

SCHEME OF EXAMINATION
And
SYLLABUS
for
BACHELOR OF VOCATION (B. Voc.)
in
ELECTRICAL
Offered by
Community College of Skill Development



**J C Bose University of Science & Technology,
YMCA Sector-6, Mathura Road, Faridabad,
Haryana, India**

ABOUT THE COMMUNITY COLLEGE OF SKILL DEVELOPMENT

Community College of Skill Development has been running Diploma in Electrical Electrician since 2013 and also got approval from UGC for B. Voc. in Electrical Electrician in 2018 with a mission to impart quality education along with extensive hands-on training on the equipment/systems in electrical laboratories and industries. At present CCSD offers skill programs in Electrical domain. The training is based on the Dual Education System, which lays great emphasis on practical training. The curriculum also provides an excellent "feeder" degree for those students uncertain about choosing a specific career. The presence of highly skilled and qualified trainer helps the students to enhance their professional and skill levels.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1: To produce competent B. Voc. Electrical graduates with a strong foundation in Construction, Installation, maintenance and process in electrical system.

PEO-2: To encourage the B. Voc. Electrical graduates to practice the profession following ethical codes, social responsibility and accountability.

PEO- 3: To train students to communicate effectively in multidisciplinary environment.

PEO- 4: To imbibe an attitude in the graduates for life-long learning process.

PROGRAM OUTCOMES

After completing the program, students will be able to

1. Develop experimentation skills and understand importance of measurement practices in Science & Technology.
2. Practice safely in all electrical works. Provide First Aid against electrical hazards.
3. Handle Charging & maintenance of Batteries. Checking specific gravity, voltage etc.
4. Prepare different types of documentation as per industrial need by different methods of recording information.
5. Apply ethical principles and commit to professional ethics and responsibilities and norms of the technical practice.

PROGRAM SPECIFIC OUTCOMES (PSOs)

To impart State-of-Art knowledge in the field of Electrical and hand on application based practical training with regular Academic and Industry interaction.

SCHEME OF EXAMINATION

YEAR	FIRST SEMESTER			SECOND SEMESTER		
I	Course	Code	Credits	Course	Code	Credits
	Electrical Machine - I	PCC-EL 101	3	Electrical Machine - II	PCC-EL 201	3
	Electrical Technology	PCC-EL 105	3	Electrical Wiring	PCC-EL- 202	3
	Communication skills	BSC- 101	3	Electrical Vehicle	PCC-EL- 205	3
	Engineering calculations - I	BSC-102	3	Engineering Calculations - II	BSC-202	3
	Electrical workshop - I	PCC-EL 107	18	Electrical workshop - II	PCC-EL- 206	18
	Total		30	Total		30
	Cumulative credits = 30 (Certificate)			Cumulative credits = 60 (Diploma)		
Qualification Pack Code: CON/Q0603						
NSQF LEVEL-4 JOB ROLE – ELECTRICIAN						
YEAR	THIRD SEMESTER			FOURTH SEMESTER		
II	Course	Code	Credits	Course	Code	Credits
	Industrial Electronics and control of drives - I	PCC-EL 307	3	On Job Training (OJT)/ Internship evaluation including report and presentation	PCC-EL 401	30
	Electrical Machine - III	PCC-EL 305	3			
	Power System	PCC- EL 306	3			
	Soft Skills	BSC-302	3			
	PLC Workshop	PCC-EL 304	18			
	Total		30		Total	
Cumulative credits = 120 (Advance Diploma)						
Qualification Pack Code: CON/Q0604						
NSQF LEVEL-5 JOB ROLE – FOREMAN						
YEAR	FIFTH SEMESTER			SIXTH SEMESTER		
III	Course	Code	Credits	Course	Code	Credits
	On Job Training (OJT)/ Internship evaluation including report and presentation	PCC-EL 501	30	Entrepreneurship	BSC-601	3
		Industrial Electronics and control of drives - II	PCC-EL 601	3		
		Fundamentals of Electromagnetism	PCC-EL 602	3		
		Installation and Maintenance of Equip.	PCC-EL 602	3		
		Modern Electric Traction System	PCC-EL 602	3		
		Minor project	BSC-603	9		
		Electrical workshop - III	PCC-EL- 603	12		
Total		30	Total		30	
Cumulative credits = 180 (B. Voc. Degree)						
Qualification Pack Code: CON/Q0605						
NSQF LEVEL- 6 JOB ROLE – SUPERVISOR						

DETAILED SYLLABUS
SEMESTER – 1st SCHEME

Paper Code	Course	L	T/P	Credits
PCC-EL-101	Electrical Machine - I	3	0	3
PCC-EL-105	Electrical Technology	3	0	3
BSC- 101	Communication Skills	3	0	3
BSC-102	Engineering Calculations - I	3	0	3
PCC-EL -107	Electrical workshop - I	0	18	18

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT**

**Electrical Machine - I
Paper Code- PCC-EL-101**

Semester 1st
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To learn the concept of electrical machines.
2. To know the different types of DC machine.
3. To learn the basics of Single phase and three transformers.
4. To understand the applications of electrical machines.

Course Contents

Unit-1 Introduction to Electrical Machines: Definition of motor and generator, Generalized Model of an Electric Machine, Torque development due to alignment of two fields, Electro- magnetically induced emf, Elementary concept of an electrical machine, Comparison of generator and motor

Unit-2 DC Machines: Construction of a DC Machine: Armature and Commutator, Types of DC Machine, Emf Equation Significance of Back Emf, Torque Developed, DC Motor Characteristics, Speed control of DC Motor, Starters of DC Motor, Application of DC Motor, Faults in DC Machines.

Unit 3: Single Phase Transformer: Working principle and Constructional features of a transformer and parts of transformer, Practical Transformer on No-Load, Equivalent Circuit Diagram of a Transformer, Losses in Transformer, Transformer Tests, Auto- transformer, Working of Auto-Transformer, Saving of Copper, Types of Transformers.

