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Choice Based Credit System (CBCS) in the Light of NEP-2020
B.Tech. EEE All Branches w.e.f. 2023

COURSE CODE	CATE GORY	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*				
BTEE503		Control System Engineering	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 on the 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 control system and mathematical modeling of the system.

Course Outcomes (COs):
After the successful completion of this course students will be able to
1. Demonstrate the understanding of basic elements and modeling of the control system.
2. Analyze the stability in time domain and frequency domain
3. Design the controller and compensators for the system

Syllabus

UNIT I **8 Hrs.**
Introduction: Basic Elements of Control System, Open loop and Closed loop systems, Differential equation, Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph, Constructional and working concept of AC servomotor.

UNIT II **8 Hrs.**
Time Domain Analysis: Time domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants Feedback control actions: Proportional, derivative and integral control.

UNIT III **8 Hrs.**
Stability Analysis and Root locus: The concept of stability, Routh's stability criterion, qualitative stability and conditional stability, limitations of Routh's stability. Characteristics equation of closed loop system root loci, construction of loci, Effect of adding, poles and Zeros on the loci, Stability by root loci.

UNIT IV **8 Hrs.**
Frequency domain Analysis: Frequency, Domain analysis, Bode plots, Determination of frequency domain specifications, Phase margin and Gain margin, Stability analysis from Bode plots, Polar plots, Nyquist plots, Stability analysis, Compensation techniques: Lag, Lead, Lead-Lag Controllers design in frequency Domain.

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in the Light of NEP-2020
B.Tech. EEE All Branches w.e.f. 2023

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BTEE503		Control System Engineering	60	20	20	30	20	3	1	2	5

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

UNIT V **8 Hrs.**

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, Solution of state equation: Eigen values & eigenvectors digitalization state transitive matrix, Concepts of Controllability and Observability.

Text Books:

1. Richard C Dorf; Robert H Bishop, "Modern control system", Pearson Education, 14th Edition, 2022
2. I. J. Nagrath and M. Gopal, "Control System Engineering", New Age International Publishers, 7th Edition, 2021.

References:

1. M. F. Golnaraghi and Benjamin C Kuo, "Automatic control systems", New York McGraw-Hill Education, 9th Edition, 2017.
2. M. Gopal, "Digital Control and State Variable Methods", Tata McGraw- Hill 4th Edition, 2014.
3. Joseph J. DiStefano, Allen R Stubberud and Ivan J Williams, Schaum's Outline Series, "Feedback and Control Systems", Tata McGraw- Hill, 2nd Edition 2014.
4. John J. D'azzo & Constantine H. Houpis, "Linear control system analysis and design", Tata McGraw-Hill., 5th Edition 2003.

List of Experiments:

1. To study the torque speed characteristics and determine the transfer function of a DC motor.
2. To study the characteristics of a small AC servomotor and determine its transfer function.
3. To study the performance of various types of controllers used to control the temperature of an oven.
4. To study the performance characteristics of an analogues PID controller using simulated systems.
5. Perform impulse response of a transfer function.
6. Perform ramp response of a transfer function.
7. Perform the transient and frequency response of a second order network.
8. Draw Nyquist plot from a transfer function.
9. Draw root locus from a transfer function.
10. Draw a bode plot from a transfer function.

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Technology and Science

Choice Based Credit System (CBCS) Scheme in light of NEP-2020

B. Tech in AU/ME/CE/EE/EEE/EC/EC-IOT/EI/R&A/MT

(2021-2025)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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BTME510	AESE	DESIGN THINKING AND INNOVATION	60	20	20	0	0	2	0	0	2

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 objective of this course is to provide (A) the new ways of creative thinking and learn the innovation cycle of design thinking process, (B) understand product design and prototyping and (C) develop innovative product.

Course Outcomes (COs):

After completion of this course student will able to

1. Compare and classify the various learning styles and memory techniques and apply them in their engineering education
2. Analyze emotional experience and inspect emotional expressions to better understand users while designing innovative products
3. Develop new ways of creative thinking and learn the innovation cycle of design thinking process for developing innovative products
4. Propose real-time innovative engineering product designs and choose appropriate frameworks, strategies, techniques during prototype development
5. Perceive individual differences and its impact on everyday decisions and further Create a better customer experience

Syllabus

Unit I **(6 Hrs)**

Learning: understanding the learning process, Kolb's learning styles, assessing and interpreting.

