DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE.

Dr. Babasaheb Ambedkar Technological University
(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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Detail Syllabus For

Final Year B. Tech. Electrical and Computer Engineering (Affiliation Institute)

With effect from the Academic Year 2025-2026

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE.

B. Tech Electrical and Computer Engineering

A) PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Programme Educational Objectives are the broad statements which describe in detail about the career and professional accomplishments after significant years of graduation, which the programme prepares the graduands to achieve.

Electrical and Computer Engineering

1) Graduates will succeed as Engineering Professionals in Industry or as Entrepreneurs in Electrical and Computer Engineering and the related disciplines and exhibit an urge for innovation.
2) Graduates will be able to adapt to the advances in Technology by acquiring knowledge and skills manifested through continuous learning and higher qualifications.
3) Graduates will be serving community as socially committed individuals, exhibiting professional ethics in addressing the technical and engineering challenges.

B) PROGRAMME OUTCOMES (POs)

Programme Outcomes are the statements as stated by NBA that declare the knowledge, skills and attitudes the students should have at the end of a four-year engineering programme in India.

Engineering graduates will be able to:

1) **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2) **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3) **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4) **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6) **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7) **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8) **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10) **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11) **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

C) PROGRAMME SPECIFIC OUTCOMES (PSOs)

Programme Specific Outcomes are the statements that assert what the graduands of a specific engineering programme should be able to do.

Electrical and Computer Engineering

1) To apply the knowledge in Electrical Engineering and Computer Engineering for the design, development testing and operation of Power and Energy Systems in the areas of Generation, Transmission, Conversion, Distribution and Utilization systems.

2) To apply the knowledge in Electrical Engineering and Computer Engineering for the design, development and operation of Industrial systems in the areas of Automation, Control, Energy Management and Economic operation.

B. Tech Final Year Electrical and Computer Engineering

SEMESTER VII											
Sr. No.	Course Code	Course Title	Teaching Scheme			Marking Scheme			Total Marks	CR	Category
			L	T	P	CA	MSE	ESE			
1	BTECC701	Electrical Drives	3	1	-	20	20	60	100	4	PCC17
2	BTECCE702	Artificial Intelligience and Machine Learning	3	-	-	20	20	60	100	4	PCC18
3	BTECPE703	Group C	3	-	-	20	20	60	100	3	OEC1
4	BTECC704	Group D	3	-	-	20	20	60	100	3	PEC3
5	BTECC705	Group E	3	1	-	20	20	60	100	3	PCC19
6	BTECL706	Electrical Drives Lab	-	-	2	60	-	40	100	1	LC
7	BTECL707	Artificial Intelligience and Machine Learning Lab	-		2	60	-	40	100	2	LC
8	BTECP708	Project Part-I	-	-	6	30	-	20	50	3	Project
9	BTECP610	Internship-II Evaluation			-			50	50	1	Internship
		Total	16	2	10	250	100	450	800	24	

BSC= Basic Science Course, ESC= Engineering Science Course, PCC= Professional Core Course, PEC= Professional Elective Course, OEC= Open Elective Course, LC= Laboratory Course.

Important Note: Minimum Eight Experiment to perform based on the syllabus for the laboratory subject.

BTECOE703	Group C (Professional Elective)
A	Industrial Automation and Control
B	Computer Aided Electrical machine design
C	Energy Audit and Conservation

BTECPE704	Group D (Professional Elective)
A	Data Science
B	Software Testing
C	Cloud Computing

BTECC705	Group E (Open Elective)
A	Embedded System and RTOS
B	Data Analytics
C	Application of Power Electronics to Power System

SEMESTER VIII											
Sr. No.	Course Code	Course Title	Teaching Scheme			Marking Scheme			Total Marks	CR	Category
			L	T	P	CA	MSE	ESE			
1	BTECC801	NPTEL online courses	3	0	0	40		60	100	3	OE
2	BTECP802	Project Part-II	0	0	8	100		150	250	12	Project
		Total			8				350	15	

NOTE: * Refer to Multidisciplinary Minor Bucket

BSC/ESC: *Basic Science Course/ Engineering Science Course,* ***PCC:*** *Programme Core Course* ***PEC:*** *Programme Elective Course,* ***(OE):*** *Open Elective Other than particular programme,****VSEC:*** *Vocational and Skill Enhancement Course,* ***HSSM:*** *Humanities Social Science and Management,* ***IKS:*** *Indian Knowledge System, HSSM- VEC: Value Education Course,* ***NPTEL Course: Online NPTEL Course***

BTECC801	NPTEL online courses
A	Block Chain and Applications
B	Introduction to Industry 4.0 and Industrial Internet of Things
C	Deep Learning
D	Entrepreneurship Essentials
E	MATLAB
F	IPR and Copyright
G	Project Management

Semester VII

BTECC701 Electrical Drives

Teaching Scheme	**Examination Scheme**
Lectures Theory: 04 Hr / Week Credit:04	Internal Assessment: 20 Marks Mid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objectives:

Course objective :

- Students will be able to understand the dynamics of drive system.
- Students will be able to use various methods of speed control of AC and DC Drive.
- Students will be have the ability to analyze the drive system
- Students will be able to select proficiently and the proper drive system for particular application.
- Students will be able to have basic knowledge of recent advancement in Electric Drive.