Unit 4: Three Phase Transformer: Construction of three phase transformer and accessories of transformers such as Conservator, breather, Buchholtz Relay, Tap Changer (off load and on load) (Brief idea) Three phase transformer Connection i.e. delta-delta, delta-star, star-delta and star-star , Star delta connections (relationship between phase and line voltage, phase and line current) Conditions for parallel operation of 3 phase Transformer, Cooling of Transformers, Difference between Power and Distribution Transformers.

Key learning Outcomes:

1. Students learn about the basics of electrical circuits.
2. Students have the knowledge of concept of DC electrical machines.
3. Students have learnt the basics of transformer and their different types.
4. Students understand about the various types of tests in transformer.

Text/Reference books:

1. “Basics of Electrical Engineering” by K.UMA RAO.
2. “Electric Machines” by Ashfaq Husain.
3. “Basic of Electrical Engineering” by D.P. Kothari and I.J. Nagrath.
4. “Fundamentals of Electrical Engineering” by Sahdev, Uneek Publication, Jalandhar

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT
ELECTRICAL TECHNOLOGY
Paper Code- PCC-EL-105

Semester 1st
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives

1. To learn about basics of Electrical.
2. To learn about different types of Theorems.

Course Contents

Unit-1. Introduction: Definition of Charge, Resistance, Voltage, Current, Power, Energy and their units, Temperature variation of resistance, Difference between AC and DC voltage and current.

UNIT-2. D.C. Circuits: Ohm's Law, Series resistance circuits, Parallel resistance circuits, Series – parallel resistance circuits, calculation of equivalent resistance, Star-delta transformation, Kirchhoff's Laws and their applications.

UNIT-3. Electric Cells: Primary cell, wet cell, dry cell, battery, Li-ion battery, series and parallel connections of cells, Electronics Manufacturing Services, Secondary cells, Lead Acid Cell, Discharging and recharging of cells, preparation of electrolyte, care and maintenance of secondary cells.

UNIT-4. Inductors and Capacitors: Capacitors: Definition, Concept of charging and discharging of capacitors, Series and parallel connection of capacitors, Energy stored in a capacitor. Inductors: Definition, Concept of charging and discharging of inductors, Series and parallel connection of inductors, Energy stored in an inductor.

Key learning Outcomes:

After undergoing the subject, the students will be able:

- To Understand about the circuits.
- To differentiate the functioning of different cells.
- To Check the batteries.

Reference Books:

1. Basic Electrical Engineering, Ritu Sahdev, Khanna Publishing House
2. Basic Electrical Engineering, Pradeep Kumar, Khanna Publishing House

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT
COMMUNICATION SKILLS
Paper Code: BSC- 101

Semester 1st
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To discuss types of communication and their forms
2. To improve comprehension
3. To improve spoken English and ability to articulate ideas
4. To improve formal writing skills

Course Contents

Unit 1: Introduction to Communication: Meaning, Importance and Function of Communication, Types of communication, language of communication; advantages and disadvantages; Barriers to Communication; Organizational Communication

Unit 2: Grammar: Parts of speech, Articles, Tenses, Formation of Sentences, Active and Passive Voice, Direct and Indirect speech

Unit 3: Writing and Comprehension: Comprehension, Composition, Translation, Paraphrasing, Letter writing

Unit 4: 7 Cs of Communication Grice's Cooperative Principle; Group Discussions; Public Speaking; Facing Interviews

Key learning Outcomes:

1. To learn about communication process and ways to make communication effective by giving attention to all elements involved.
2. To improve grammar and gain confidence by enhancing their abilities to articulate their ideas.
3. To acquire better writing skills in formal communication.
4. To be able to revise documents for fruitful reading and comprehension.

Reference books:

1. Wren and Martin. *High School English Grammar and Composition*. New Delhi: RRP, 2007
2. Murphy, Raymond. *Essential English Grammar*. New Delhi: Cambridge, 2017

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT
ENGINEERING CALCULATIONS-I
Paper Code: BSC-102

Semester 1st
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives

1. To familiarize the prospective engineers with Basics of mathematics
2. To understand fundamental arithmetical operations.
3. To learn Unit systems, Fractions and Decimals, roots, percentage.
4. To have Knowledge of differential quantities.

Course Contents

Unit-I: Trigonometry – Introduction, Trigonometric Identities, Quadrant Rule, Trigonometric Ratios of Some Specific Angles, Ratios of Complementary Angles, Introduction

Unit-II: Differentiation- Introduction to Derivatives, Product Rule, Quotient Rule, Chain Rule, Derivatives of Algebraic Function, Derivative of Trigonometric Functions.

Unit –III: Integration: concepts of integration, integration of trigonometric, exponential and logarithmic functions, integration by parts.

Unit-IV: Algebra- Algebraic Expressions and Identities, Terms Coefficients and Factors, Monomials Binomials and Polynomials, Multiplication and Division of Algebraic Expressions, Standard Identities and Their Applications. Fundamental Arithmetical Operation- Addition, Subtraction, Multiplication and Division. Applied Workshop Problems Involving Addition, Subtraction, Multiplication and Division, System Of Units – Definition, Different Types & System Of Units i.e., (C.G.S. & SI Units for Length, Mass, Area, Volume, Capacity, Time) HCF, LCM, Square Root Cube Root.

Key learning Outcomes:

1. To Apply the Arithmetical Operations and Conversion of Units.
2. To Convert in Fraction and Decimals, Percentage.
3. To Solve HCF, LCM, Square Roots and Cube Roots.
4. To Deal with Differential Problems.
5. To Learn About Trigonometric Ratios.

Reference Books:

1. Mathematics Book by R.D Sharma
2. Advanced Engineering Mathematics by Jain Rk.
3. A Basic Course in Mathematics by Nabjyoti Dutta.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT**

**Electrical Workshop
Paper Code- PCC-EL-107**

Semester- 1st
Stream–Electrical
L T P Total Credits
3 0 0 18

Internal: 30 Marks
External: 20 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To understand the safety measures in electrical.
2. To know the different equipment's used in electrical workshop and their use, care & maintenance.
3. To understand about the various joints and soldering joints.
4. To have knowledge of electrical connections, meters and instruments.
5. To obtain practical skills of basic operation and working of tools used in the workshop.

