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Choice Based Credit System (CBCS) in the Light of NEP-2020
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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTEE502	DCC	POWER ELECTRONICS	60	20	20	30	50	2	1	2	4

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):

This course aims to equip the students with a basic understanding of modern power semiconductor devices, various important topologies of power converter circuits for specific types of applications. The course also equips students with an ability to understand and analyze non-linear circuits involving power electronic converters.

Course Outcomes (COs):

Upon completion of the course, the student will be able to

1. Understand the principle of operation of commonly employed power electronic converters.
2. Analyze non-linear circuits with several power electronic switches.
3. Equipped to take up advanced courses in Power Electronics and its application areas.

Syllabus

UNIT-I **9 Hrs.**

Power Semiconductor diodes and Transistors: Types of power diodes-General purpose diodes-Fast recovery diodes- Their characteristics and applications, Bipolar junction transistors, Power MOSFETS P-Channel, N-Channel, IGBTs- Basic Structure and working, Steady state and switching characteristics-Comparison of BJT, MOSFET and IGBT-Their applications.

UNIT-II **10 Hrs.**

Principle of operation of SCR, Static and dynamic characteristics-Two transistor analogy, condition of turn on & off of SCR, Gate characteristics, GTO, DIAC, TRIAC, UJT, IGCT Characteristics.

Trigger circuits-R, RC and UJT triggering circuits. Various commutation methods of SCRs, Protection of SCRs, Series and Parallel operation of SCRs, String efficiency.

UNIT-III **9 Hrs.**

AC-DC Converter: Principles of controlled rectification—Study of single phase and three phase half controlled and full controlled bridge rectifiers with R, RL, RLE loads Effect of source inductances. Dual Converters—circulating current mode and Non-circulating current mode, Control Strategies.

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BTEE502	DCC	POWER ELECTRONICS	60	20	20	30	50	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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UNIT-IV **9 Hrs.**

DC-DC Converter: Classification of Choppers: A, B, C, D &E, Jones and Morgens chopper. Switching mode regulators - Study of Buck, Boost, Buck-Boost regulators.
AC-AC Converter: Principle of operation of Single Phase Bridge type cyclo-converters and their applications. Single phase and Three phase AC Voltage controllers with R & RL load.

UNIT-V **9 Hrs.**

DC-AC Converter: Principle of operation of Single Phase Inverters-Three phase bridge inverters (180 and 120 Degree modes)-voltage control of invertors—Single Pulse Width Modulation-Multiple pulse width Modulation-Sinusoidal Pulse Width Modulation .Comparison of Voltage Source Inverter and Current Source Inverters.

Textbooks:

:

1. Rashid, M.H, 'Power Electronics - Circuits, Devices and Applications', Prentice Hall Publications, 3 rd Edition, 2003.
2. M.D.Singh and K.B.Kanchandhani, 'Power Electronics', Tata McGraw-Hill Publishing Company Limited, 2nd Edition, 2006.

References:

1. Ned Mohan, Tore M. Undeland, William P. Robbins, 'Power Electronics', John Wiley & Sons Publications, 3rd Edition, 2006.
2. Vedam Subramaniam, 'Power Electronics', New Age International (P) Ltd Publishers, 2001.
3. Philip T. Krein, 'Elements of Power Electronics', Oxford University Press, 1st Edition, 2012.
4. V. R. Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', Oxford University Press, 1st Edition, 2005. 4. P.S. Bimbhra, 'Power Electronics', Khanna Publishers, 3rd Edition, 13th Reprint, 2004

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BTEE502	DCC	POWER ELECTRONICS	60	20	20	30	50	2	1	2	4

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.

List of Experiments:

1. Show Static and dynamic characteristics of an SCR.
2. Examine Static and dynamic characteristics of TRAIC.
3. Examine Static and dynamic characteristics of DAIC.
4. Determine Characteristics of MOSFET and IGBT.
5. Analyze Single phase SCR Half controlled converter with R and RL load.
6. Analyze Single phase fully controlled (bridge) converter with R and RL load.
7. Design 3-phase SCR Half Controlled Converter (using simulation platform like MATLAB/Simulink)
8. Design of 3-phase SCR Fully Controlled Converter (using simulation platform like MATLAB /Simulink)
9. Recall of classes of commutation A, B, C, D, E, F.
10. Simulation of Chopper circuit using SCR.

