के समान पाठ्यक्रम के सिलेबस की समतुल्यता संलग्न सारणी अनुसार निर्धारित की गयी है। अतः CE/EE/EC/CSE/IT/IP विभाग के विद्यार्थी सारणी के तृतीय कॉलम मे दर्शित विषयों के स्थान पर उनके सम्मुख अंतिम कॉलम में दर्शित विषय एवं Mechanical विभाग के विद्यार्थी संलग्न सारणी अनुसार सरल क्रमांक (Serial No.) में दर्शित प्रथम विषय के कोड अनुसार Final Subject Code & Subject (After Equivalence) के सेलेबस द्वारा आगामी परीक्षाओं की तैयारी करना सुनिश्चित करें।

प्राचार्य / मुख्य परीक्षा नियंत्रक
जबलपुर इंजीनियरिंग महाविद्यालय,
जबलपुर (म.प्र.)

EQUIVALENCE OF SUBJECTS OF DIFFERENT SCHEMES
OF UNDER GRADUATE COURSES (B.E. / B.Tech.) OF ELECTRICAL ENGG.

S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
1	Grading	EE-38 High Voltage Engg. **B.E. VII Sem./B.E. (PTDC) VI Sem.**	EE701 High Voltage Engg. **B.Tech. VII Sem.**
	CBGS	EE7001 High Voltage Engg. **B.E. VII Sem.**	
	AICTE	EE701 High Voltage Engg. **B.Tech. VII Sem.**	
2	Grading	EE-40 Electrical Drive **B.E./B.E.(PTDC) VII Sem.**	EE702 Electric Drives **B.Tech. VII Sem.**
	CBGS	EE7002 Electric Drive **B.E. VII Sem.**	
	AICTE	EE702 Electrical Drives **B.Tech. VII Sem.**	
3	Grading	EE-052A Power System Control **B.E. /B.E. (PTDC) VIII Sem.**	EE703 Power System Control **B.Tech. VII Sem.**
	CBGS	EE7003 Power System Control **B.E. VII Sem.**	
	AICTE	EE703 Power System Control **B.Tech. VII Sem.**	
4	Grading	EE-42 Power System Planning & reliability **B.E. /B.E. (PTDC) VII Sem.**	EE704A Power System Planning & reliability **B.Tech. VII Sem.**
	CBGS	EE7004A Power System Planning & reliability **B.E. VII Sem.**	
	AICTE	EE704A Power System Planning & reliability **B.Tech. VII Sem.**	
5	Grading	EE-052B Advance Digital Communication **B.E./B.E. (PTDC) VIII Sem.**	EE704C Advanced Digital Communication **B.Tech. VII Sem.**
	CBGS	EE7004C Advance Digital Communication **B.E. VII Sem.**	
	AICTE	EE704C Advanced Digital Communication **B.Tech. VII Sem.**	

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6	Grading	EE-043B Generalized Theory of Electrical Machine **B.E./B.E.(PTDC) VII Sem.**	EE705A Generalized Theory of Electrical Machine **B.Tech. VII Sem.**
	CBGS		
	AICTE	EE705A Generalized Theory of Electrical Machine **B.Tech. VII Sem.**	
7	Grading	EE-43A Digital Control System **B.E./B.E.(PTDC) VII Sem.**	EE705B Digital Control System **B.Tech. VII Sem.**
	CBGS	EE7005B Digital Control System **B.E. VII Sem.**	
	AICTE	EE705B Digital Control System **B.Tech. VII Sem.**	
8	Grading	EE-46 EHV AC & DC transmission **B.E. VIII / B.E.(PTDC) VII Sem.**	EE801 EHV AC & HVDC Transmission **B.Tech. VIII Sem.**
	CBGS	EE8001 EHV AC & DC transmission **B.E. VIII Sem.**	
	AICTE	EE801 EHV AC & HVDC Transmission **B.Tech. VIII Sem.**	
9	Grading		EE803B SCADA System & Application **B.Tech. VIII Sem.**
	CBGS	EE8003A SCADA Systems & Applications **B.E. VIII Sem.**	
	AICTE	EE803B SCADA System & Application **B.Tech. VIII Sem.**	
10	Grading		EE803C Renewable & Non Conventional Energy Sources **B.Tech. VIII Sem.**
	CBGS	EE8003C Renewable & Non Conventional Energy Sources **B.E. VIII Sem.**	
	AICTE	EE803C Renewable & Non Conventional Energy Sources **B.Tech. VIII Sem.**	
11	Grading		EE804B Power Quality **B.Tech. VIII Sem.**
	CBGS	EE8004B Power Quality **B.E. VIII Sem.**	
	AICTE	EE804B Power Quality **B.Tech. VIII Sem.**	

OK. OK. OK. OK. OK. OK.

