

# **SCHEME OF EXAMINATION**

**And**

## **SYLLABUS**

**For**

**Bachelors 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**

**2023-24**

## **ABOUT THE PROGRAM**

A Bachelor of Vocation (B. Voc.) in Electrical is a vocational undergraduate degree program that focuses on providing practical skills and knowledge in the field of electrical engineering. This program is designed to equip students with the necessary skills and competencies required for various roles in the electrical industry. This program is an outcome of industry and student demand. Only Degree program in Electrical with more than 80% Practical to make you more employable and outshine your career. This program is designed to introduce the students to the operation of today's complex electricity and power nature by giving them a comprehensive understanding from basic to advanced, of various electrical technologies like power generation, transmission and distribution, electrical wiring, electrical machine, measuring instruments, electrical & electronics, etc. Students under this program will acquire the necessary skills to Construct, Install, maintain, and process electrical systems. Vocational training programs have been created with the aim of imparting industry-specific skills in students. These programs are crafted in such a way that the students acquire skills, which will lead them to employment in the respective sector.

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

PEO 1: To equip graduates with the practical skills and knowledge needed to excel in electrical installation, maintenance, and troubleshooting roles in the industry.

PEO 2: To instill a strong sense of safety awareness and ethical conduct, ensuring that graduates work responsibly and prioritize the well-being of themselves and others.

PEO 3: To prepare graduates to adapt to evolving technologies and industry practices, fostering a commitment to lifelong learning and professional development.

PEO 4: To develop graduates' communication and teamwork skills, enabling them to collaborate effectively with colleagues and professionals in the electrical field.

## **PROGRAM OUTCOMES**

After completing the program, students will be able to:

1. Have a strong understanding of electrical systems, circuits, and components, including the ability to analyse, design, and troubleshoot them effectively.
2. Proficient in electrical installation, maintenance, and repair tasks, applying industry-standard practices and safety protocols.
3. Operate and maintain various electrical equipment and tools, ensuring proper functioning and safety.

4. Aware of safety regulations and codes related to electrical work, ensuring that their activities adhere to industry standards and legal requirements.
5. Effectively communicate with team members and clients, as well as maintain accurate records and documentation related to electrical projects.
6. Skilled in diagnosing electrical problems and finding effective solutions, applying critical thinking, and troubleshooting techniques.
7. Open to learning and adopting new technologies and industry trends as they emerge.
8. Demonstrate professionalism, ethical behaviour, and a strong work ethic in their interactions with clients, colleagues, and employers.
9. Encouraged to apply their electrical skills for the betterment of the community, participating in projects that address local needs and challenges.

### **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. B. Voc. in Electrical encompass graduates' proficiency in electrical installation, maintenance, and equipment operation, as well as their ability to troubleshoot and solve electrical problems.

## SCHEME OF EXAMINATION

### FIRST SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
BSC-105EL	English Literacy	3-0-0	3	25	75	BSC
BSC-106	Typography and Computer Application	3-0-0	3	25	75	BSC
EL-101	Electrical Technology	3-0-0	3	25	75	PCC
EL-102	Fundamental of Electromagnetism	3-0-0	3	25	75	PCC
EL-104	Electrical Workshop - I	0-0-5	5	30	70	SDP
MAC-101 to 103	Mandatory Audit Course	3-0-0	3	25	75	MAC
<b>Total</b>		<b>15-0-5</b>	<b>20</b>	<b>155</b>	<b>445</b>	

### SECOND SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
BSC-203EC	Engineering Calculations	3-0-0	3	25	75	BSC
BSC-204BS	Behavioral Skills	3-0-0	3	25	75	BSC
EL-201	Electrical Wiring	3-0-0	3	25	75	BSC
EL-202	Electrical Vehicle	3-0-0	3	25	75	PCC
EL-203	Electrical Machine - I	3-0-0	3	25	75	PCC
EL-205	Electrical Workshop - II	0-0-5	5	30	70	SDP
<b>Total</b>		<b>15-0-5</b>	<b>20</b>	<b>155</b>	<b>445</b>	

### THIRD SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
BSC-302ES	Employability Skills	3-0-0	3	25	75	BSC
EL-301	Power Plant Engineering	3-0-0	3	25	75	PCC
EL-302	Transmission and Distribution of Electrical Power	3-0-0	3	25	75	PCC
EL-303	Electrical Machine - II	3-0-0	3	25	75	PCC
EL-304	Basic Electronics	3-0-0	3	25	75	PCC
EL-306	Electrical Workshop - III	0-0-5	5	30	70	SDP
<b>Total</b>		<b>15-0-5</b>	<b>20</b>	<b>155</b>	<b>445</b>	