Memory: understanding the memory process, problems in retention, memory enhancement techniques.

Emotions: understanding emotions, experience & expression, assessing empathy, application with peers.

Unit II **(6 Hrs)**

Design Thinking: definition, need, objective, concepts & brainstorming, stages of design thinking process (explain with examples) – **empathize, define, ideate, prototype, test**.

Creative Thinking: understanding creative thinking process, understanding problem solving, creative problem solving test.

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Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
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Shri Vaishnav Institute of Technology and Science

Choice Based Credit System (CBCS) Scheme in light of NEP-2020

B. Tech in AU/ME/CE/EE/EEE/EC/EC-IOT/EI/R&A/MT

(2021-2025)

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BTME510	AESE	DESIGN THINKING AND INNOVATION	60	20	20	0	0	2	0	0	2

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Unit III **(6 Hrs)**

Product Design: process of engineering product design, design thinking approach, stages of product design, examples of best product designs and functions, assignment – engineering product design. Prototyping: What is prototype? Why prototype? Rapid prototype development process, testing, sample example, test group marketing

Unit IV **(6 Hrs)**

Celebrating the Difference: understanding individual differences & uniqueness, group discussion and activities to encourage the understanding, acceptance and appreciation of individual differences Customer Centricity: practical examples of customer challenges, use of design thinking to enhance customer experience, parameters of product experience, alignment of customer expectations with product design.

Unit V **(6 Hrs)**

Feedback, Re-design & Re-create: feedback loop, focus on user experience, address "ergonomic challenges, user focused design, rapid prototyping & testing, final product, final presentation – **"solving practical engineering problem through innovative product design & creative solution".**

Text and Reference Books:

1. E. Balaguruswamy "Developing Thinking Skills (The way to Success)" Khanna Book Publishing Company, 2022.
2. Gavin Ambrose and Paul Harris "Basics Design 08: Design Thinking" Bloomsbury Publishing India Pvt. Ltd. 2009.
3. Vijay Kumar "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization" Wiley Pub. 2012.
4. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.
5. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
6. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.

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Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in the Light of NEP-2020
B.Tech. in Electrical Engineering
(Common to EE\EX)
(2022-2026)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
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BTEE 501N		Electrical Machines-II	60	20	20	0	0	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 Educational Objectives (CEOs):
To prepare the students to have a basic and practical knowledge of DC machine. To prepare the students to have a basic knowledge of 3 phase Synchronous machine.

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

1. Demonstrate various parts of an electrical machine.
2. Conduct Different test on DC machine.
3. Understand and analyze synchronous generator.
4. Demonstrate constructional details, principle of operation of Special Machines.

Syllabus

UNIT I **[8 Hrs]**

DC Generators: Introduction, construction, types, emf equation, lap and wave windings, armature reaction, commutation, methods of improving commutation, equalizer rings, demagnetizing and cross magnetizing ampere turns, various characteristics of shunt, series and compound generators, voltage build up, losses and efficiency, condition for maximum efficiency.

UNIT II **[8 Hrs]**

DC Motors: Introduction, principals, back-emf, torque of motor, types, characteristics of shunt, series and compound motors, speed control (field and armature control methods), basic idea of solid state devices in controlling of DC motors, Starting of DC motors, three point and four point starters, losses and efficiency, testing (brake test, swimburnes, hopkinson test), Applications.

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in the Light of NEP-2020
B.Tech. in Electrical Engineering
(Common to EE\EX)
(2022-2026)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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BTEE 501N		Electrical Machines-II	60	20	20	0	0	3	1	2	5

UNIT III **[9 Hrs]**

Synchronous Generators (Alternators): Introduction, Construction, advantages of rotating field, types of rotors, emf equation, excitation systems, equivalent circuit and their phasor diagrams, voltage regulation, synchronous impedance method, mmf method. Zero power factor method, two reaction theory of salient pole rotor, phasor diagram, power developed and power angle characteristics of salient pole machine, determination of Xd and Xq, synchronization, synchronizing power and torque, parallel operation application.