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BTEE602	DCC	Renewable Energy	60	20	20	0	0	3	0	0	3

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 course will provide understanding of various renewable energy sources, systems and applications in the present context and its need.

Course Outcomes (COs):
After the successful completion of this course students will be able to

1. Demonstrate the knowledge of solar energy and its applications
2. Demonstrate the knowledge of wind energy and its applications
3. Demonstrate the knowledge of bio energy and fuel cell.
4. Analyze economic aspect of renewable energy sources.

Syllabus

UNIT I **8 hrs.**

Solar Energy: Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, solar radiation geometry, Instruments for solar radiation measurements, empirical equations for prediction of availability of solar radiation, radiation on tilted surface solar energy conversion into heat, types of solar collectors, evacuated and non-evacuated solar air heater, concentrated collectors, air heater and cylindrical parabolic collector

UNIT II **8 hrs.**

Solar Energy Application: solar energy thermal storage, heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air conditioning, solar pond, heliostat, solar furnace photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and disadvantages

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			THEORY			PRACTICAL		L	T	P	CREDITS
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BTEE 602	DCC	Renewable Energy	60	20	20	0	0	3	0	0	3

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.

UNIT III **8 hrs.**

Wind Energy: Energy available from wind, basics of lift and drag, basics of wind energy conversion system, effect of density, angle of attack and wind speed, windmill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm

UNIT IV **10 hrs.**

Bio Energy : Types of biogas plants, biogas generation, factors affecting biogas generation, advantages and disadvantages, biomass energy, energy plantation, gasification, types and applications of gasifiers.

Hydrogen and Fuel Cell: hydrogen as a renewable energy source, source of hydrogen, fuel for vehicle

Hydrogen production: direct electrolysis, direct thermal decomposition of water, biological and biochemical methods of hydrogen production. Storage of hydrogen: gaseous, cryogenic and metal hydride, utilization of hydrogen fuel cell- principle of working, construction and applications

UNIT V **8 hrs.**

Economic Analysis: Initial and annual cost, basic definitions, present worth calculations, repayment of loan in equal annual installments, annual savings, cumulative saving and life cycle cost, economic analysis of add on solar system, payback period, clean development mechanism.

Textbooks:

1. G.D. Rai , "Non-Conventional Energy Sources ", Khanna Publishers New Delhi, 6th edition 2013.
2. S. P. Sukhatme and J. K. Nayak "Solar Energy: Principles of Thermal Collection and Storage ", McGrawHill Education, 4rd edition 2017.

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BTEE 602	DCC	**Renewable Energy**	60	20	20	0	0	3	0	0	3

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.

References:

1. G.N Tiwari and M .K Ghosal , "Renewable energy resources" Narosa Publication 2007.
2. Twidell & Wier, CRC Press (Taylor & Francis) 3rd 2015
3. John A. Duffie, William A. Beckman , "Solar Engineering of Thermal Processes", John Wiley, New York 4th Edition 2013
4. Shobh Nath Singh," Non-conventional energy resources" , Pearson Education India 2017

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Name of Program: Bachelor of Technology in Electronics & Communication

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTEC603	EC	Discrete Time Signal Processing	60	20	20	30	20	3	1	2	5

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 Objective:

This course will introduce the basic concepts and techniques for processing of discrete time signals. To familiarize with the important methods in DSP, including digital filter design, transform-domain processes and Multirate processing.

Course Outcome:

After completion of this course the students are expected to be able to demonstrate following attributes:

1. Student will be able to represent discrete time signal analytically and visualize them in the time & frequency domain and also understand the different transforms techniques & their significance.
2. Student will be able to analyze and design the discrete time system and design different digital filters using the concept of digital signal processing.

Syllabus:

UNIT I **10 Hrs.**

Discrete-Time Signals and Systems: Discrete-time signals, discrete-time systems, system properties (linearity, time-invariance, memory, causality, BIBO stability), analysis of discrete-time LTI systems, discrete time systems described by difference equation, solution of difference equation

UNIT II **10 Hrs.**

z-Transform: The direct z-transform, Region of Convergence , properties of ROC, properties of the z-transform, inverse z transform, analysis of linear time-invariant systems in the z- domain, pole-zero plots, time-domain responses of simple pole-zero plots, causality and stability.

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UNIT III **10 Hrs.**

Discrete Fourier Transform: DFT, Properties of the DFT, Efficient computation of the DFT: Decimation-in-time and Decimation-in frequency Fast Fourier transform algorithms, decomposition for 'N' composite number.