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Subject Code	Subject Name & Title	Maximum Marks allotted					Total Marks	Hours / Week			Total Credits
		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assign ments	End Sem	Lab Work		L	T	P	
EE701	High Voltage Engineering	70	20	10	30	20	150	3	-	2	4

Course Outcomes

CO1 – Understanding of breakdown phenomenon in different mediums.
CO2 – Understanding of generation and measurement of high voltage.
CO3 – Implementation of insulation coordination, testing and protection schemes for high voltages.

HIGH VOLTAGE ENGINEERING

Module –I Breakdown in gases

Breakdown mechanism in gases : ionization, ionization processes, Townsend's mechanism, time lag for breakdown, Streamer theory, Paschen's law, effect of temperature on B.D. Voltage, Desirable properties of a gaseous insulation, SF6 as an insulator, vacuum as a dielectric.

Breakdown of gases in uniform and non uniform fields : factors affecting time lag for BD, BD in a uniform AC field, BD under impulse voltage, volt time characteristics, B.D. in non uniform field, degree of non uniformity, effect of polarity of electrodes on B.D. voltage, Carona: carona loss on conductor at DC voltage, carona loss on conductor at AC voltage.

Module-II Breakdown in liquids, solids, composite insulation and applications of insulating materials

Breakdown in liquid and solids : Break down in liquids, classification of liquids, B.D. in pure liquids, B.D. in commercial liquids, different theories of B.D. in liquids

Different theories of B.D. in solids, intrinsic B.D. electromechanical B.D. thermal B.D. mechanism of B.D. occurring after prolonged operation

B.D. of composite dielectrics

Partial discharge

Applications of insulating materials

Module-III Generation for HV testing

Generation of High Voltage : Impulse voltage, impulse voltage generation, single stage IG circuits- their analysis, multistage IG, constructional details of IG.

Generation of High AC voltage : Cascaded transformer, series resonant transformer, tesla coil

Generation of high DC voltage- half and full wave rectifier, voltage double circuit

Module -IV HV Measurements

Measurement of impulse voltage by sphere gap. Measurement of AC, DC high voltage, sphere gap, voltage dividers. Measurement of dielectric constant and loss factor, Partial discharge measurements, impulse analyzer system.

Module -V Over voltage and insulation coordination

Charge formation in clouds, lightning surges, switching surges, protection against over-voltages, surge diverters, surge modifiers.

High voltage testing of power apparatus

Impulse testing of power transformer, testing of cables and some HV apparatus, testing of insulators, bushings, isolators and circuit breakers.

References :

1. M.S. Naidu and V.Kamaraju "High Voltage Engineering" Tata Mc Graw Hill Education 2013
2. D.V. Razevig "High Voltage Engineering" translated by Dr. M.P. Chourasia Khanna Pub.
3. E. Kuffel, W. S. Zingal & J. Kuffel "High Voltage Engineering fundamentals" Newres publication 2000
4. C.L. Wadhana " High Voltage Engineering" New age international publishers 2007
5. R.Arora "High voltage and electrical insulation engineering" wiely
6. Various 1.5 and IEC standards for HV lab techniques and testing

List of Experiments:

1. Various standards for high voltage testing of electrical apparatus
2. IE, IEC Standards
3. High voltage laboratories layout
4. Indoor and outdoor laboratory
5. Testing facilities
6. Safety precautions

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		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work					
EE702	Electrical Drives	70	20	10	30	20	150	3	-	2	4

Course Outcomes

CO1 – Relation between Power Electronic switches and Machines to form a drive.
CO2 – Application of various converter topology in association with machines.
CO3 – Discussion of special drives and case studies.