UNIT IV **[8 Hrs]**

Synchronous Motors: Introduction, construction, principal of operation, starting of synchronous motor, equivalent circuit and phasor diagrams, power and torque, performance calculation, speed torque characteristics, power factor control-effect of change of excitation.

UNIT V **[7 Hrs]**

Synchronous Motors: V curve and inverted V curve, synchronous condenser and reactors, synchronous phase modifiers, hunting-causes and remedies, applications, synchronous induction motor application.

Textbooks:

1. A. E. Fitzgerald, C. KingsleyJr and Umans, Electric Machinery, 6th Edition McGraw Hill, International Student Edition.
2. I.J. Nagrath & D.P. Kothari, Electric Machines, 3/e, Tata McGraw Hill, New Delhi.

References:

1. M.G. Say, Performance & design of AC machines, CBS publishers & distributors, Delhi, 3rd edition
2. A.E. Clayton & N.N. Nancock, The Performance & design of DC machines CBS publications & distributors, Delhi, 3rd edition
3. P.S. Bhimbra, Generalized theory of Electrical Machines, Khanna publishers, Delhi,
4. Ashfaq Husain, Electric Machines, DhanpatRai, New Delhi.
5. Syed A. Nasar, Electric Machines & Power Systems, Volume I , Tata McGraw Hill, New Delhi
6. E. Fitzerald, C. Kingsley & S.D. Umans , Electric Machinery Tata McGraw Hill ,New Delhi ,5 edition.
7. Stephen J Chapman, Electric Machinery Fundamentals, McGraw-Hill

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Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in the Light of NEP-2020
B.Tech. in Electrical Engineering
(Common to EE\EX)
(2022-2026)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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BTEE 501N		Electrical Machines-II	60	20	20	0	0	3	1	2	5

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

1. To obtain open circuit characteristics of self excited DC shunt generator and to find its critical resistance.
2. Speed control of D.C. shunt motor by Field current control method & plot the curve for speed verses field current.
3. Speed control of D.C. shunt motor by Armature voltage control method & plot the curve for speed verses armature voltage.
4. To perform Swinburne's test on a DC shunt machine and to calculate efficiency at full load.
5. To perform Hopkinson's test on a DC shunt machine and to calculate full load efficiency (a) when running as motor and (b) when running as generator.
6. Draw & verify open circuit characteristics of 3-Ø synchronous generator.
7. Draw & verify short circuit characteristics of 3-Ø synchronous generator.
8. Draw & verify external load characteristics of 3-Ø synchronous generator.
9. Calculate X_d & X_q parameter of synchronous machine by slip test.
10. Synchronization of a three-phase alternator with the infinite bus and control load sharing.
11. Draw & verify 'V' curve of 3-Ø synchronous motor.

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
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								
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BTEE511	DE	Power Quality	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):
This course aims to study the production of voltages sags, overvoltage and harmonics and methods of control and also study various methods of power quality monitoring.

Course Outcomes (COs):
Upon completion of the course, the student will be able to
1. Demonstrate the major power quality problems.
2. Understand equipments that are required to measure the quality of power, as well as techniques available to mitigate power quality problems.

Syllabus

UNIT I **9 Hrs.**
INTRODUCTION TO POWER QUALITY
Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Association (CBEMA) Curve.

UNIT II **8 Hrs.**
VOLTAGE SAGS AND INTERRUPTIONS
Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
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								
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BTEE511	DE	Power Quality	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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UNIT III **8 Hrs.**

OVERVOLTAGES

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding - line arresters - protection of transformers and cables.

UNIT IV **8 Hrs.**

HARMONICS

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

UNIT V **8 Hrs.**

POWER QUALITY MONITORING

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.

Textbooks:

1. R.C. Duggan, "Electrical Power Systems Quality", TMH publication, Third Edition, 2012.
2. C.Sankaran, "Power Quality" by CRC publication, 2001.

References:

1. J. Vikramarajan, " Enhancement of the Power Quality and Power Factor in Power System" 2014.
2. Chattopadhyay, "Electric Power Quality",springer, 2011

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
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								
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BTEE512	DE	Reliability Engineering	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 overall aim of this course is to provide knowledge of basic reliability evaluation theories with applications for electric power systems. The course gives a thoroughly introduction to reliability theory and generally used models. It aims to arm the students with the concepts of evaluation of generation, transmission and distribution system reliability and their impacts on system planning.