### FOURTH SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
EL-401	Industrial Electronics and control of drives	3-0-0	3	25	75	PCC
EL-402	Basics of Measuring Instruments	3-0-0	3	25	75	PCC
EL-404	PLC Workshop	0-0-5	5	30	70	SDP
BSC-401P	Project	3-0-0	3	30	70	SDP
OEC-401 to 404	Open Elective Course	3-0-0	3	25	75	OEC
PEC-EL-401 to 404	Program Elective Course	3-0-0	3	25	75	PEC
<b>Total</b>		<b>15-0-5</b>	<b>20</b>	<b>160</b>	<b>440</b>	

**FIFTH SEMESTER**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credits</b>	<b>Marks Weightage</b>		<b>Course Type</b>
			<b>Internal</b>	<b>External</b>	
EL-501	On Job Training (OJT)/ Internship	20	150	350	OJT
<b>Total</b>		<b>20</b>	<b>150</b>	<b>350</b>	

**SIXTH SEMESTER**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credits</b>	<b>Marks Weightage</b>		<b>Course Type</b>
			<b>Internal</b>	<b>External</b>	
EL-601	On Job Training (OJT)/ Internship	20	150	350	OJT
<b>Total</b>		<b>20</b>	<b>150</b>	<b>350</b>	

### **LIST OF MANDATORY AUDIT COURSES**

<b>Course Code</b>	<b>Course Name</b>
MAC-101	Human Value and Professional Ethics
MAC-102	Balanced Diet and Nutrition
MAC-103	Environmental Science

### **LIST OF OPEN ELECTIVE COURSES**

<b>Course Code</b>	<b>Course Name</b>
OEC-401	Entrepreneurship
OEC-402	Trends in Technology
OEC-403	Waste Management
OEC-404	Industry 4.0

### **LIST OF PROGRAM ELECTIVE COURSES**

<b>Course Code</b>	<b>Course Name</b>
PEC-EL-401	Restructured Power System
PEC-EL-402	Network Analysis and Synthesis
PEC-EL-403	Waste to Energy
PEC-EL-404	Special Purpose Machines

## DETAILED SCHEME AND SYLLABUS

### FIRST SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
BSC-105EL	English Literacy	3-0-0	3	25	75	BSC
BSC-106	Typography and Computer Application	3-0-0	3	25	75	BSC
EL-101	Electrical Technology	3-0-0	3	25	75	PCC
EL-102	Fundamental of Electromagnetism	3-0-0	3	25	75	PCC
EL-104	Electrical Workshop - I	0-0-5	5	30	70	SDP
MAC-101 to 103	Mandatory Audit Course	3-0-0	3	25	75	MAC
<b>Total</b>		<b>15-0-5</b>	<b>20</b>	<b>155</b>	<b>445</b>	

### LIST OF MANDATORY AUDIT COURSES

Course Code	Course Name
MAC-101	Human Value and Professional Ethics
MAC-102	Balanced Diet and Nutrition
MAC-103	Environmental Science



## **BSC-105EL: ENGLISH LITERACY**

### ***B. Voc. (Electrical) I Semester***

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Spoken English skills

**Successive:** Basics Communication Skills

**Course Objectives:** The objective of studying this course is to acquire knowledge on the Basic English grammar starting from speeches to syntactic category going forward with tenses and its types. To comprehend voices, narration and sentence making.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 To learn about Parts of Speech.
- CO2 To learn about Syntactic Category.
- CO3 To know more about the Tenses.
- CO4 To acquire knowledge on Voices and Sentence Making.

**Course Contents:**

#### **Unit 1: Parts of Speech**

Noun, Pronoun, Verb, Adverb, Adjective.

#### **Unit 2: Literacy Skills**

Preposition, Conjunction, Interjection.

#### **Unit 3: Fragment of Tenses**

Present tense, Past Tense, Future Tense.

#### **Unit 4: Sentence Formation**

Active and Passive voice, Direct and Indirect Narration, Simple Sentences, Compound Sentences, Complex Sentences, Compound-Complex Sentences.

**Text Books/ 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.

## **BSC-106: TYPOGRAPHY AND COMPUTER APPLICATION**

### ***B. Voc. (Electrical) I Semester***

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Successive:** MS Office, MS Word, MS Excel, and MS PowerPoint.