ELECTRICAL DRIVES

Module I :

Basic Concepts of Electric Drives : Elements of drive systems, Requirement of electric drives, Rating & Selection of drives, groups and individual drives, Constant power and Constant torque drives.

Motor Mechanism dynamics : Review of Characteristics of AC & DC motors, load characteristic, load-drive speed torque characteristics, quadrant speed torque characteristics. Mechanical Systems Stability of Electric drives, referred moment of inertia and torque of motor load combination, load equalization.

Module II :

DC Drives : Starting & Braking of conventional, Phase controlled and chopper controlled drives, Transient & Steady state analysis, Energy recovery systems.

Module III :

Induction Motor Drives : Conventional method of Starting braking and speed control, PWM, (VSI) Voltage source Inverter and Current Sources (CSI) fed IM drives, cyclo converter fed drive, Vector control drives.

Slip Controlled IM Drives : Review of Conventional methods & converter controlled-Crammers & Scherbius drives; rotor impedance control.

Module IV :

Synchronous Motors Drives : VSI and CSI fed; self-controlled-Brush less &. commutatorless dc & ac motor drives.

Module V :

Special Drives : Fundamentals of Switched reluctance motors, Stepper Motors, Permanent Magnet Motor Introduction to vector control; Digital control of drives.

Case Studies Electric traction, steel & cements plants, textile & paper mills, machine tool drive and CNC, electric cars.

References:

- Pillai S. K. "A first course on Electrical Drives", Second edition, Wiley Eastern.
- Dubey G. K., "Power Semiconductor Controlled Drives", Prentice-Hall, Englewood Cliffs .
- Dubey G. K. , "Fundamentals of Electrical Drives". Narosa Publishing House.
- Bose B. K., "Power Electronics and AC Drives", Prentice-Hall.
- Murphy M. D., and Tumbuli F., "Power Electronic Control of AC Motors", Pergamon Press, Oxford University Press.
- P.V. Rao, "Power semiconductor Drives", BS Publications

List of Experiments:

1. To perform Speed-Torque characteristics of a separately excited DC motor using open and close loop armature voltage control.
2. To perform Speed-Torque characteristics of a separately excited DC motor using open and close loop field control.
3. To perform four-quadrant speed-torque characteristics of a separately excited DC motor using close loop control.
4. To perform Speed-Torque characteristics of Single Phase Induction Motor using open loop controlled V/f method.
5. To perform Speed-Torque characteristics of Single Phase Induction Motor using close loop controlled V/f method.
6. To perform Speed-Torque characteristics of Three Phase Induction Motor using open loop controlled V/f method.
7. To perform Speed-Torque characteristics of Three Phase Induction Motor using close loop controlled V/f method.
8. To perform the speed control on 3-phase Induction motor using Sensor-less vector control.
9. To perform Speed-Torque characteristic of Permanent Magnet synchronous motor (PMSM) using open loop control.
10. To perform Speed-Torque characteristic of Permanent Magnet synchronous motor (PMSM) using close loop control.
11. To perform Speed-Torque characteristic of Permanent Magnet Brush Less DC motor (PMBLDC) using open loop control.
12. To perform Speed-Torque characteristic of Permanent Magnet Brush Less DC motor (PMBLDC) using close loop control.
13. To perform Speed-Torque characteristic of Switched Reluctance Motor (SRM) using open loop control.
14. To perform Speed-Torque characteristic of Switched Reluctance Motor (SRM) using close loop control.

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		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assign ments	End Sem	Lab Work					
EE703	Power System Control	70	20	10	30	20	150	3	-	2	4

Course Outcomes

CO1 – Explain power system restructuring and deregulation.
CO2 – Determine voltage control methods in an interconnected system.
CO3 – Analyze frequency control in an interconnected system.

POWER SYSTEM CONTROL

Module – I : General problems associated with modern interconnected power systems, deregulation of electric utilities , Competitive market for generation, power system restructuring, congestion, available transfer capacities, pricing of energy.

Module – II : Distribution in deregulated market, the development in competition, demand side management, Maintaining distribution planning, transmission expansion in new environment, Transmission in open access, Unbundling Generation, Transmission and distribution, BOT, ISO power exchange (PX). Energy market and terms related to energy market.