Course Outcomes (COs):
At the end of the course, the students will be able to:

1. Understand the concept of probability theory, distribution, network modelling and reliability analysis.
2. Analyze the reliability functions with their relationships and Markov modeling.
3. Evaluate reliability models using frequency and duration techniques and generate various reliability models.
4. Explicate the reliability of composite systems and distribution systems.

Syllabus

UNIT I **9 Hrs.**

Probability Theory: Introduction to Probability, Probability distributions: Random variables, density, and distribution functions. Mathematical expectation. Binominal distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution. Normal Gaussian, Gamma and Beta distribution. Correlation and regression.

UNIT II **8 Hrs.**

Basic Tools and Techniques- Random processes methods & Markov process, Computation of power system reliability measures by using Markov reward models, Evaluation of reliability indices, Universal Generating Function (UGF) Method, Monte Carlo simulation.

Chairperson	Chairperson	Controller of Examinations	Joint Registrar
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Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
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								
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BTEE512	DE	Reliability Engineering	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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UNIT III **8 Hrs.**

Generation System Reliability Analysis: Capacity Outage Calculations, Reliability indices using the loss of load probability method, unit commitment and operating constraints, optimal reserve management, single and multi-stage expansion. Interconnected System, Factors affecting interconnection under emergency assistance.

UNIT IV **6 Hrs.**

Transmission System Reliability Analysis: Introduction, Objectives of Transmission Planning, Network Reconfiguration, System and Load Point Indices, Data required for Composite System Reliability.

UNIT V **10 Hrs.**

Distribution System Reliability Analysis: Radial Networks– Introduction, Network Reconfiguration, Evaluation Techniques, Effects of Lateral Distribution Protection, Bus Bar Failure, Scheduled Maintenance, Temporary and Transient Failure, Weather Effects, Breaker Failure.

Textbooks:

1. R. Billinton, R.N.Allan, Reliability Evaluation of Power systems, Plenum Press, New York.
2. Marko Cepin, "Assessment of Power System Reliability- Methods and Applications", Springer, 2014.

References:

1. Sharles E.Ebeling. "An Introduction to Reliability and Maintainability Engineering", TMH.
2. J.Endrenyi , "Reliability Modelling in Electric Power Systems", John Wiley & sons, NY.
3. Athanasios Papoulis and S.Unnikrishna Pillai ,"Probability, Random variables and Stochastic Processes, 4th edition, Tata McGraw Hill, 2017.

Chairperson	Chairperson	Controller of Examinations	Joint Registrar
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Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in the Light of NEP-2020
B.Tech. in Electrical and Electronics Engineering
(2021-2025)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTEE514	DE	Introduction of IoT in Electrical Engineering	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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Course Educational Objectives (CEOs): The objective of study of IoT in Electrical Engineering is to:

1. Study IoT characteristics and definition
2. Study various IoT Sensors and communication technology
3. Study physical devices and endpoints
4. Study applications of IoT in electrical Engineering

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

1. Attain knowledge of IoT in Electrical Engineering
2. Attain knowledge on IoT sensors and devices
3. Attain knowledge on internet connectivity of IoT
4. Learn application of IoT in various domain.

Syllabus

UNIT I **7Hrs.**

Introduction to IoT

Introduction: Definition and characteristics of IoT, Physical design of IoT, Logical Design of IoT, IoT enabling technologies, IoT levels and deployment templates.

UNIT II **8 Hrs.**

IoT/M2M and Internet Connectivity

M2M, difference between IoT and M2M, Introduction to internet connectivity, Internet connectivity principles, Internet based communication, IP addressing in the IoT, Media access control, Application layer Protocols: HTTP, HTTPS, FTP, Telnet, and others.

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UNIT III **8 Hrs.**

IoT physical devices and End points

Basic building blocks of an IoT devices, raspberry pi, Raspberry pi interfaces, other IOT interfaces.