Course Contents

1. Implementation in the shop floor of the various safety measures. Visit to the different sections of the Institute Demonstration on elementary first aid. Artificial Respiration.
2. Demonstration of Trade hand tools. Identification of simple types- screws, nuts & bolts, chassis, clamps, rivets etc. Use, care & maintenance of various hand tools.
3. Practice in using cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand. Demonstration & Practice on bare conductor's joints-such as Britannia, straight, Tee, Western union. Joints.
4. Practice in soldering- Measurement of Resistance and Measurement of specific Resistance. Application of Wheatstone bridge in measurement of Resistance.
5. Demonstration and identification of types of cables. Demonstration & practice on using standard wire gauge. Practice on crimping thimbles, Lugs. Examination and checking of cables and conductors and verification of materials according to the span.
6. Verification of Ohm's Law, Verification of Kirchhoff's Laws. Verification of laws of series and parallel circuits. Verification of open circuit and closed-circuit network. Measuring unknown resistance using Wheatstone bridge.
7. Practice on installation and overhauling common electrical accessories. Fixing of switches, holder plugs etc. in T.W. boards. -Identification and use of wiring accessories concept of switching.
8. Assembly of a Dry cell- Electrodes-Electrolytes. Grouping of Dry cells for a specified voltage and current, Ni cadmium & Lithium cell. Practice on Battery Charging, Preparation of battery charging, testing of cells, Installation of batteries, Charging of batteries by different methods. Practice on Electroplating and anodizing, Cathodic protection.
9. Routine care & maintenance of Batteries.
10. Charging of a Lead acid cell, filling of electrolytes- Testing of charging checking of discharged and fully charged battery.
11. Measurement of resistance by different methods- a) Using Wheatstone Bridge b) By voltage drop method. Experiment to demonstrate the variation of resistance of a metal with the change of temperature. -Measure of 'R' by drop method. -Series & shunt ckts-use of Multimeters
12. Connection of Calling Bell, Buzzer, Alarms, Electric Iron, Heater, Light. Rewinding /assembly of different electrical appliances. Study, maintenance and repair of domestic equipment's – Electric Kettle, Heater / Immersion Heater Hot Plate, Geyser, Washing machine cooking range, Incubators, Furnaces, Pump set. Etc.

13. Identification and study of the parts of a D.C. machine. Practicing dismantling and assembling in D.C. Machine.
14. Connection of shunts Generators, Measurement of voltages-Demonstration on field excitation. Connection of compound Generator-Voltage measurement-cumulative and differential – No Load & Load characteristics of Series, Shunt & Compound Generator. Controlling and protecting DC Generator.

Key learning Outcomes:

1. Students have knowledge of caring and maintenance of different tools used in workshop.
2. Students have the practice of soldering the joints.
3. Students have practical experience of electrical connections of measuring instruments.
4. Student understand about the different types of batteries and their maintenance.
5. Students have experienced practicing the dismantling and assembling of DC machine.

Text/Reference books:

1. “Electrician” by National Instructional Media Institute, Chennai
2. “Electrical Workshop: Safety, Commissioning, Maintenance & Testing of Electrical Equipment” by R.P. Singh.

SEMESTER – 2nd SCHEME

Paper Code	Course	L	T/P	Credits
PCC-EL-201	Electrical Machine - II	3	0	3
PCC-EL-202	Electrical Wiring	3	0	3
PCC-EL-205	Electrical Vehicle	3	0	3
BSC-202	Engineering Calculations - II	3	0	3
PCC-EL-206	Electrical workshop - II	0	18	18

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT
ELECTRICAL MACHINE-II
Paper Code - PCC-EL-201

Semester 2nd
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To discuss types of communication and their forms.
2. To improve comprehension.
3. To improve spoken English and ability to articulate ideas
4. To improve formal writing skills

Course Contents

Unit I: Electrical Panels: Working principle and components of electrical panels, transformers and generators, operational characteristics of electrical panels and power distribution through the same advance troubleshooting in electrical panels, transformers and generators

Unit II: Electric Motors: Working principle and connection of AC single phase and AC three phase motors, submersible pumps and their maintenance selection and use of starters such as DOL, Star Delta, Step down Transformer starter etc.

Unit III: Electrical Circuits: Concepts of electrical circuits which includes properties and functions of RCL circuits, inductive DC, AC circuits, details of capacitors, inductors and their actions in DC, AC circuits. Type of connections and tests to be carried out in capacitive, inductive AC and DC circuits, Advantages of three phase supply over single phase line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced.

Unit IV: Heavy Machineries: Detailed concept of electrical installation sequence of electrical panels, transformers, DGs, cables, cranes and electrification of Machineries, Method of erection of an electrical panel and Tower Crane.

Key Learning Outcomes:

1. Understands the concept of operation of machines
2. Learns basics of electrical circuits
3. Have knowledge of basic electrical terms

Reference books:

1. Basics of Electrical Engineering by K.UMA RAO.
2. Electric Machines by Ashfaq Husain.
3. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi.
4. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi.
5. Fundamentals of Electrical Engineering by Sahdev, Uneek Publication, Jalandhar.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT**

**Electrical Wiring
Paper Code-PCC-EL-202**

Semester 2nd
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To gain knowledge of basic electrical wiring
2. To have knowledge of basic electrical wiring symbols
3. To learn about various connections and their applications.

Course Contents

Unit I: Introduction: Scope of the National Electrical Code, Graphical symbols for diagrams, letters symbols and signs, Guide for preparation of diagrams.

Unit II: Domestic and Industrial Wiring: Meggar, Selection of the wiring system, Material Required for Wiring, Preparation for wiring, Methods of wiring, Domestic Wiring Methods, Advantages, Disadvantages, Uses and Precautions Regarding various Domestic wirings, I. E. or I.S. Rules Regarding wiring, Tests for wiring as per I.E. Rules before supplying mains, General faults of Electrical Installations, Wattage of Lamp for various Uses, Location of Lamp points,

Unit III: Cutting tools and Fasteners: Drilling, Hand taps, Gauges, limit gauges and fixed gauges, different types of threads, Fasteners, Riveting, riveting by hand, Shapes of rivet Heads, Riveted Joints, Spacing of Rivets, Hand Drilling Machines.