Module – III : Introduction to SCADA, Introduction to Flexible AC Transmission System (FACTS), Voltage quality in power systems, Distributed generation. Phasor measurements unit-concept, working and applications in wide area, online monitoring of power system.

Module – IV : MW Frequency control – Coherency, Control area, modeling of speed control mechanism, load damping, block diagrammatic representation of single and two area interconnected system, static and dynamic response , optimum parameter adjustment.

Module – V : MVAR Voltage Control – Difference in control strategy over MW-f-control characteristics of an exciting system, DC AC and static excitation system, general block diagram representation of voltage regulators.

Reference Books :

1. P.S. Kundur, Prabha Kundur, "Power System Stability and Control" ,McGraw HillEducation,2005
2. D.P.Kothari and I.J.Nagrath, "Modern Power System Analysis",Tata Mc-Graw Hill Publishing Company, Third Edition, 2008.
3. C.L.Wadhwa, "Electrical Power Systems", New-Age International Publishers", Sixth edition, 2009.
4. PSR Murthy," Power System Operation and Control",McGraw Hill Publishing

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		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work					
EE704A	Power System Planning & Reliability	70	20	10	-	-	100	3	1	-	4

Course Outcomes

CO1 – Illustrate the basic concepts and techniques of modern reliability theory.

CO2 – Apply the approaches and techniques to assess reliability of Power systems..

CO3 – Introduce the principles and techniques of Quality Control and their practical uses in design and monitoring of Power systems.

POWER SYSTEM PLANNING & RELIABILITY

Module-I : Review of Probability Theory: Element of probability theory, Probability Distribution, Random variable, Density and distribution functions. Reliability function, MTTF, Hazard rate function, Bathtub curve, Conditional probability, Binominal distribution, Poisson distributions, Normal distribution, Exponential distribution, Weibull distribution.

Module-II : Reliability of Engineering Systems: Component reliability, Reliability of systems with non-repairable components, Series configuration, Parallel configuration, Combined series-parallel systems, System structure function, Minimal tie-set, Minimal cut-set and Decomposition methods. Repairable systems, MARKOV analysis, Load sharing system, Standby systems, Degraded systems.

Module-III : Reliability of Engineering Systems : Reliability model of a generating unit, State space methods, Combing states, sequential addition method, Load modelling, Cumulative load model, Merging of generation and load models, Loss of load probability, Percentage energy loss, Probability and frequency of failure, Operating reserve calculations.

Module-IV : Power Network Reliability : Weather effect on transmission lines, Common mode failures, Switching after faults, three state components, Normally open paths, Distribution system reliability.

Module-V : Composite System Reliability : Bulk Power supply systems, Effect of varying load, Inter connected systems, correlated and uncorrelated load models, Cost and worth of reliability.

Reliability Improvement & Testing: Reliability growth process, Growth curve, Growth model, Reliability life testing, Test time calculations, Length of test, Burn in testing, Acceptance testing, Accelerated life testing, Environmental test, Reliability estimations.

References:

- J. Endreny, Reliability Modelling in Electric Power Systems, John Wiley & Sons.
- Roy Billinton & Ronald, Nallan, Reliability Evaluation of Power Systems, Plenum Press, New York.
- Charles E Ebeling, An Introduction to Reliability and Maintainability Engineering, McGraw Hill Education.

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		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work					
EE704C	Advance Digital Communication	70	20	10	-	-	100	3	1	-	4

Course Outcomes

CO1 – Understand and appreciate the need of various modulation and spread spectrum techniques.

CO2 – Analyze the properties of basic Modulation techniques and apply them to Digital Communication

CO3 – Design and develop the different types of modulation techniques, equalizer to improve the performance under fading channels for various applications.

ADVANCE DIGITAL COMMUNICATION

Module – I : Digital PAM, binary PAM formats, line coding, band limited digital PAM systems Nyquist pulse shaping, equalization, synchronization techniques, bit and frame synchronization. Coded pulse modulation, voice digitization rate (VDR) of PCM, DPCM, DM, ADM, CVSD, log PCM, their performance comparison, VDR reduction by speech coding, VOCODERS, noise performance of PCM and DM, Digital multiplexes. AT & T and CCITT hierarchies, quasi-synchronous multiplexes.