UNIT IV **10 Hrs.**

Digital filters Design Techniques: Design of IIR digital filters: Approximation of Derivatives, Impulse invariant and Bilinear transformation, Lowpass/Highpass Butterworth & Chebyshev filter design, Design of FIR digital filters: windowing techniques Rectangular, Hamming, Hanning windows.

UNIT V **10 Hrs.**

Multi rate digital signal processing: Introduction, design of practical sampling rate converters, Decimators, Interpolators, signal flow graph, Polyphase decompositions.

Text Books:

1 John. G Proakis & D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Application", 4th Edition, Pearson Education,2007.
2 S.Salivahanan, A Vallavaraj & C.Gnanapriya, "Digital Signal Processing", 3rd Edition, TMH, 2017.
3 A.V. Oppenheim & R.W. Schaffer, "Digital Signal Processing", 3rd Edition, PHI, 2010.

References:

1 Rabiner and Gold: Theory and Application of Digital Signal Processing, I st Edition, PHI Learning, 2009.
2 Ingle and Proakis: Digital Signal Processing- A MATLAB based Approach, 3rd Edition, Thompson, Cengage Learning, 2010.
3 S. K. Mitra, "Digital Signal Processing: A Computer Based Approach", 4th Edition, TMH, 2013.

List of Experiment:

1. Generate, analyze and plot various discrete-time signals.
2. Verify the operations on sequences (addition, multiplication, scaling, shifting, folding etc).
3. Implement linear time-invariant (LTI) systems and test them for stability and causality.
4. Analyze and Compute z-transforms of various discrete time signals.
5. Compute DFT of sequences and generate the phase and frequency plots.
6. Generate linear convolution of two sequences and plot the response.
7. Generate circular convolution of two sequences and plot the response.
8. Design IIR Filter for the given parameters.
9. Design FIR Filter for the given parameters.
10. Implement Up sampling and Down sampling of a sinusoidal signal and analyze the results.

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BTEE 604N	**SEC**	**Electrical Simulation Lab**	0	0	0	30	20	0	0	4	2

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***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 course will provide knowledge of various softwares in field of Electrical Engineering.

Course Outcomes (COs):
After the successful completion of this course students will be able to
1. Demonstrate the application of PSCAD in Electrical Engineering
2. Demonstrate the application of PowerWorld in Electrical Engineering
3. Demonstrate the application of Matlab and simulink in Electrical Engineering

List of Experiments:
1. Analyze reactive power and power factor in single-phase and three-phase circuits in PSCAD
2. Obtain the parameters of a 345 kV transmission line and modeling it in PSCAD.
3. Perform power flow calculations using MATLAB
4. Perform out power flow calculations using PowerWorld.
5. Obtain the current harmonics drawn by power electronics interface using Power World
6. Obtain the effect of sudden short-circuit on a synchronous generator output.
7. Analyze the effect of real and reactive powers on bus voltages.
8. Simulate various faults using MATLAB
9. Simulate transient stability in a 3-bus example power system using MATLAB.
10. Analyze the dynamic interaction between two control areas using Simulink modeling and economic dispatch using PowerWorld.

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BTEE609	SEC	Electrical Safety Lab	0	0	0	30	20	0	0	2	1

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):
To introduce the students with the

1. Electrical safety during installation of electrical equipment.
2. Hazardous zones in electrical safety.
3. IE rules and their standards.

Course Outcomes (COs):
After the successful completion of this course students will be able to

1. Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
2. Summarize the Safety aspects during Installation of Plant and Equipment.
3. Describe the electrical safety in residential, commercial, and agricultural installations.
4. Describe the various Electrical Safety in Hazardous Areas
5. State the electrical systems safety management and IE rules.

List of Experiments:

1. Case study to understandprimary and secondary electrical shocks.
2. Case study to understandsafety during installation of electrical plant and equipment.
3. Case study to understand safety installation of power transformer and outdoor switchyard equipment.
4. Case study to understandsafety during installation of electrical rotating machines.
5. To measure insulation resistance of rotating machines.
6. Case study to understandelectrical safety in residential, commercial, and agricultural installation.
7. Case study to identify hazardous zones and classification of enclosures for hazardous zones.

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BTEE609	**SEC**	**Electrical Safety Lab**	0	0	0	30	20	0	0	2	1

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.