Unit IV: Electrical Accessories: Electrical Accessories and their Uses, Switches and their types, Lamp holders and their types, Ceiling Rose, Pin Plug, Socket and Adopter, Fuse outlets and their types, Precautions for using Electrical Cables, Measurement of wires, Measurement of Cables, Types of wires, Types of Cables, Fire Alarm.

Key learning Outcomes:

1. Have knowledge of electrical wiring instruments.
2. Learns lines and symbols of wiring.
3. Learns freehand wiring diagram.
4. Understands projections of drawing.

Text/Reference books:

1. Frederic P. Hartwell and H. P Richter; Practical Electrical Wiring: Residential, Farm, Commercial, and Industrial, Park Publishing, 2014.
2. Electrical Wiring Commercial, 17E Ry C. Mullin, Phil Simmons NEC 2020.
3. Rex Cauldwell; Wiring a House, Published by The Taunton Press, 2002.

**J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
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**Electrical Vehicle
Paper Code-PCC-EL-205**

Semester 2nd
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives

1. To familiarize students with basic of power derived vehicles.
2. To understand the configuration and working of a vehicle.
3. To have a knowledge of designing of an Electric Vehicle.

Course Contents

Unit I: Introduction of Electric Vehicles: Electric vehicle Architecture: Major components of electric vehicle, Hybrid Electric vehicles, In-vehicle Safety devices and usage of safety devices. Mandatory Safety precautions while handling Electric Vehicle. Safety measure to be taken before & while driving an electric vehicle. Instrument Cluster: Different Symbols/Icons Meaning and functions, Various gauges and meters reading Different pages of cluster display & diagnostic page

Unit II: Battery: Fundamentals of batteries, different Types of batteries dry batteries, zinc chloride, lead acid and lithium-Ion batteries construction and working. Battery, Tools for checking the battery, Capacity in AH & KWH, Battery Charging, Safety Applications of battery, **Li-Ion Battery:** HV Battery pack detailed explanation of Lithium-Ion battery, in vehicle Removal and reinstallation of battery Safety precautions for handling a high voltage battery, Battery connections Battery management system, Battery cooling system

Unit III: Introduction of HV components in electric vehicle: Traction motors: DC and AC motors, Traction controller, Traction batteries, Traction cooling system, EV charging, precautions while working on High voltage.

Unit IV: EV Charging System: Electric Vehicle Charger: Main components of EV Charger, EV Charging Sockets, Charging of Electric Vehicle, EV charging system and its classification, Basic Charging system faults and rectification, safety precautions for EV charging.

Key Learning Outcomes:

1. Students will learn about Electrical Vehicles.
2. Students will be updated about latest technology.
3. Understands the design of an Electric vehicle.

Reference Books:

1. Iqbal Husain; Electric and Hybrid Vehicles: Design Fundamentals, Third Edition, CRC Press, 2021.
2. Ali Emadi, Mehrdad Ehsani and John M. Miller; Vehicular Electric Power Systems: Land, Sea, Air and Space Vehicles, First Edition, Marcel Dekker, 2004.

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Engineering Calculations-II

Paper Codes: BSC-202

Semester 2nd
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives

1. To familiarize the prospective graduates with Basics of mathematics.
2. To understand fundamental arithmetical operations.
3. To learn Unit systems, Fractions and Decimals, roots, percentage.
4. To have Knowledge of ratio and proportion, factorization and mensuration.

Course Contents

Unit-I Complex number: Definition of Complex Number, Operations on Complex Number (Add., Sub., Multiplication, Division), Conjugate Complex Number, Modulus and Amplitude of a Complex Number, Polar form of a Complex Number.

Unit -II Matrices and Determinants: Definition and Properties of Determinants, Definition and Types of Matrixes, Transpose of a Matrix, Symmetric, Skew Symmetric Matrices, Orthogonal matrices, Hermitian and Skew Hermitian, Minors and Cofactors, Adjoint and Inverse of a Matrix, Cramer's Rule, Solution of Simultaneous Linear Equations by Inverse Matrix Method, Characteristic Matrix, Characteristic Equation, Eigen Values & Vectors, Cayley Hamilton Theorem (verification only).

Unit -III Differentiation: Introduction to Derivatives, Product Rule, Quotient Rule, Chain Rule, Derivatives of Algebraic Function, Derivative of Trigonometric Functions, partial derivative.

Unit - IV Integration: Concepts of integration, integration of trigonometric, exponential and logarithmic functions, integration by parts.

Key learning Outcomes:

1. Students will learn about complex number.
2. Students will learn about matrix and determinants.
3. Students will able to deal with derivative Problems.
4. Students will able to solve and learn integration.

Reference Books:

1. Mathematics Book by R.D Sharma
2. Advanced Engineering Mathematics By Jain Rk.
3. A Basic Course in Mathematics By Nabjyoti Dutta.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT**

**Electrical Workshop II
Paper Code- PCC-EL- 206**

Semester- 2nd
Stream–Electrical
L T P Total Credits
3 0 0 18

Internal: 30 Marks
External: 20 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To have knowledge of electrical symbols and wiring Circuit.
2. To understand about the verification of electrical laws which have studied earlier.
3. To grasp the detailed explanation of concept of DC and AC machines.
4. To understand the concept of safety in machines.
5. To have knowledge of electrical connections, meters and instruments.

Course Contents:

1. Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.
2. Field test on dc series machines.
3. Speed control of dc shunt motor by armature and field control.
4. Swinburne's test on dc motor.
5. Retardation test on dc shunt motor.
6. Regenerative test on dc shunt machines.
7. Load test on single phase induction motor.
8. No load test on three phase induction motor and determination of performance parameters at different load conditions.
9. Blocked rotor test on three phase induction motor.
10. Conduct an experiment to draw V and Λ curves of synchronous motor at no load and load conditions.
11. To join electrical cables using standard cable joining methods.
12. Test underground cable for faults and remove the faults.
13. Determine the number of solar cells in series / parallel for given power requirement.
14. Practice installation of conduits, race ways, switch boards, distribution boards, lights, fans and lighting fixtures.
15. Practice cable laying through conduits.