Course Outcome:

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

CO1. Analyze the dynamics of Electrical Drives system.

CO2. Use various control techniques for controlling the speed of AC and DC motors.

CO3. Analyze the AC and DC drives.

CO4. To Select/recommend the appropriate Drive according to the particular applications.

CO5. State the recent technology of AC and DC drive

Unit	Contents	Hrs.
1	**INTRODUCTION** Advantages of Electrical Drives, Parts of Electrical drive, Choice of Electric drives Dynamics of Electrical drives: fundamental torque equations, multiquadrant operation, nature and classification of load torques, steady state stability, concept of load equalization in drives	8
2	**CONTROL OF ELECTRICAL DRIVES** Modes of operation: Steady state, Acceleration, Deceleration, Drive classification. Closed loop control of drives : Current limit control, torque control, speed control, position control, Control of multi motor drives, speed sensing, current sensing, Classes of motor duty & criteria for selection of motor.	6
3	**DC MOTOR DRIVES** Review of basic characteristics of DC motors, Single phase drives : Single phase half wave converter drives, semi converter drives, Full converter drives, Dual converter drives. Three phase drives : Three phase half wave drives, semi-converter drives, full converter drives, dualconverter drives, DC-DC converter drives: Principle of Rheostatic and regenerative braking control, combined control, two and four quadrant DC-DC converter fed drives. Introduction to closed loop control of DC drives.	7

4	**INDUCTION MOTOR DRIVES** Review of starting, braking and speed control of three phase induction motors, Stator voltage control, Rotor voltage control, frequency control, Voltage and frequency control, Current control, Closed loop control of Induction motors, Principle of Scalar and Vector control of Induction motor, Multiquadrant operation of induction motor drives fed from Voltage Source Inverters. Static rotor resistance control method, static slip power recovery control-Static Scherbius drive and StaticKramer drive.	**7**
5	**SYNCHRONOUS MOTOR DRIVES** Review of starting, pull in and braking of Synchronous motor,Static variable frequency control for Synchronous motors,Load commutated inverter fed Synchronous motor drive, Introduction to closed loop control of Load commutated inverter fed Synchronous motor drive.	**6**
	Text Books: 1. . Dubey G. K., "Fundamentals of Electrical Drives", Narosa Publishing house 2. 2. De N. K., Sen P. K., "Electric Drives", Prentice Hall of India **3.** 3. VedamSubramanyam, "Electrical Drives and Control", TMH **Reference Books:** 1. Vedam Subrahamanyam, "Electric Drives – Concepts & Applications",1997, Tata McGraw-Hill. 2. H.Partab, "Art & Science of Utilization of Electrical Energy", 1999, Dhanpat Rai & Sons. 3. H.Partab, "Modern Electrical Traction",1973, Pritam Surat & Brothers.	

BTECC702	Artificial Intelligience and Machine Learning	
Teaching Scheme Lectures Theory: 04Hr / Week Credit:04		**Examination Scheme** Internal Assessment: 20 Marks Mid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objective:

1. Acquaint with fundamentals of artificial intelligence and machine learning.
2. Learn feature extraction and selection techniques for processing data set.
3. Understand basic algorithms used in classification and regression problems.
4. Outline steps involved in development of machine learning model.
5. familiarize with concepts of reinforced and deep learning.
6. Implement and analyze machine learning model in mechanical engineering Problems.

Course Outcome:

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

CO1. Demonstrate fundamentals of artificial intelligence and machine learning.
CO2. Apply feature extraction and selection techniques.
CO3. Apply machine learning algorithms for classification and regression problems.
CO4. Devise and develop a machine learning model using various steps.
CO5. Explain concepts of reinforced and deep learning.
CO6. Simulate machine learning model in mechanical engineering problems.

Unit	Contents	Hrs.
1	**Introduction to AI & ML** History of AI, Comparison of AI with Data Science, Need of AI in Mechanical Engineering, Introduction to Machine Learning. Basics: Reasoning, problem solving, Knowledge representation, Planning, Learning, Perception, Motion and manipulation. Approaches to AI: Cybernetics and brain simulation, Symbolic, Sub-symbolic, Statistical. Approaches to ML: Supervised learning, Unsupervised learning, Reinforcement learning.	6
2	**Feature Extraction and Selection** Feature extraction: Statistical features, Principal Component Analysis. Feature selection: Ranking, Decision tree - Entropy reduction and information gain, Exhaustive, best first, Greedy forward & backward, Applications of feature extraction and selection algorithms in Mechanical Engineering.	6
3	**Classification & Regression** Classification: Decision tree, Random forest, Naive Bayes, Support vector machine. Regression: Logistic Regression, Support Vector Regression. Regression trees: Decision tree, random forest, K-Means, K-Nearest Neighbor (KNN). Applications of classification and regression algorithms in Mechanical Engineering.	7