Module – II : Digital CW modulation, BPSK, DPSK, DEPSK, QPSK, MPSK, QASK, BFSK, Doubinary encoding, QPR coherent and non-coherent systems, error probabilities in PSK, DPSK, FSK, QPSK, 16QAM, MSK, QPR and bit.

Module – III : Matched correlation and optimum filters and symbol error rate.

Module – IV : Spread Spectrum techniques : DS, CAMA, FH, PN sequence, power requirement PN- sequence code, and Walsh code.

Module – V : ISDN & Value added communication system simulation & Analysis using MATLAB & Simulink Application using communication toolboxes.

Reference Books :

1. Digital Communication by Haykins Mc Graw Hill Int Edition
2. Modern Digital & Analog Communication by B.P. Lathi, Willey Eatern Ltd 2000
3. Communication Systems by A B Carlson, Tata Mc Graw Hill 2000

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		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work					
EE705A	Generalised Theory of Electrical Machines	70	20	10	-	-	100	3	1	-	4

Course Outcomes

CO1 – Analyze and apply the concept of steady state analysis and electrical transients in polyphase machines

CO2 – The generator and motor operation in steady state and transient conditions

CO3 – Evaluate the basic operation and performance of special machines and can select special machines for different purpose.

GENERALISED THEORY OF ELECTRICAL MACHINES

Module - I : Generalised Theory : Conversions – Basic two pole machines – Transformer with movable secondary – Transformer voltage and speed voltage Kron's primitive machine Analysis of electrical machines.

Module – II : Linear Transformation : Invariance of Power – Transformations from displaced brush axis, three phases to two phase, Rotating axes to stationary axes Transformed impedance matrix Torque calculations.

Module – III : DC Machines : Generalized Representation – Generator and motor operation – Operation with displaced brushes – Steady state and transient analysis – sudden short circuit – Sudden application on inertia load – Electric braking of DC motors.

Module – IV : AC Machines : Synchronous Machines : Generalized Representation – Steady state analysis Transient analysis – Electro-mechanical transients. Induction Machines : Generalized representation performance equation – steady state analysis – Transient analysis Double case machine – Harmonics – Electric braking.

Module - V : Special Machines : Generalized Representation and steady state analysis of Reluctance motor Brushless DC Motor – Variable Reluctance Motor Single phase series motor.

Reference Books :

1. Gupta J.B. Theory & Performance of Electrical Machines, S.K.Kataria & Sons, New Delhi 2010
2. Bimbhra P.S. Generalized Circuit Theory of Electrical Machines, Khanna Pub Ltd. 5th Edition.

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		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work					
EE705B	Digital Control System	70	20	10	-	-	100	3	1	-	4

Course Outcomes

CO1 – Acquire the knowledge of digital control system concepts.

CO2 – Analyze the considered digital control systems using state space and z domain technique.

CO3 – Design a digital controller to meet given performance specifications using conventional and recent methods .

CO4 - Examines the stability of the considered digital control systems using various techniques.

DIGITAL CONTROL SYSTEM

Module - I :

Introduction: Digital Control Systems, quantization and quantization error, Z-transform, Z-transforms of elementary functions, properties of Z-transform, Inverse Z-transform, Z-transform method for solving difference equations

Module – II :

Z-plane Analysis of Discrete time Control Systems: Introduction, Impulse sampling and data hold, pulse transfer function, realization of digital controllers and digital filters

Module – III :

Design of Digital control systems by Conventional methods: Introduction, Mapping between s-plane and z-plane, transient and steady-state response analysis, Design based on frequency response methods, Analytical Design method.

Module –IV :

State Space Analysis: State space representation of digital systems, solving discrete state space equations, pulse transfer function matrix, discretization of continuous time state space equations, Liapunov stability analysis.