Key Learning Outcomes:

1. Students have learnt about the validation of electrical laws.
2. Students have knowledge of electrical connection in DC and AC machines.
3. Students have experienced about wiring and installations.
4. Student understand about the electrical cables and faults involved in it.
5. Students have learnt about the concept of solar PV panels and connection the solar PV cells in series and parallel groups to charge the battery for a given power requirement.

SEMESTER – 3rd SCHEME

Paper Code	Course	L	T/P	Credits
PCC-EL-307	Industrial Electronics and control of drives - I	3	0	3
PCC-EL-305	Electrical Machine - III	3	0	3
PCC- EL 306	Power System	3	0	3
BSC-302	Soft Skills	3	0	3
PCC-EL-304	PLC Workshop	0	18	18

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
COMMUNITY COLLEGE OF SKILL DEVELOPMENT
INDUSTRIAL ELECTRONICS AND CONTROL OF DRIVES-I
PCC- EL-307

Semester 3 rd	Sessional – 25 Marks
Stream– Electrical	Theory – 75 Marks
L T P Total Credits	Total: 100 Marks
3 0 0 3	Duration of Exam: 3 Hours

Course Objectives:

1. To have Basic knowledge of Control of basic Industrial electronic devices.
2. To familiarize with the Industrial electronic devices.
3. To study Power conversion techniques.

Course Contents

Unit I: Electrical Drives: Shaft Drive Types of Power Modulators, Comparison between A.C. and D.C. Drives, Drive operation, Advantages and Disadvantages of D.C. Drive, Variable Voltage Variable Frequency Drive (VVVFD), Applications of A.C. Drives.

Unit II: Introduction to SCR: Construction and working principles of an SCR, two transistor analogy and characteristics of SCR, SCR specifications and rating, Construction, working principles and V-I characteristics of DIAC, TRIAC and Quadriac, Basic idea about the selection of heat sinks for SCR and TRIACS, Methods of triggering a Thyristor. Study of triggering circuits, UJT, its Construction, working principles and V-I characteristics, UJT relaxation oscillator, Commutation of Thyristors, Series and parallel operation of Thyristors, Applications of SCR, TRIACS and Quadriac such as light intensity control, speed control of DC and universal motor, fan regulator, battery charger etc., dv/dt and di/dt protection of SCR.

Unit III: Uninterrupted power supplies: UPS online, off-line, Storage devices (batteries), SMPS, CVT.

Unit IV: Inverters, Choppers, Dual Converters and Cyclo-Convertors: Inverter introduction, working principles, voltage and current driven series and parallel inverters and applications; Choppers- introduction, types of choppers and their working principles and applications; Dual converters- introduction, working principles and applications 4.4 Cyclo-converters- introduction, types, working principles and applications.

Key Learning Outcomes:

1. Understands the concept of various semiconductor devices.
2. Have knowledge of basic conversion devices.
3. Have knowledge of SCR, UPS, Inverter, Choppers, Dual Converters and Cyclo-Convertors.

Text/Reference books:

1. "Industrial Electronics and Control by Biswanath Paul; PHI Learning Private Limited, Delhi, 2014.
2. Industrial Electronics and Control by SK Bhattacharya and S Chatterjee; Tata McGrawHill Publishing Company Limited, New Delhi.
3. Power Electronics handbook devices, circuits, and applications by Muhammad H. Rashid; Butterworth-Heinemann publications.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
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**Electrical Machines –III
Paper Code-PCC-EL-305**

Semester 3 rd	Sessional – 25 Marks
Stream– Electrical	Theory – 75 Marks
L T P Total Credits	Total: 100 Marks
3 0 0 3	Duration of Exam: 3 Hours

Course Objectives:

1. To learn safety measures from Electrical hazards.
2. To have Basic knowledge of Electrical Instruments.
3. To familiarize with the Electrical Machines.

Course Contents

Unit I: Synchronous Machines: Main constructional features of commutator and brushless excitation system, Generation of three phase emf, Production of rotating magnetic field in a three-phase winding, Concept of distribution factor and coil span factor and emf equation Armature reaction on unity, lag and lead power factor, Operation of single synchronous machine independently supplying a load - Voltage regulation by synch-impedance method, Need and necessary conditions of parallel operation of alternators Synchronizing an alternator (Synchroscope method) with the bus bars, Operation of synchronous machine as a motor –its starting methods, Effect of change in excitation of a synchronous motor, Cause of hunting and prevention, Rating and cooling of synchronous machines, Applications of synchronous machines (as an alternator, as a synchronous condenser).

Unit 2: Induction Motors: Salient constructional features of squirrel cage and slip ring 3-phase induction motors, Principle of operation, slip and its significance and connection of submersible motor (Monoblock), Locking of rotor and stator fields, Rotor resistance, inductance, emf and current, Relationship between copper loss and the motor slip, Power flow diagram of an induction motor, Factors determining the torque, Torque-slip curve, stable and unstable zones, Effect of rotor resistance upon the torque slip relationship, Double cage rotor motor and its applications, Starting of 3-phase induction motors, DOL, star-delta, auto transformer, Causes of low power factor of induction motors, Testing of 3-phase motor on no load rotor test and find efficiency, Speed control of induction motor, conventional and thyristor.

Unit 3: Special Purpose Machines: Construction and working principle of linear induction motor, stepper motor, Schrage motor, DC Generator.

Unit 4: DC Generator: Basic structure of DC Machine, Construction and Magnetic circuit of DC Machine, Lap and Wave winding, Commutation, Methods of Improving Commutation, Characteristics of DC Generators.

Key learning Outcomes:

1. Students learn about the basics of electrical circuits.
2. Students have the knowledge of concept of DC electrical machines.
3. Students have learnt the basics of transformer and their different types.
4. Students understand about the various types of tests in transformer.