4	**Development of ML Model** Problem identification: classification, clustering, regression, ranking. Steps in ML modeling, Data Collection, Data pre-processing, Model Selection, Model training (Training, Testing, K-fold Cross Validation), Model evaluation (understanding and interpretation of confusion matrix, Accuracy, Precision, Recall, True positive, false positive etc.), Hyper parameter Tuning, Predictions.	7
5	**Reinforced and Deep Learning** **Characterist**ics of reinforced learning; Algorithms: Value Based, Policy Based, Model Based; Positive vs Negative Reinforced Learning; Models: Markov Decision Process, Q Learning. Characteristics of Deep Learning, Artificial Neural Network, Convolution Neural Network. Application of Reinforced and Deep Learning . **Applications:** Human Machine Interaction, Predictive Maintenance and Health Management, Fault Detection, Dynamic System Order Reduction, Image based part classification, Process Optimization, Material Inspection, Tuning of control algorithms	7
	Text Books: 1. Deisenroth, Faisal, Ong, Mathematics for Machine Learning, Cambridge University Press,2020. 2. B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020. 3. Parag Kulkarni and Prachi Joshi, "Artificial Intelligence – Building Intelligent Systems", 4. PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015 5. Stuart Russell and Peter Norvig (1995), "Artificial Intelligence: A Modern Approach," Third 6. edition, Pearson, 2003. **Reference Books** 1. Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018. 2. Mohri, Rostamizdeh, Talwalkar, Foundations of Machine Learning, MIT Press, 2018. 3. Kumar, Zindani, Davim, Artificial Intelligence in Mechanical and Industrial Engineering,CRC Press, 2021. 4. Zsolt Nagy - Artificial Intelligence and Machine Learning Fundamentals-Apress (2018) **5.** Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH	

BTECOE703A	Industrial Automation and Control	
Teaching Scheme Lectures Theory: 03 Hr / Week Credit:03		**Examination Scheme** Internal Assessment: 20 MarksMid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objectives:

1. To learn about automation systems in industries
2. To learn various ways to program PLC
3. To study PLC applications
4. To study SCADA system and its applications in power system

Course Outcome:

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

CO1. develop awareness of various automation systems in industries.
CO2. understand the purpose, functions, and operations of a PLC and SCADA
CO3. able to write programs for PLC.
CO4. understand working of robot and various control schemes.

Unit	Contents	Hrs
1	**Introduction to Industrial Automation** Architecture of Industrial Automation Systems, Elements of an Automated System, Functional hierarchy of an Industrial Automation system, Levels of Automation.	6
2	**Programmable Logic Controllers** Introduction, Architecture of PLC, PLC Operation, PLC Hardware Components-Input-Output module (Discrete and Analog), PLC Programming - Ladder Logic, Functional Block Diagram (FBD), Ladder Logic Programming (NO-NC, Timer and Counter), PLC Communication, Application of PLCs.	8
3	**Industrial Drives Control** Classification of Industrial Drives, DC Motor Drives, Induction Motor Drives, Variable Speed Drives, Servo Motor Drives, Step Motor Drives, BLDC Motor Drives, Control of Drives, Industrial Application of Drives.	7
4	**SCADA** SCADA system Architecture, Elements of SCADA System, Human Machine Interface, Master Terminal Unit, Remote Terminal Unit. Alarm Handling and Trending, Access Control, Automation Logging, Archiving, Report Generation. Types of interfaces, SCADACommunication.SCADA Applications: Operation and control of interconnected power system, Automatic substation control, Electric Power Generation, Transmission and Distribution sector operation.	8
5	**Distributed Control System** Introduction and Overview, System Architecture, System Elements, Difference between Centralized and Distributed Control System. Displays: Group Display,	7

	Overview Display, Detail Display, Data Highways, Field Buses, Multiplexers and Remote Sensing Terminal Units, I/O Hardware, Case study of any one DCS.	
	Reference Books: 1. C. D. Johnson, "Process Control Instrumentation Technology", Prentice Hall of India. 2. B. G. Liptak, Instrument Engineer's Handbook, Process Control, Chilton Book Company. 3. W. Bolton, "Programmable Logic Controllers", Elsevier. 4. Hughes, "Programmable Controllers", ISA Publications. 5. Frank D. Petruzella, "Programmable Logic Controllers", McGraw-Hill Book Company. 6. John W. Webb and Ronald A. Reis, "Programmable Logic Controllers", PHI. 7. Stuart A. Boyer "Supervisors Control and Data Acquisition", ISA.	

BTECOE703B	Computer Aided Electrical machine design	
Teaching Scheme Lectures Theory: 03 Hr/Week Credit:03		**Examination Scheme** Internal Assessment: 20 MarksMid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objectives:

1. . Main objective of subject is to prepare computer based design of motors to be used for Electrical Vehicles.