**Course Objectives:** The objective of studying this course is to Understand and learn about the basics of Microsoft windows and MS office program that will enable the students to create documents for printing and sharing.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Learners will be able to claim proficiency in Word and PowerPoint.
- CO2 Learners will be able to independently create professional looking documents and presentations.
- CO3 Learners will be familiar with some advanced Word and PowerPoint functions.
- CO4 Learners will understand how to use Word and PowerPoint in a variety of professional, educational and personal situations.

**Course Contents:**

#### **Unit 1: MS Windows**

Basic components of windows, icons, types of icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders. Control panel – display properties, adding and removing software and hardware, setting date and time, screensaver and appearance using windows accessories.

#### **Unit 2: Documentation Using MS Word**

Introduction to word processing interface, Toolbars, Menus, Creating & Editing Document, Formatting Document, Finding and replacing text, Header and footer, Drop cap, Auto-text, Autocorrect, Bookmark, Advance Features of MS-Word-Mail Merge, Macros, linking and embedding object.

#### **Unit 3: Electronic SpreadSheet using MS Excel**

Introduction to MS-Excel, Cell, cell address, Creating, Editing and Formatting Worksheet, Moving and copying data in excel, Formulas and Functions, Charts, Cell referencing, Advance

features of MS-Excel-Pivot table & Pivot Chart, Linking and Consolidation, Database Management using Excel-Sorting, Filtering, Validation, Conditional formatting, Analyzing and Presenting Complex data.

#### **Unit 4: Presentation using MS PowerPoint**

Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.

#### **Text Books/ Reference Books:**

1. V. Rajaraman, Computer Fundamentals.
2. Ashok Arora, Fundamentals of Computer Systems.
3. Russell A Stultz, Fundamentals of Computer Systems.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-101: ELECTRICAL TECHNOLOGY

### *B. Voc. (Electrical) I Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Basic knowledge of circuits.

**Successive:** Network Theory, Network Theorem, Alternating current, Direct current, Network elements.

**Course Objectives:** The objective of studying this course is to:

1. Understand the basics of electrical.
2. Understand the various theorems applicable in an electrical circuit/ network.
3. Familiarize with the various components present in an electrical network/ circuit.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Analyze and solve DC networks by different analysis methods and theorems.
- CO2 Differentiate various types of components present in an electrical network.
- CO3 Differentiate between AC and DC networks in an electrical network.
- CO4 Understand the use of various types of cells/ battery and the electrochemical reaction occurring inside it.

### **Course Contents:**

#### **Unit 1: Introduction**

Definition of Charge, Resistance, Voltage, Current, Power, Energy and their units, Difference between alternating current and direct current, Ohm's Law, Independent and dependent sources, Active and passive elements in the circuit, ac sources.

#### **Unit 2: D.C. Circuits**

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, Series and parallel connections of cells, Secondary cells, Lead Acid Cell, Li-ion battery, Discharging and recharging of cells, preparation of electrolyte, care and maintenance of secondary cells.

## **Unit 4: AC Circuits**

Representation of sinusoidal waveforms, peak, average and RMS values, Series and parallel RLC circuit, real power, reactive power. Capacitors: Definition, Series and parallel connection of capacitors, Energy stored in a capacitor. Inductors: Definition, Series and parallel connection of inductors, Energy stored in an inductor.

### **Text Books/ Reference Books:**

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. A. K. Theraja and S. G. Tarnekar, "Electrical Technology", S. Chand, 2000.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-102: FUNDAMENTAL OF ELECTROMAGNETISM

### *B. Voc. (Electrical) I Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Successive:** Basics of Electrostatics, Basics of Magnetostatics, Fundamental of Electromagnetism, Electromagnetic fields.

**Course Objectives:** The objective of studying this course is to:

1. Understand and apply the concepts of electromagnetism and their properties.
2. Understand the properties of conducting materials.
3. Understand the concepts related to electric and magnetic fields.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the basic laws of electromagnetism.
- CO2 Obtain the electric and magnetic fields for simple configurations under static conditions.
- CO3 Learners will be able to define the properties of various conducting materials.
- CO4 Learners will be able to understand the properties of both static and moving charge.

**Course Contents:**

#### **Unit 1: Electrostatics**

Coulomb's Law, Electric field Intensity, Electric flux Density, Electric field, electric potential, electrical field intensity due to point charges, electric potential due to point charges, Gauss's law.

#### **Unit 2: Introduction to Magnetism**

Magnets, Classification of materials, Magnetic polarity, Laws of magnetic force, 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 3: 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, 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.