Text/Reference books:

1. "Basics of Electrical Engineering" by K.UMA RAO.
2. "Electric Machines" by Ashfaq Husain.
3. "Basic of Electrical Engineering" by D.P. Kothari and I.J. Nagrath.
4. "Fundamentals of Electrical Engineering" by Sahdev, Uneek Publication, Jalandhar

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
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POWER SYSTEM

PCC- EL-306

Semester 3 rd	Sessional – 25 Marks
Stream– Electrical	Theory – 75 Marks
L T P Total Credits	Total: 100 Marks
3 0 0 3	Duration of Exam: 3 Hours

Course Objectives:

1. To learn about basic concept of Safety
2. To learn how to reduce workplace hazards.
3. To provide knowledge on various safety devices.
4. To learn safety measures during industrial as well as environmental hazards.

Course Contents

Unit-I: Generation of Electrical Energy: Conventional and Non-Conventional Methods of Power Generation, Sources of Energy, Generating Stations Hydro Electric Power Station, Schematic Arrangement of Hydroelectric Power station, Selection of slits for Hydroelectric

Unit II: Power Plants: Power Plant, Constituent of Hydroelectric Power Plant, Classification of Hydroelectric Power Plant, Nuclear Power Station, Selection of site for Nuclear Power Station, Merits and Demerits of Nuclear Power Plants, Power rating Nuclear Power Plant Reactor, on-Conventional Methods of Power Generation, Magneto Hydro Dynamic(MHD) Power Generation, Solar Power Generation, Solar Collectors, Solar Furnace, Solar Cell, Wind Energy, Geothermal Energy, Biomass Energy, Tidal Power Generation.

Unit III: Transmission and Distribution: Transmission, Relative Merits and Demerits of Various Transmission Systems, Distribution, Sub-station, Circuit Breakers, Advantages and Disadvantages of Overhead Line, Types of Overhead Lines, Materials used in Overhead Lines, Overhead Lines, Guarding, Indian Electricity Rules, Regarding Overhead Line, Under-ground Cables, Classification of Under-ground Cables, Construction of Under-ground Cable, Types of Underground Cables, Installation of Underground Cable, Faults in Underground Cable, XLPE Cables, Characteristics and advantages of XLPE, Useful Tables.

Unit-IV: Losses in Transmission: Corona, Reason of Corona Formation, Factors Responsible for Corona, How to Reduce the Corona Effect.

Key Learning Outcomes:

1. To Illustrate and Familiarize the students with the concept of generation, transmission and distribution of power.
2. Students should able to draw and read single line diagram of power system.
3. Students should able to know about protection, maintenance and installations of power system.

Text/Reference books:

1. “Modern Power System Analysis” Third Edition by D. P. Kothari and I. J. Nagrath.
2. “Power System Engineering” Second Edition by D. P. Kothari and I. J. Nagrath.
3. “Electrical Power Systems” First Edition by C. L. Wadhwa.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
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Soft Skills

Paper Code: BSC-302

Semester 3rd
Stream– Electrical
L T P Total Credits
3 0 0 3

Sessional – 25 Marks
Theory – 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To help the students in building interpersonal skills.
2. To develop skill to communicate clearly.
3. To enhance team building and time management skills.
4. To learn active listening and responding skills.

UNIT 1: Grammar and Vocabulary

1. Tenses, 2. Subject–verb agreement. 3. Sentence Analysis: Simple, Compound and Complex sentences. 4. Phrases: Adjective, Adverb and Noun Phrase, 5. Clauses: Adjective, Adverb and Noun Phrase. 6. Voice, Narration, Gerund, Participle.

UNIT 2: Oral Communication

1. Listening Skill – Active listening, Barriers to active listening. 2. Speaking Skill–Stress patterns in English, 3. Questioning skills, 4. Barriers in Speaking 5. Reading Skill–Skimming, Scanning, Intensive reading, 6. linking devices in a text, 7. Different versions of a story/ incident.

UNIT 3: Writing Skills

Letter writing, Business letters • Application letters • Covering letters • Report writing o Academic report • Business report • Technical report • Technical project report • Job Application and Resume writing

UNIT- IV: Soft Skills

1. Body Language– Gesture, posture, facial expression. 2. Group Discussion– Giving up of PREP, REP Technique. 3. Presentation Skills: a. (i) How to make power point presentation b. (ii) Body language during presentation 4. Resume writing: Cover letter, career objective, Resume writing (tailor made) 5. Interview Skills: Stress Management, Answering skills.

UNIT- 5: Stress and Time Management

Introduction • Stress in Today’s Time • Identifying the Stress Source • Signs of Stress • Ways To Cope With Stress • Healthier Ways To Deal With Stress • Time Management • Prioritize Your Work • Smart Work • Four Ds Of Decision Taking.

Key learning Outcomes

1. Self-Awareness, Personal Development and Life skills.
2. Leadership and communication
3. Social Justice and Responsibility

Reference Books:

1. Advanced English Usage: Quirk & Greenbaum; Pearson Education.
2. Developing Communication Skills: Banerjee Meera & Mohan Krishna; Macmillan Publications, 1990.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
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**PLC Workshop
Paper Code-PCC-EL-304**

Semester- 2nd
Stream–Electrical
L T P Total Credits
3 0 0 18

Internal: 30 Marks
External: 20 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To learn safety measures from Electrical hazards.
2. To have Basic knowledge of PLC automation.
3. To learn about PLC programming.