Course Outcome:

CO1: To introduce the importance of computer aided design method.
CO2: Implement equations in software program.
CO3: Create software-based design of DC Motor, Induction Motor & Special Electric Motor
CO4: Select appropriate motor for EV applications.
CO5: Analysis of machine part with FEM
CO6: Prepare GUI for design of electrical machines.

Unit	Contents	Hrs.
1	**Concept of computer-aided design and optimization Introduction;** Computer Aided Design; Explanation of details of flow chart; Input data to be fed into the program; Applicable constraints Max or Minimum permissible limits; Output data to be printed after execution of program; Various objective parameters for optimization in an electrical machine; Selection of optimal design; Explanation of lowest cost and significance of "Kg/KVA"; Flowcharts.	8
2	**Basic concepts of design** Introduction; Specification; Output coefficient; Importance of specific loadings; Electrical Materials: Conducting Materials, Insulating Materials and Magnetic Materials; Magnetic circuit calculations; General procedure for calculation of Amp Turns; Heating and Cooling; Modes of heat dissipation; Standard ratings of Electrical machines; Ventilation in rotating machines; Quantity of cooling medium; Types of enclosures; General design procedure; Steps to get optimal design	6
3	**Application of finite element method in design:** Introduction; Basics of Finite element, Shape functions, Single element computation. Assembly of elemental coefficient matrix, Global coefficient matrix, Application of FEM technique for design problems. Use of open source FEM software for 2D design. Computation of Capacitance of capacitor, cable, multi dielectric cable through FEM, Computation of electrostatic field for various geometry, skin and proximity effect in conductors	3
4	**Computer aided design of induction motor:** Introduction; Flowcharts and programs for computer aided design of Induction motor, 2D FEM open source software-based Induction motor part design	12
5	**Computer aided design of dc machines**: Introduction; Flowcharts and programs for computer aided design of DC	7

	machines. 2D FEM open source software-based DC machine part design	
	Reference Books:/ **Reference Books:** 1. Dr. M. Ramamoorthy. Computer- Aided Design of Electrical Equipment. Affiliated East-West press Pvt. Ltd. New Delhi 2. S.K. Sen, Principles of Electrical Machine Design with Computer Programmes. Oxford & IBH Publishing Co. 3. C.G. Veinott, Computer aided design of FHP motors, McGraw Hill Pub. Co. 4. Maurya, Jallan, Shukla, Computer aided design of electrical machines. Kataria publication 5. Ramu Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives,CRC Press. 6. R. Krishnan, Switched Reluctance Motor Drives: Modeling, Simulation, Analysis,Design, and applications, CRC Press 7. K. T. Chau, Electric Vehicle Machines and Drives: Design, Analysis and Application, Wiley Publication. 8. J Reddy, An Introduction to the Finite Element Method. TMH Publication 9. S.J Salon, 'Finite Element Analysis of Electrical Machines', Springer, YesDEE publishers, Indian reprint, 2007. 10. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor& Francis, 2005 11. K M Vishnu Murthy, Computer aided design of electrical machines. B S Publications	

BTECOE703C Energy Audit and Conservation

Teaching Scheme	**Examination Scheme**
Practical: 03 Hr / Week	Internal Assessment: 20 Marks
Credit:03	Mid-Sem Exam: 20 Marks
	End Sem Exam: 60 Marks

Course Objectives:

1. To understand the basic process involved in the energy audit and the terminologies associated in the process.
2. To be able to develop audit reports of any firm including large and small scale industries, residential and commercial establishments.
3. To select and comment on the appropriate method for the planning and monitoring of any

Course Outcome:

CO1. To recognize Global Environmental Issues and Role of Renewable & non-conventionalenergy sources

CO2. To estimate Energy efficiency opportunities in Thermal- Mechanical Systems and Electrical System.

CO3. To analyze Energy Conservation Proposals economically and prepare audit reports.

Unit	Contents	Hrs.
1	**SOURCES OF ENERGY:** Energy resources, Stored & running resources, Environmental Concerns – Global Warning , Depletion of Ozone layer,	6
2	Energy Conservation Act 2001, Designated Consumers, Energy Policy, BEE and its role in Energy Conservation, Energy Audit – Need, Types , Methodology, Steps involved in Energy Audit, Energy Costs and Benchmarking , Measurements for Energy Audit, Energy Management Duties and Responsibilities.	7
3	**THERMAL MECHANICAL SYSTEMS** Boiler Efficiency by direct and indirect methods, Energy efficiency opportunities in boilers, HVAC, and refrigeration systems, compressed air systems, pumps, cooling towers, fans and blowers, Cogeneration – Need and Principle , Prime movers for cogeneration, Waste heat recovery systems – Recuperators, economizer heat recovery boilers.	8
4	**ELECTRICAL SYSTEMS** Utilities: Energy conservation in generation, transmission,distribution & utilization, Electrical billing , load management ,maximum demand control, APFC Panel , PF improvement and benefits , Energy Efficient motors and starter, lightning systems, Electronic Ballast	6
5	Planning, Implementation & monitoring of energy conservation project, Time Value of money, Financial Investment – Simple payback period, ROI (Return on Investment), Net Present value, Internal rate of return, profitability index. All calculations and numerical interpretation. Case studies on various industrial sectors like Steel Plant, Thermal Plant, Industries Building and Commercial Establishments and preparing audit reports	6