#### **Text Books/ Reference Books:**

1. Matthew N. O. Sadiku, "Elements of Electromagnetic", Oxford University Press, 3<sup>rd</sup> Edition, 2001.
2. Nathan Ida, "Engineering Electromagnetics", Springer (India) Pvt. Ltd., New Delhi, 2<sup>nd</sup> Edition, 2001.
3. Edward Mills Purcell, "Electricity and Magnetism", Cambridge University Press, 2011.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

**EL-104: ELECTRICAL WORKSHOP – I**  
***B. Voc. (Electrical) I Semester***

No. of Credits:	5	Sessional:	30 Marks		
L	T	P	Total	Practical:	70 Marks
0	0	5	5	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Successive:** Electric circuits and wiring

**Course Objectives:** The objective of this course is to:

1. Understand the safety measures in electrical.
2. To know the different equipment used in electrical workshops and their use, care & maintenance.
3. Understand about the various joints and soldering joints.
4. To obtain practical skills of basic network laws and theorems.

**Course Outcomes:** After the completion of this course, the students will be able to:

- CO1 Identify various hand tools.
- CO2 Understand the mechanism of current, voltage and resistance and will be able to measure them for any conducting material.
- CO3 Identify various joints and soldering joints.
- CO4 Learn basic network laws and theorems.

**List of Experiments:**

1. Demonstration of Trade hand tools.
2. Identification of simple types of screws, nuts & bolts, chassis, clamps, rivets etc. Use, care & maintenance of various hand tools.
3. Practice in using cutting pliers, screwdrivers etc. skinning the cables, and joint practice on a single strand.
4. Demonstration & Practice on bare conductor's joints such as Britannia, straight, Tee, Western union Joints.
5. Practice in soldering.
6. Measurement of Resistance and Measurement of specific Resistance. Application of Wheatstone bridge in measurement of Resistance.
7. 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.
8. Verification of Ohm's Law, Verification of Kirchhoff's Laws. Verification of laws of series and parallel circuits.



9. Verification of open circuit and closed-circuit network. Measuring unknown resistance using Wheatstone bridge.
10. Practice on installation and overhauling common electrical accessories.
11. Fixing of switches, holder plugs etc. in T.W. boards. Identification and use of wiring accessories concept of switching.

## MAC-101: HUMAN VALUE AND PROFESSIONAL ETHICS

### *B. Voc. (Electrical) I Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Course Objectives:** The objective of studying this course is to:

1. Understand the value system.
2. Understand Honesty and Integrity.
3. Understand the Harmony.
4. Understand universal declaration of human rights.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Learn about value education system
- CO2 Improve understanding of values for life.
- CO3 Acquire knowledge about harmony in the society.
- CO4 Understand the human Right and Social Evils.

**Course Contents:**

#### **Unit 1: Introduction**

Value education-its purpose and significance in the present world, Value system, The role of culture and civilization, Holistic living, Balancing the outer and inner - Body, Mind and Intellectual level- Duties and responsibilities.

#### **Unit 2: Salient values for life**

Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity, and inclusiveness, Self-esteem and self- confidence, punctuality - Time, task and resource management, Problem solving and decision-making skills- Interpersonal and Intra personal relationship, Team work, Positive and creative thinking.

#### **Unit 3: Understanding Harmony**

**Harmony in Family and Society:** How to owe responsibilities in family, Understanding Values in Human- Human relations, Role of Trust and Respect, Samman (Respect) for all, Akhand Samaj (A United Society)

**Understanding the harmony in Society:** Solution to our day-to-day problems, Prosperity and Compassion, the formula for establishing a fearless society, crafting a society that co- exists, Human Goals, Universal Human Order, From Family to the World.

**Harmony in Nature:** Understanding the Harmony in Nature, making sure your contribution is in harmony with nature, Interconnectedness, and mutual fulfillment.

#### **Unit 4: Environment and Ecological balance**

Interdependence of all beings - living and non-living, The binding of man and nature - Environment conservation and enrichment.

#### **Unit 5: Human Right and Social Evils**

Human Rights: Universal Declaration of Human Rights National Integration - Peace and non-violence - Dr. APJ Kalam's ten points for enlightened citizenship - Social Values and Welfare of the citizen - The role of media in value building - Human Rights violations - Social Evils: Corruption, Cybercrime, Terrorism, Alcoholism, Drug addiction, Dowry, Domestic violence, Untouchability, female infanticide, atrocities against women and how to tackle them.