Course Contents

1. Delta PLC
2. Siemens PLC
3. Allen Bradley PLC programming
4. Wonderware SCADA.

SEMESTER – 4th SCHEME

Paper Code	Course	Teaching Schedule	Examination Schedule (Marks)		Total Marks	Credits
PCC-EL-401	On-Job Training	8 hours per day for one semester	200	300	500	30

Procedure for Annual Examination and Continuous Assessment

(A) Annual Exam Marks

1. Project Evaluation: 50 marks
2. Project Seminar: 50 marks
3. Project Viva: 100 marks

(B) Continuous Assessment Marks

1. Assessment by Institute faculty: 100 marks
2. Assessment by Industrial Guide: 100 marks
3. Conduct Marks: 50 marks

Total 500 Marks

SEMESTER – 5th SCHEME

Paper Code	Course	Teaching Schedule	Examination Schedule (Marks)		Total Marks	Credits
PCC-EL-501	On-Job Training	8 hours per day for one semester	200	300	500	30

Procedure for Annual Examination and Continuous Assessment

(A) Annual Exam Marks

4. Project Evaluation: 50 marks
5. Project Seminar: 50 marks
6. Project Viva: 100 marks

(B) Continuous Assessment Marks

4. Assessment by Institute faculty: 100 marks
5. Assessment by Industrial Guide: 100 marks
6. Conduct Marks: 50 marks

Total 500 Marks

SEMESTER – 6th SCHEME

Paper Code	Course	L	T/P	Credits
BSC-601	Entrepreneurship	3	0	3
PCC-EL-601	Industrial Electronics and control of drives - II	3	0	3
BSC-603	Minor project	0	9	39
PCC-EL-603	Electrical workshop - III	0	12	12
Elective Course				
Paper Code	Course	L	T/P	Credits
PCC-EL-602	Fundamentals of Electromagnetism	3	0	3
PCC-EL-602	Installation and Maintenance of Equipment's	3	0	3
PCC-EL-602	Modern Electric Traction System	3	0	3

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ENTREPRENEURSHIP

Paper Code: BSC-601

Semester 6 th	Sessional – 25 Marks
Stream– Electrical	Theory – 75 Marks
L T P Total Credits	Total: 100 Marks
3 0 0 3	Duration of Exam: 3 Hours

Course Objectives

1. Sketching an apt business plan
2. Hiring and retaining a skilled workforce
3. Financial Stability
4. Aligning marketing and sales

Course Contents

Unit 1: Entrepreneurship and entrepreneur: Need of Employment and Opportunities, Essential Characteristics of a good Entrepreneur, Industrial Policy, Classification of industries- Micro, small scale, medium scale, large scale, Type of industries- Production, Job based & Service

Unit 2: Entrepreneurial Development: Product identification/ selection, Site selection, Plant layout, Institutional support needed, Pre market survey.

Unit 3: Entrepreneurship Support System and Start-ups: Introduction to start-up's, Role of District Industries Centre in setting up industry, Function of NSIC, SISI, NISIET, NRDC, SSIC, SIDO, NMTC, KVIC, RSMML, Role of state finance corporation, state electricity corporations, pollution control board, BIS, I.S.O. etc.

Unit 4: Introduction to Tax System, Insurance and Acts: Idea of income tax, sales tax, excise duty and custom duty, Industrial and fire insurance, procedure for industrial insurance, Introduction to Industrial acts, factory act, Workmen's compensation act 1923, Apprentice's act 1961, Environmental protection act 1986

Unit 5: Project Report Preparation: Procedure of preparing a project report, Format of project report, Preparation of project report, Introduction to ISO: 9000 Series of Quality System

Key learning Outcomes:

1. Students will be aware about the concepts of Entrepreneurship development and significance of entrepreneurship in economic development.
2. It will help students to know about various acts related to an industry.
3. Students will be able to prepare project report.
4. They will be able to know the support available from Govt. to start a new venture.

Reference Books

1. Khanka S.S., "Entrepreneurship Development" S. Chand.
2. Desai A.N., "Entrepreneurship & Environment" Ashish, New Delhi.
3. Drucker, Peter, "Innovation and Entrepreneurship" Heinemann, London.
4. Jain Rajiv, "Planning a small-scale Industry: A Guide to Entrepreneurs" S.S. Books, delhi.
5. Kumar, S. A., "Entrepreneurship in Small Industry" Discovery, New Delhi.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
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Industrial Electronics and Control of Drives-II

Paper Code: PCC-EL-601

Semester 6 th	Sessional – 25 Marks
Stream– Electrical	Theory – 75 Marks
L T P Total Credits	Total: 100 Marks
3 0 0 3	Duration of Exam: 3 Hours

Course Objectives:

1. To familiarize with the Industrial Electronics components.
2. To have Basic knowledge of Power converters.
3. To study Electrical Accessories and wiring techniques.

Course Contents

Unit I: Introduction to Thyristor: Basic structure and operation of a Thyristor, two transistor analogy and of Thyristor, V-I characteristics, Methods of triggering a Thyristor, Applications of thyristor, dv/dt and di/dt protection of thyristor, Snubber Circuits and Gate Circuits.

Unit II: Rectifiers: Introduction, types, Working principles and applications of Rectifiers, Uncontrolled rectifiers, controlled rectifiers, Basic structure and operation of uncontrolled and controlled rectifiers under various loads: resistive, inductive and RL load; Three phase configuration of uncontrolled rectifiers.

Unit III: Chopper: Introduction, types of choppers and their working principles and applications: Buck converters, Boost Converters, and Buck-boost converters; working of chopper under both continuous and discontinues conduction mode.

Unit IV: Inverters and Cyclo-converters

Inverters: Introduction, Working principles and applications of Inverters, Voltage source inverters (VSI), Current source inverters (CSI), Structure and operation of VSI and CSI.

Cyclo-converters: Introduction, types, Working principles and applications of Cyclo-converters.

Key learning Outcomes:

1. Understands the concept of Thyristor.
2. Have knowledge of basic Power converters.
3. Learns the application of electronic devices in Power conversion.
4. Learns circuit series in electric home appliances.

Text/Reference books:

1. Industrial Electronics and Control by Biswanath Paul; PHI Learning Private Limited, Delhi, 2014.
2. Industrial Electronics and Control by SK Bhattacharya and S Chatterjee; Tata McGrawHill Publishing Company Limited, New Delhi.
3. Power Electronics handbook devices, circuits, and applications by Muhammad H. Rashid; Butterworth-Heinemann publications.