	References: 1.“Industrial Energy Conservation” Charles M Gottschalk ,John Willey and Sons 2. “Energy Management” Paul O Callagham, Tata Mc Grawhill 3. “Energy Technology” – S Rao and B Parulekar , Khanna Publisher	

BTECPE704A	**Data Science**
Teaching Scheme Lectures Theory: 03 Hr / Week Credit:03	**Examination Scheme** Internal Assessment: 20 Marks Mid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objective:

1. Introduce the basic concepts and workflow of data science including data collection, cleaning, analysis, and visualization.
2. To equip students with essential programming and statistical tools for data analysis using Python/R.
3. To develop understanding of data pre-processing, feature selection, and model building techniques.
4. To apply machine learning algorithms for classification, regression, and clustering.
5. To demonstrate real-world data science applications using case studies and projects.

Course Outcome:

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

CO1. Understand the fundamental concepts, tools, and workflow involved in data science.

CO2. Perform data cleaning, preprocessing, and exploratory analysis using Python/R.

CO3. Apply statistical methods to analyze and interpret real-world data.

CO4. Build and evaluate predictive models using machine learning techniques.

CO5. Demonstrate the ability to apply data science concepts to solve practical problems through mini-projects or case studies.

Unit	Contents	Hrs.
1	Introduction of Data Science Data Science Process: Define, Collect, Process, Analyze, Communicate Applications and Use Cases in Industry (Healthcare, Finance, Retail, etc.) Roles in Data Science: Data Engineer, Data Analyst, Data Scientist Data Types: Structured, Unstructured, Semi-Structured Data Collection Methods and Data Sources (APIs, Web Scraping, Databases)	**6**
2	Data Wrangling and Exploration Data Preprocessing: Handling Missing Data, Data Cleaning Data Transformation and Normalization Feature Engineering and Dimensionality Reduction Data Visualization Tools (Matplotlib, Seaborn, Plotly) Exploratory Data Analysis (EDA) Techniques Introduction to Pandas and Numpy Libraries	**6**
3	Statistical Foundations and Machine Learning Probability Concepts and Distributions Hypothesis Testing and Confidence Intervals Correlation and RegressionSupervised Learning: Linear Regression, Logistic Regression, Decision Trees.Unsupervised Learning: K-Means, PCA.Introduction to Scikit-learn and ML Model Evaluation	**6**

	(Confusion Matrix, Accuracy, Precision, Recall)	
4	Big Data and Tools Introduction to Big Data and Hadoop Ecosystem.Basics of HDFS and MapReduce.Spark: Architecture and RDDs.Introduction to NoSQL (MongoDB).Data Storage: Relational vs. Non-relational databases.Working with Real-world Datasets	**6**
5	**Capstone Project and Emerging Trends** Mini Project: End-to-End Data Science Workflow**,**Data Ethics, Privacy, and Responsible AI**.**Introduction to Deep Learning and Neural Networks**.**Trends in Data Science: AutoML, DataOps, MLOps**.**Case Studies in Data Science from Industry**.** Tools Overview: Jupyter Notebook, GitHub, Google Colab, Tableau	**6**
	Textbooks & References: 1. "Doing Data Science" – Cathy O'Neil and Rachel Schutt 2. "Python for Data Analysis" – Wes McKinney 3. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" – Aurélien Géron 4. NPTEL / Coursera / edX resources (for supplementary material)	

BTECPE704B	Software Testing

Teaching Scheme	Examination Scheme
Lectures Theory: 03 Hr / Week Credit:03	Internal Assessment: 20 Marks Mid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objective:

1. To study fundamental concepts in software testing, including software testing objectives,
2. processes, criteria, strategies, and methods.
3. To learn planning of a test project, designing test cases and test data, conducting test operations,
4. managing software problems and defects, and generating a test report.
5. To develop an understanding of the meaning and importance of quality in relation to software
6. systems and the software development process.
7. To study issues and techniques for implementing and managing software quality assurance processes .

Course Outcome:

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

CO1. To apply software testing knowledge and its processes to software applications.
CO2. To identify various software testing problems.
CO3. To solve software testing problems by designing and selecting software test models, criteria,strategies and methods.
CO4. To apply the techniques learned to improve the quality of software development.5. To prepare a software quality plan for a software project.