Module - V :

Pole placement and State Observers design: Controllability, Observability, useful transformations of state space analysis and design, Design through pole placement, state observer

Reference Books :

1. Katsuhiko Ogatta, " Discrete time Control Systems" Second Edition, Prentice Hall of India (2005)

2. I H Nagrath, " State Space methods and digital control systems" , New Age International (2004).

3.M.Gopal,:Digital Control and state variable Methods", Tata McGraw Hill,Fourth edition 2009

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Bachelor of Technology (Electrical Engineering) Semester: VIII

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Subject Code	Subject Name & Title	Maximum Marks allotted					Total Marks	Hours / Week			Total Credits
		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work		L	T	P	
EE801	EHV A.C. & D.C. TRANSMISSION	70	20	10	30	20	150	3	-	2	4

Course Outcomes

CO1 – To understand the concept, planning of DC power transmission and comparison with AC Power transmission.

CO2 – To classify various compensators suited for various power system purposes.

CO3 – To familiarize the students with the HVDC converters and their control system.

CO4 –To analyse harmonics and design of filters.

EHV A.C. & D.C. TRANSMISSION

Module-I: Constitution of EHV A.C. and D.C. links, Kind of D.C. links, Limitations and Advantages of A.C. and D.C. transmission, Principal application of A.C. and D.C. transmission, Trends in EHV A.C. and D.C. transmission, Power handling capacity. Converter analysis, Graetz's circuit, firing angle control, overlapping.

Module –II: 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).

Module –III: Components of EHV D.C. system, converter circuits, rectifier and inverter valves, Reactive power requirements, harmonics generation, Adverse effects, Classification, Remedial measures to suppress, filters, Ground return. Converter faults & protection. harmonics misoperation, Commutation failure, Multi-terminal D.C. lines.

Module –IV: Control of EHV D.C. system desired features of control, control characteristics, Constant current control, Constant extinction angle control. Ignition Angle control. Parallel operation of HVAC & DC system. Problems & advantages.

Module –V: Travelling waves on transmission systems, their shape, Attenuation and distortion, effect of junction and termination on propagation of travelling waves. Over voltages in transmission system. Lightning, switching and temporary over voltages: Control of lighting and switching over voltages

Reference:

1. S. Rao,- "EHV AC & DC Transmission" Khanna pub.
2. Kimbark,-" HVDC Transmission" john willy & sons pub.
3. Arrillaga,- "HVDC Transmission"2nd Edition ,IEE londan pub.
4. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
5. T.K. Nagsarkar,M.S. Sukhiza, -"Power System Analysis", Oxford University
6. Narain.G. Hingorani, l. Gyugyi-"Undustanding of FACTS concept and technology", John Wiley & sons pub.
7. P.Kundur- "H.V.D.C. Transmission" McGraw Hill Pub.

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Subject Code	Subject Name & Title	Maximum Marks allotted					Total Marks	Hours / Week			Total Credits
		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work		L	T	P	
EE803B	SCADA Systems & Applications	70	20	10	-	-	100	3	-	-	3

Course Outcome

CO1 – Understanding of Supervisory control & Data acquisition.

CO2 – Design of SCADA systems with establishment of communication protocols.

CO3 – Application of the SCADA to utilities for their operation & control.

SCADA SYSTEMS & APPLICATIONS

Module I: Introduction to SCADA and PLC:SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. PLC: Block diagram, programming languages, Ladder diagram, Functional Block diagram, Applications, Interfacing of PLC with SCADA.

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

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

Module IV: SCADA Communication-Various industrial communication technologies-wired and wireless methods and fiber optics, open standard communication protocols.

Module 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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Subject Code	Subject Name & Title	Maximum Marks allotted					Total Marks	Hours / Week			Total Credits
		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work		L	T	P	
EE803C	Renewable & Non Conventional Energy Sources	70	20	10	-	-	100	3	-	-	3

Course Outcome

CO1 – Understand the need of energy conversion and the various methods of energy storage.
CO2 – Explain the field applications of renewable energy sources.
CO3 – Illustrate the concepts of Direct Energy Conversion systems & their applications.

RENEWABLE & NON CONVENTIONAL ENERGY SOURCES

Module – I: Renewable Energy Systems
Energy Sources, Comparison of Conventional and non-conventional, renewable and non-renewable sources. Statistics of world resources and data on different sources globally and in Indian context. Significance of renewable sources and their exploitation. Energy planning, Energy efficiency and management.