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INSTALLATION AND MAINTENANCE OF EQUIPMENTS

Paper Code: PCC-EL-602

Semester 6 th	Sessional – 25 Marks
Stream– Electrical	Theory – 75 Marks
L T P Total Credits	Total: 100 Marks
3 0 0 3	Duration of Exam: 3 Hours

Course Objectives:

1. To understand about the measuring equipment's.
2. To study about standard parameters

Course Contents

Unit-1: Introduction to Electrical Measuring Instruments: Concept of measurement and instruments, Concept of measurement of electrical quantities and instruments for their Measurements, sources of error. Types of electrical measuring instruments – indicating, integrating and recording type instruments, Essentials of indicating instruments – deflecting, controlling and damping torque

Unit-2. Ammeters and Voltmeters (Moving coil and moving iron type): Concept of ammeter and voltmeters and difference between them, Construction and working principles of moving Iron and moving coil instruments, Merits and demerits, sources of error and application of these instruments Wattmeter (Dynamometer Type) ,Construction, working principle, merits and demerits of dynamometer type wattmeter, Digital wattmeters.

Unit-3. Energy meter: Induction Type; Construction, working principle, merits and demerits of single-phase and three-phase energy meters, Errors and their compensation, Simple numerical problems , Construction and working principle of maximum demand indicators ,Digital energy meter (diagram, construction and application)

Unit-4. Measuring Instruments: Construction, working principle and application of Meggar, Earth tester (analog and digital) Multimeter, Frequency meter (dynamometer type) single phase power factor meter (Electrodynamometer type). Working principle of synchroscope and phase sequence indicator, tong tester (Clamp-on meter)

Key learning Outcomes:

After undergoing the subject, students will be able to:

1. Connect and repair different indicating and recording instrument in electric circuits.
2. Measure different electrical quantities like current, voltage, power, energy, power factor and frequency.
3. Select the type and range of instruments to be use for the job.
4. Operate CT (Current transformer) and PT (Potential transformer) for measurement.
5. Select and use suitable sensors for measurement of different non-electrical quantities.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
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MODERN ELECTRIC TRACTION SYSTEM

Paper Code: PCC-EL-602

Semester 6 th	Sessional – 25 Marks
Stream– Electrical	Theory – 75 Marks
L T P Total Credits	Total: 100 Marks
3 0 0 3	Duration of Exam: 3 Hours

Course Objectives:

1. To understand about the Electrified tractive system.
2. To study about standard components of power-driven vehicles

Course Contents

UNIT 1: Introduction: Electric traction system, advantages over other system, types of electric traction systems, Choice of traction system in India, Historical background of track electrification in India, single phase low frequency DC system, Composite System, Disadvantage of single-phase DC system, Comparison between pure AC and DC system.

Track Mechanics: Types of Services (Urban, Suburban and mainline), Speed time curve, Tractive effort and tractive effort speed characteristics, power of traction motor, specific energy consumption, Factors affecting slip.

UNIT 2: Power Supply arrangement: Constituents of Power supply system i.e., substation, Sectioning and paralleling post, Subsection and post, Sub-sectioning post and elementary sections, Major control posts or switching substations, Major equipment of substations.

Equipment used in and outside the Locomotive: Block diagram of Locomotive, Overhead equipment, Section Insulator, Polygon OHE, supporting structure, Current collector, Circuit breaker, Tap changer, Transformer, Rectifier connections, Smoothing reactors.

UNIT 3: Traction Motors and Traction Motor Control: Desirable characteristic of traction motors, Comparative study of characteristic of Induction motor, Linear induction motor and their suitability for traction applications, Series parallel control of traction motors, Advantages of series parallel control, Simple numerical problems.

UNIT 4: Braking: Requirements of braking system, Types of brakes (Mechanical, hydraulic, magnetic and eddy current), Electrical braking – plugging, Rheostatic and Regenerative braking.

Key learning Outcomes:

1. Students will learn about Electrical Vehicles.
2. Students will be updated about latest technology.
3. Understands the design of an Electric vehicle.

Reference Books:

1. Iqbal Husain; Electric and Hybrid Vehicles: Design Fundamentals, Third Edition, CRC Press, 2021.
2. Ali Emadi, Mehrdad Ehsani and John M. Miller; Vehicular Electric Power Systems: Land, Sea, Air and Space Vehicles, First Edition, Marcel Dekker, 2004.

**J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
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FUNDAMENTAL OF ELECTROMAGNETISM

Paper Code: PCC-EL-602

Semester 6 th	Sessional – 25 Marks
Stream– Electrical	Theory – 75 Marks
L T P Total Credits	Total: 100 Marks
3 0 0 3	Duration of Exam: 3 Hours

Course Objectives:

1. To understand about electrostatic and magnetostatic in an electrical circuit.
2. To study about standard parameters.

Course Contents

Unit-1: Introduction to Magnetism: Magnets, Classification of materials, Magnetic polarity, Laws of magnetic force, Ewing's molecular theory of magnetism, Magnetic field, Magnetic Induction, Magnetic flux, Magnetic flux density, Magnetic intensity or magnetizing force, Permeability, Relation between B and H, Intensity of magnetism (J or I), Susceptibility, Relation between B, H, I and K.

Unit-2: Electromagnetism: Electromagnetism, Magnetic effect of electric current, Direction of magnetic lines of force, Typical electromagnetic fields, Electromagnet, Current carrying conductor placed in magnetic field, Work law and its applications, Biot-Savart law, Application of Biot-Savart law, Force between two parallel current carrying conductors, Magnitude of mutual force, one ampere.

Unit-3: Magnetic Circuits: Magnetic circuit and its analysis, Comparison between magnetic and electric circuits, Ampere-turns calculations, series and parallel magnetic circuit, leakage flux, Magnetization or B-H curve, Magnetic Hysteresis, Hysteresis loss, Magnitude of Hysteresis loss, Importance of Hysteresis loss.

Unit-4: Electromagnetic Induction: Electromagnetic Induction, Faraday's law of Electromagnetic Induction, Direction of Induced EMF, Induced EMF, Dynamically and statically induced EMF, Self and mutual inductance and their expressions, Co-efficient of coupling, Inductance in series and parallel, Energy stored in a magnetic field, Magnetic energy stored per unit volume, Lifting power of a magnet, closing and opening of an inductive circuit, Rise and decay of current in an inductive circuit, Eddy current loss.

Key learning Outcomes:

1. Student will be able to connect and repair different indicating and recording instruments in electric circuits.
2. Student will be able to measure different electrical quantities like current, voltage, power, energy, power factor, frequency etc.