Unit	Contents	Hrs.
1	Principles of Testing Software development life cycle model: Phases of software project, Quality, Quality assurance and quality control, Testing, Verification and validation, Process models to represent various phases, Life cycle models, Software testing life cycle. White Box Testing (WBT) and Black Box Testing: Static testing, Structural testing, Challenges in WBT. Black box testing: Black box testing process.	6
2	Integration Testing: Definition, As a type of testing: Top-down integration, Bottom-up integration, Bidirectional integration, System integration, Choosing integration method, As a phase of testing, Scenario testing: System scenarios, Use case scenarios, Defect bash.	6
3	System and Acceptance Testing, Functional Vs non Functional, Functional system testing, Nonfunctional system testing, Acceptance testing.	6

4	Performance testing, Regression testing, Internationalization testing, Adhoc testing. Factors governing performance of testing, Methodology, tools and process for performance testing. Regression Testing: Introduction, Types of Regression testing, Regression testing process. Adhoc testing: Introduction, Buddy testing, Pair testing, Exploratory testing, Iterative testing, Agile and Extreme testing, XP work flow, Defect seeding.	**6**
5	Testing Object Oriented Software: Introduction, Comparison of object oriented and procedural software, System testing example, Unit testing of classes, Tools for testing object oriented software, Testing web applications.	**6**
	Text Book: 1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", 2. Pearson publication, 2nd Edition, 2006. **Reference Books:** 1. Louise Tamres, "Introducing Software Testing", Pearson publication, 2002. 2. Boris Beizer, "Software Testing Techniques", Dreamtech press, 2nd Edition, 2014.	

BTECPE704C	Cloud Computing

Teaching Scheme	Examination Scheme
Lectures Theory: 03 Hr / Week Credit:03	Internal Assessment: 20 Marks Mid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objective:

1. Introduce the rationale behind the cloud computing revolution and the business drivers
2. Understand various models, types and challenges of cloud computing
3. Understand the design of cloud native applications, the necessary tools and the design tradeoffs.
4. Realize the importance of Cloud Virtualization, Abstraction`s, Enabling Technologies and cloud security

Course Outcome:

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

1. Describe various cloud computing platforms and service providers.
2. Illustrate the significance of various types of virtualization.
3. Identify the architecture, delivery models and industrial platforms for cloud computing based applications.
4. Analyze the role of security aspects in cloud computing.
5. Demonstrate cloud applications in various fields using suitable cloud platforms

Unit	Contents	Hrs.
1	Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency.	6
2	Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management,Virtualization for Data Center Automation.	6
3	Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure, Inter-Cloud Resource Management.	6
4	Cloud Security: Top concern for cloud users, Risks, Privacy Impact Assessment, Cloud Data Encryption, Security of Database Services, OS security, VM Security, Security Risks Posed by Shared Images and Management OS, XOAR, A Trusted Hypervisor, Mobile Devices and Cloud Security Cloud Security and Trust Management: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centers.	6

5	Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments.	**6**
	Text Books: 1. Google Cloud Teaching Resources – LMS [for practical component] 2. AWS Cloud Developing – AWS Academy Courses [for practical component] 3. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, 2nd Edition, Elsevier 2018 4. Kai Hwang, Geoffrey C Fox, and Jack J Dongarra, Distributed and Cloud Computing, Morgan Kaufmann,Elsevier 2012 **Reference Books:** 1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi, Mastering Cloud Computing McGrawHill Education, 1st Edition, 2017 2. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Education, 2017. 3. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud,O'Reilly Publication, 1st Edition, 2009 4. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, 2nd Edition, 2009.	

BTECC705A Embedded System and RTOS

Teaching Scheme	**Examination Scheme**
Lectures Theory: 04 Hr / Week Credit:03	Internal Assessment: 20 Marks Mid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objective:

1. To introduce the fundamental concepts of embedded systems, including design challenges, processor technologies, and IC technologies.
2. To develop understanding of general-purpose processor design and application-specific instruction set processors (ASIPs) with focus on ARM-based microcontrollers.
3. To provide hands-on knowledge of system control and peripheral interfacing, such as GPIO, Timers, UART, SPI, and I²C.
4. To explain the working and implementation of real-time operating systems (RTOS) and process scheduling with practical examples.
5. To expose students to embedded system design techniques using simulation tools, and to apply these techniques to case studies like digital camera system design.

Course Outcome:

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

CO1. Understand the architecture and design process of embedded systems, including hardware-software co-design using custom and general-purpose processors.

CO2. Design and analyze embedded systems using general-purpose processors such as ARM7TDMI-S and comprehend memory architecture and control.

CO3. Interface and configure common peripherals such as GPIO, Timers, UART, SPI, and I²C, with real-world embedded applications.

CO4. Apply the concepts of RTOS in embedded system design, understand process scheduling, and simulate designs using tools like Proteus VSM.

CO5. Develop embedded applications based on user and designer perspectives, including requirements gathering and functional specification for complex systems like digital cameras.