8. To study safety management policy and safety auditing.
9. Case study to understand objective and scope of ground clearances and section clearances of electrical equipment.
10. To study standards of safety, voltageand current limit as per IE rules (Electricity ACT 2003)

Textbooks:

1. S. Rao, Prof. H.L. Saluja, "Electrical safety, fire safety Engineering and safety management", Khanna Publishers. New Delhi
2. www.apeasternpower.com/downloads/elecact2003.pdf

References:

1. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi.

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BTEE613	DE	Energy Auditing	60	20	20	0	0	3	0	0	3

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):
To prepare the students to have a basic and practical knowledge of Energy Audit. To prepare the students to have a basic knowledge of pre-Audit and post Audit.

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

1. Demonstrate various types of energy audit.
2. Conduct Different Strategies of energy audit.
3. Understand and analyze Energy Audit Instruments Combustion Analysis.
4. Methodologies of Conducting Energy Audit Preliminary Questionnaire.

Syllabus

UNIT I **8 Hrs.**

Energy Audit: Definition, Need and Objectives.
Types of Energy Audit Internal Audit, External Audit, Walk through Energy Audit, Preliminary Energy Audit, Detailed Energy Audit, Investment Grade Energy Audit, Industrial Energy Audit, Utility (Services) Energy Audit, Commercial Energy Audit, Residential Energy Audit.

UNIT II **8 Hrs.**

Energy Audit Strategies Monitoring and Control, Questioning the Need, Minimizing the Need of End Use, Minimizing the Losses, Operating the Equipment at Optimum Efficiency, Operating the Most Efficient Equipments from Set of Equipments, Minimizing the Idle Redundant Running, Proper Maintenance of the Equipment, Substitution with Efficient Equipment, Substitution with more Efficient Equipment, Substitution with more Efficient Process, Energy Storage, Fuel Substitutions, Quality Control and Recycling. Basic Components of Energy Audit Preparing for Audit Visit, Instrumentation, Data Collection Techno-economic Analysis, Safety Considerations.

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BTEE613	DE	Energy Auditing	60	20	20	0	0	3	0	0	3

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT III **7 Hrs.**

Energy Audit Instruments Combustion Analysis, Temperature Management, Pressure Measurement, Flow Measurement, Humidity Measurement, Energy and Power Measurement, Light Level Measurement, Infrared Equipment, Tachometer & Stroboscope, P.F. Meter, Ultrasonic flow meter, and Steam & Air Leak Detector.

UNIT IV **8 Hrs.**

Important Survey Items Buildings, Lightings, HVAC, Furnaces & Ovens, Boilers and Steam Lines, Air Compressor and Compressed Air Distribution Lines, Chillers and Chilled Water Distribution Lines, Process Water Generation and Distribution Lines, Electrical Distributions Transformers and Lines, Pumps, Fans and Blowers, Cooling Towers, Electrical Motors, Waste Heat Sources, Material Transport, Peak Load Equipments.

UNIT V **8 Hrs.**

Methodologies of Conducting Energy Audit Preliminary Questionnaire, Review of Previous Records, Introductory Meeting, Walk through Tour, Flow Chart Construction for Detail Energy Audit, Identification of Required Audit Instruments, Finalization of Audit Schedule with the Company, Getting Detailed Data.

Post Audit Analysis Process Flow Diagram, Material and Energy Balance.. Audit Subsidy Scheme of PCRA, IDBI and IREDA.

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Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
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Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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Choice Based Credit System (CBCS) in the Light of NEP-2020
B.Tech. in Electrical Engineering
(Common to EE\EX)
(2021-2025)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTEE 613		**Energy Auditing**	60	20	20	0	0	3	0	0	3

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.

Textbooks:

1. Albert Thumann, P.E., C.E.M. , Plant engineers & Managers Guide To Energy Conservation edition-2011, Published By The Fairmont Press , Inc 700 Indian Trail Liburn, GA30047.
2. BEE Volume I –Second Edition 2005 5. G.G. Ranjan: Optimizing Energy Efficiencies in Industry ,Edition McGraw Hill

References:

1. Instructions to Energy Auditors, Vol. - I & Vol. - II – National Technical Information Services U. S. Deptt. Of Commerce Springfield, VA 22161.
2. Energy Auditing, The Fairmont Press Inc. Published by Atlanta, Georgia Commercial Energy Auditing Reference Handbook, Third Edition 2016, Steve Dorty.

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