UNIT IV **8 Hrs.**

Sensors

Introduction, sensor Technology, participatory sensing, Industrial IoT and Automotive IoT, Actuator, sensor data communication Protocols, Radio frequency identification Technology, wireless sensor Network technology

UNIT V **8 Hrs.**

Application of IoT in Smart Grid And Other Domains

Generation, Transmission, Distribution and Metering, Energy Storage, Smart Monitoring and Diagnostics System at Major Power Plants, Real-Time Monitoring and Control of Processes, SCADA, Proprietary Communication, Home automation, Building automation, IoT application in environment, cities, agriculture, industry

Textbooks:

1. George Mastorakis , (2016), Internet of Things (IoT) in 5G Mobile Technologies, 1st ed. Edition, Publisher SPRINGER.
2. ArshdeepBahga, Vijay Madisetti (2016) Internet of Things-A hands on approach, 1st Edition, Universities Press
3. Raj Kamal (2017), Internet of Things-Architecture and design principles, IstEdition, Mc Graw Hill Education

References:

1. Enterprise IoT: Strategies and Best Practices for Connected Products and Services, Dirk Slama, Frank Puhlmann, Jim Morrish, Rishi M Bhatnagar, Publisher O'REILLY

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BTEC 507	DCC	Programming in Python	0	0	0	30	20	0	0	2	1

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Course Objective:

1. Learn Syntax and Semantics and create Functions in Python.
2. Handle Strings and Files in Python.
3. Understand Lists, Dictionaries and Regular expressions in Python.
4. Implement Object Oriented Programming concepts in Python.

Course Outcome:

After learning the course, the student will be able:

1. To develop proficiency in creating applications using the Python Programming Language.
2. To be able to understand the various data structures available in Python programming language and apply them in solving computational problems.
3. To be able to do testing and debugging of code written in Python.
4. To be able to draw various kinds of plots using PyLab.
5. To be able to do text filtering in Python.

Syllabus

UNIT I

Introduction: History of Python, Need of Python Programming, Running Python Scripts, Variables, Assignment, Operators and Expressions: Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations.

UNIT II

Data Structures: Lists, Tuples, Sets, Dictionaries, Sequences.
Control Flow - if, if-elif-else, for, while, break, continue. Functions - Defining Functions, Calling Functions, Passing Arguments. Modules: Creating modules, import statement, from, import statement, name spacing.

UNIT III

Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

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UNIT IV

Object Oriented Programming OOP in Python: Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data Hiding.

UNIT V

File Handling: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data.

List of Experiments:

1. Develop programs to understand the control structures of python.
2. Develop programs to learn different types of structures (list, dictionary, tuples) in python.
3. Write a Python program to sum all the items in a list.
4. Write a Python program to get the largest and smallest number from a list.
5. Develop programs for data structure algorithms using python – searching and sorting.
6. Write a Python Program to perform Linear Search.
7. Write a Python Program to perform Binary Search.
8. Write a Python Program to perform Selection sort.
9. Write a Python Program to perform Insertion sort.
10. Write a Python Program to perform Merge sort.
11. Write a Python program to get a list, sorted in increasing order by the last element in each tuple from a given list of non-empty tuples: Sample List: [(2, 5), (1, 2), (4, 4), (2, 3), (2, 1)] Expected Result: [(2, 1), (1, 2), (2, 3), (4, 4), (2, 5)]
12. Write a Python program to check a list is empty or not.
13. Write a Python program to remove duplicates from a list.
14. Programs that take command line arguments (word count).
15. Write a Program that Reads a Text File and Counts the Number of Times a Certain Letter Appears in the Text File.
16. Write a Program to Read a Text File and Print all the Numbers Present in the Text File.

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17. Write a Program to find the most frequent words in a text read from a file.
18. Implement Object Oriented Programming concepts in Python.
19. Write A Program to Append, Delete and Display Elements of a List Using Classes.
20. Write A Program to Create a Class and Compute the Area and the Perimeter of the Circle.
21. Write A Program to Create a Class which Performs Basic Calculator Operations.
22. Write A Program to Create a Class in which One Method Accepts a String from the User and another prints it.
23. Learn to plot different types of graphs using PyPlot.

References:

1. John V Guttag. "Introduction to Computation and Programming Using Python", 3nd edition,Prentice Hall of India, 2021
2. Wesley J. Chun. "Core Python Programming" 3rd Edition, Prentice Hall, 2012
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley, 2013
4. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication, 2nd edition, 2018.

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