Unit	Contents	Hrs.
1	Introduction: Embedded system overview, Design challenge, Processor technology, IC technology, Design technology, Custom single processor technology, Hardware-combinational logic, Sequential logic, Custom single purpose processor design, RT-level custom single purpose processor design, Optimizing custom single purpose processors	7
2	General purpose processor Software: Basic architecture, Operation, Programmers view, Development environment, Application specific instruction set processor, Selecting a microprocessor, General purpose processor design. Introduction, ARM7TDMI-S processor, Block diagram, Memory mapping, Memory accelerator module.	7

3	System control: Pin description, Register description, Crystal oscillator, External interrupt inputs, Other system controls, Memory mapping control, Phase locked loop, Power control, Reset, APB divider, Wakeup timer. GPIO: GPIO register map, Timer-TIMER / COUNTER0 and TIMER / COUNTER1 register map, Example timer operation, Architecture.	**7**
4	UART: UART0/1 - UART0/1 register map, UART0/1 baud rate, UART0/1 auto-baud, UART0/1 block diagram. Serial peripheral interface: SPI data transfers, SPI pin description, SPI register map, SPI block diagram; I2C-bus interface: I2C bus configuration, I2C operating modes, I2C Bus serial interface block diagram, Summary of I2C registers.	**7**
5	Introduction, Process scheduling, Examples of RTOS, Microprocessor and microcontroller based system design, typical design examples, system design and simulation using simulation software such as Proteus VSM. Digital Camera Example Introduction, Introduction to a Simple Digital Camera; User‘s Perspective, Designer‘s perspective requirements specification non functional requirements, Informal functional specification, refined functional specification.	**7**
	Reference Books 1. Frank Vahid ―Embedded System Design- A Unified system Hardwar/Software Introduction‖, (3rd Edition, J **Reference Books:** 1. LPC 214x User manual (UM10139):- www.nxp.com.. 2. Andrew N. Sloss, Dominic Symes and Chris Wright ―ARM System Developer‘s Guide – 3. Designing and Optimizing System Software‖, (Elsevier) ISBN: 1-55860-874-5. 4. LPC 17xx User manual (UM10360) :- www.nxp.com 5. ARM architecture reference manual : - www.arm.com 6. Steve Furber ―An Engineer‘s Introduction to the LPC2100 series‖ Trevor Martin (Hitex (UK) 7. Ltd.).―ARM System-on-Chip Architecture‖ (2nd Edition, Addison-Wesley Professional)ISBN13: 9780201403527	

BTECC705B Data Analytics	
Teaching Scheme Lectures Theory: 03 Hr / Week Credit:03	**Examination Scheme** Internal Assessment: 20 Marks Mid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objective:

1. To understand the computational approaches to big data analytics
2. To understand the various search methods and visualization techniques
3. To learn to use various techniques for mining data stream
4. To understand the applications using Map Reduce Concepts

Course Outcome:

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

1. Appreciate the computational softwares and techniques for handling big data in business applications

Unit	Contents	Hrs.
1	**INTRODUCTION TO BIG DATA** Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.	6
2	**MINING DATA STREAMS** Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.	6
3	**HADOOP** History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features Hadoop environment.	6
4	**FRAMEWORKS** Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM Info Sphere Big Insights and Streams.	6
5	**VISUALIZATION TECHNIQUES** Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis	6

	techniques- interaction techniques - Systems and applications.	
	Reference Books 1. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, 2013. 2. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier, Second Edition, 2015. 3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition, 2007. 4. 4. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets",Cambridge University Press, 2014. 5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 6. Paul Zikopoulos, Chris Eaton "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill, 2012. 7. Paul Zikopoulos, Dirk de Roos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, "Harness the Power of Big data - The big data platform", McGraw Hill, McGraw-Hill Osborne Media, 2012.	

TECC705C Application of Power Electronics Power System

Teaching Scheme	**Examination Scheme**
Lectures Theory: 04 Hr / Week Credit:03	Internal Assessment: 20 Marks Mid-Sem Exam: 20 Marks End Sem Exam: 60 Marks

Course Objective:

1. To know the basic principle of conventional active and reactive power flow control in power systems and problems associated with long distance power transmission.
2. To make students aware how power electronics devices can be used to find solution to the problems in long distance power transmission.

Course Outcome:

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

CO1 : Understand the concept of FACTs

CO2 :Select and implement proper compensator to solve the problems occurring power transmission

CO3 :Model and analyze the FACT controllers

CO4: Understand and apply the active filtering techniques in mitigation of harmonic distortion.