Module – II: Wind Energy System
Wind Energy, Wind Mills, Grid connected systems. System configuration, working principles, limitations. Effects of wind speed and grid conditions. Grid independent systems - wind-battery, wind diesel, wind hydro biomass etc. wind operated pumps, controller for energy balance.Small Hydro System Grid connected system, system configuration, working principles, limitations. Effect of hydro potential and grid condition. Synchronous versus Induction Generator for stand alone systems. Use of electronic load controllers and self excited induction generators.Wave Energy System: System configuration: grid connected and hybrid systems.

Module – III: Solar Radiation
Extraterrestrial solar radiation, terrestrial solar radiation, Solar thermal conversion, **Solar Photo tonic System** Solar cell, Solar cell materials, efficiency, Characteristics of PV panels under varying insulation. PV operated lighting and water pumps, characteristics of motors and pumps connected to PV panels.
Biomass Energy System: System configuration, Biomass engine driven generators, feeding loads in stand-alone or hybrid modes, Biomass energy and their characteristics.

Module – IV: Energy from oceans, Ocean temperature difference, Principles of OTEC, plant operations,
Geothermal Energy, Electric Energy from gaseous cells, Magneto-hydro generated energy, Non hazardous energy from nuclear wastes, Possibilities of other modern non-conventional energy sources.

Module – V: Electric Energy Conservation
Energy efficient motors and other equipment. Energy saving in Power Electronic controlled drives. Electricity saving in pumps, air-conditioning, power plants, process industries, illumination etc. Methods of Energy Audit.
Measurements systems; efficiency measurements. energy regulation, typical case studies, various measuring devices analog and digital, use of thyristors.

References:

1. John Twidell & Toney Weir, Renewable Energy Resources, E & F N Spon.
2. El-Wakil, Power Plant Technology, McGraw Hill.
3. Rai G D, Non-conventional Energy Resources, Khanna.
4. F Howard E. Jordan, "Energy-Efficient Electric Motor & their Application-II", Plenum Press, New York, USA.
5. Anna Mani, "Wind Energy Resource Survey **in** India-Ill", Allied Publishers Ltd., New Delhi,
6. S.P. Sukhatme: Solar Energy, TMH-4e,
7. Dr. A. Ramachandran, Prof B.V Sreekantan & M F.C. Kohli etc, "TERI Energy Data Directory & Year book 1994-95", Teri Tata Energy Research Institute, New Delhi

Jabalpur Engineering College, Jabalpur

(AICTE Model Curriculum based scheme)

Bachelor of Technology (Electrical Engineering) Semester: VIII

w.e.f. July 2017-18 batch

Subject Code	Subject Name & Title	Maximum Marks allotted					Total Marks	Hours / Week			Total Credits
		Theory			Practical						
		End Sem	Mid Sem	Quiz, Assignments	End Sem	Lab Work		L	T	P	
EE804B	Power Quality	70	20	10	-	-	100	3	-	-	3

Course Outcome

CO1 – To introduce to students the term and definition of power quality disturbances, and their causes, detrimental effects and solutions.
CO2 – Understand the causes of power quality problems and relate them to equipment.
CO3 –To introduce the harmonic sources, passive filters, active filters and standards.
CO4 – To prepare students to know the power quality monitoring method, equipments and develop the ability to analyze the measured data.

POWER QUALITY

Module –I: Introduction, power quality -voltage quality, power quality evaluations procedures term and definition: general classes of power quality problem, causes & effect of power quality disturbances.

Module –II: Voltage sags and interruption: sources of sags and interruption, estimating voltages sag performance, fundamental principles of of protection, monitoring sags.

Module –III: Transients over voltages: sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients, fundamentals of harmonics and harmonics distortion, harmonics sources from commercial load and from industrial loads.

Module –IV: Applied harmonics : harmonics distortion evalutions, principles for controlling harmonics, harmonics studies devices for controlling harmonic distortion, filters, passive input filter standards of harmonics.

Module –V: Electro-magnetic compatibility, constant frequency control, constant tolerance band control, variable tolerance band control, discontinuous current control.

Reference Books:

1. Power Quality- by R.C. Duggan
2. Power System harmonics –by A.J. Arrillga
3. Power electronic converter harmonics –by Derek A. Paice