Unit	Contents	Hrs.
1	Review of semiconductor devices, Steady state and dynamic problems in AC systems, Power flow	6
2	Flexible AC transmission systems (FACTS): Basic realities & roles, Types of facts controller, Principles of series and shunt compensation.	7
3	Description of static var compensators (SVC), Thyristor Controlled series compensators (TCSC), Static phase shifters (SPS), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPFC).	7
4	Modelling and Analysis of FACTS controllers. Control strategies to improve system stability. Power Quality problems in distribution systems.	7
5	Harmonics, harmonics creating loads, modelling, Series and parallel resonances, harmonic power flow, Mitigation of harmonics, filters, passive filters. Active filters, shunt, series hybrid filters, voltage sags & swells, voltage flicker. Mitigation of power quality problems using power electronic conditioners. IEEE standards.	8
	Reference Books 1. Understanding of FACTs., Hingorani, N. G.; IEEE Press 1996. 2. Power Quality.; Heydt G.T.; Stars in a Circle Pblications , Indiana, 1991. 3. Static Reactive Power Compensation.; Miller T.J.E.; John Wiley & Sons, New York, 1982 4. Flexible AC Transmission System. (FACTs).; Yong Hua Song.; IEE 1999.	

	5. 5. Recent Publications on IEEE Journals.	

BTECL706 Electrical Drives Lab

Teaching Scheme	**Examination Scheme**
Practical: 02Hr / Week Credit:01	Internal Assessment: 60 Marks End Sem Exam: 40 Marks

Course Outcome:

1. Efficiently use various AC and DC drive.
2. Simulate various drive system

Expt. No	Title of Experiment	Hrs.
1	Study the ramp comparator firing circuit.	**2**
2	Study of single phase half wave converter and semi converter DC Drive .	**2**
3	Study of single phase full controlled converter (Bridge converter) DC Drive.	**2**
4	Speed control of DC motor using chopper.	**2**
5	Simulation of single phase half wave and semiconductor controlled DC drive.	**2**
6	Simulation of chopper fed DC Drive .	**2**
7	Study of AC Drive .	**2**
8	Study of V/f control of AC drive	**2**
9	Study the inverter fed induction motor drive.	**2**
10	Simulation of AC drive .	**2**

BTECL707 Artificial Intelligence and Machine Learning Lab

Teaching Scheme	**Examination Scheme**
Practical: 02Hr / Week Credit:01	Internal Assessment: 60 Marks End Sem Exam: 40 Marks

COURSE OBJECTIVES:

1. Study about uninformed and Heuristic search techniques.
2. Learn techniques for reasoning under uncertainty
3. Introduce Machine Learning and supervised learning algorithms
4. Study about ensembling and unsupervised learning algorithms
5. Learn the basics of deep learning using neural networks

Expt. No	Title of Experiment	Hrs.
1	Implementation of Uninformed search algorithms (BFS, DFS)	**2**
2	Implementation of Informed search algorithms (A*, memory-bounded A*)	**2**
3	Implement naïve Bayes models	**2**
4	Implement Bayesian Networks	**2**
5	Build Regression models	**2**
6	Build decision trees and random forests	**2**
7	Build SVM models	**2**
8	Implementing ensembling techniques	**2**
9	Implement clustering algorithms	**2**
10	Implement EM for Bayesian networks	**2**

BTECP708: PROJECT PART-I

Teaching Scheme: Examination Scheme:	
Teaching Scheme:	Examination Scheme:
Practical: 6hr	Continuous Assessment: 30 Marks
Total Credits: 3	End Term Exam: 20 Marks

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarize the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student. In case of students opting for Internship in the eighth semester, the Project may be industry-based.

BTECP610: Internship-II Evaluation

Teaching Scheme: Examination Scheme:	
Teaching Scheme:	Examination Scheme:
Practical: 6hr	Continuous Assessment: 30 Marks
Total Credits: 3	End Term Exam: 20 Marks

Students are expected to undergo industrial training for at least four weeks at factory / design offices or in combination of these after VI semester. Training session shall be guided and certified by qualified engineer / industry expert. A neat detailed report on activities carried out during training is expected. Students should undergo training in Summer Vacation after Semester VI and appear at examination in Semester VII. A brief report of industrial training shall be submitted. Evaluation shall be based on report and power point presentation.

Semester VIII

BTECC801 NPTEL online courses

Teaching Scheme	**Examination Scheme**
Lectures Theory: 0 Hr / Week Credit:03	Internal Assessment: 40 Marks End Sem Exam: 60 Marks

NPTEL online courses

A	Block Chain and Applications
B	Introduction to Industry 4.0 and Industrial Internet of Things
C	Deep Learning
D	Entrepreneurship Essentials
E	MATLAB
F	IPR and Copyright
G	Project Management

BTEEP802 INHOUSE PROJECT PART-II

Teaching Scheme	**Examination Scheme**
Lectures Theory: 26 Hr / Week Credit:13	Internal Assessment: 100 Marks End Sem Exam: 250 Marks

In phase-II of In-house project, work should consist of detailed report for chosen topic and output of work proposed in VIIth semester, in addition to the contents specified in semester VII. Assessment will be based on the work carried out by the student, report submitted and presentation.Internship in Industry In this course, students should go to industry for internship for one semester and do assigned work. After, completion of the Internship student should submit the report to the department. Assessment will be based on the work carried out by the student, report submitted and presentation, in consultation with the guide

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