#### **Text Books/ Reference Books:**

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.
3. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## MAC-102: BALANCED DIET AND NUTRITION

### *B. Voc. (Electrical) I Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

#### **Pre- Requisite:** Nil

**Course Objectives:** The objective of studying this course is to understand and apply the concepts of balanced diet and nutritional value, students will be able to identify and apply food principles to food and nutrition systems.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the basic concepts of a balanced diet.
- CO2 Analyze the type of food and their nutritional value.
- CO3 Evaluate calorie (BMR).
- CO4 Learn the role of diet in healthy living.

#### **Course Contents:**

##### **Unit 1: Concepts and Components of Food Nutrition**

Meaning of nutrition, Basic definition regarding nutritional requirements, Nutritional need of human; Concept of food, Acceptance of food, Function of food, Components of food and their classification; Macronutrients – Carbohydrate, Fat, Protein (source, function and effect on the body); Micronutrients – Vitamins, Mineral, Water, roughage (source, function and effect on body); Planning Balanced Diet.

##### **Unit 2: Food Group**

Cereals and Millet – Selection, Preparation and Nutritive value; Pulses, Nuts and Oilseeds- Selection, Preparation and Nutritive value; Milk and Milk production - Selection, Preparation and Nutritive value; Vegetable and Fruits - Selection, Preparation and Nutritive value; Fatty oil and Sugar, Jaggery - Selection, Preparation and Nutritive value.

##### **Unit 3: Food and Digestion**

Energy – Key concepts, Definition and Components of energy requirements.; Energy – Imbalance concepts of metabolism, anabolism and catabolism; Calorie requirement – BMR, SDA; Physical activity – carbohydrates, lipids and protein metabolism; Factors affecting energy- requirement and expenses; Factors affecting BMR; Factors influencing energy expenditure in physical activity; Methods and requirements for estimating energy expenditure.

#### **Unit 4: Yogic concepts of Diet and Nutrition**

General introduction to diet concepts, concepts of mitahara, Definition and classification, yogic diet according to traditional yoga texts; Concepts of diet according to Gheranda Samhita and Hathapradipika; Satvik, Rajsik and Tamasik diet as describe in Bhagwadgeeta; Pathya and Apathya food according to the texts of Yoga; Role of yogic diet in healthy living; Diet according to nature of the body – Vata, Pitta and Kapha

#### **Text Books/ Reference Books:**

1. Bakhru, H. K., 1991, A Complete Handbook of Nature Cure.
2. Kumar Neeraj, Nagendra, 2014, Mera Aahar Mera Swasthya.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## MAC-103: ENVIRONMENTAL SCIENCE

### *B. Voc. (Electrical) I Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Course Objectives:** The objective of studying this course is:

1. To provide the students a detailed knowledge on the threats and challenges to the environment due to developmental activities.
2. To identify the natural resources and suitable methods for their conservation and sustainable development.
3. To focus on the importance of ecosystem and biodiversity for maintaining ecological balance.
4. To learn about various attributes of pollution management and waste management practices.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Get the information about the ecosystem and also about its functions like Food chain, Ecological pyramids etc.
- CO2 Get the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of the environment by the usage of these resources.
- CO3 Gain the knowledge about the ecosystem diversity, its values and also about the importance of the endemic species and different techniques involved in its conservation
- CO4 Gain knowledge about the different types of pollution and their control technologies, Wastewater treatment, Bio medical waste management etc.
- CO5 Get the complete information about Environmental Impact Assessment, Sustainable developmental activities, environmental policies and regulations, awareness among people about protection of wild life, forest and other natural resources.

**Course Contents:**

#### **Unit 1: The Multidisciplinary Nature of Environmental Studies**

Definition, scope and importance. Need for public awareness.

#### **Unit 2: Natural Resources Renewable and Non-Renewable Resources**

Natural resources and associated problems, Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and

tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits, and problems. Mineral resources: Use and exploitation, environmental effects of extracting and mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

### **Unit 3: Ecosystems**

Concept of an ecosystem Structure and Concept of an ecosystem, Structure and function of an ecosystem. Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, and estuaries).

### **Unit 4: Biodiversity and Its Conservation**

Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

### **Unit 5: Social Issues and The Environment**

From Unsustainable to Sustainable Development urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation. Consumerism and waste products, Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act, Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation, public awareness.

### **Text Books/ Reference Books:**

1. "Perspectives in Environmental Studies" by A. Kaushik and C. P. Kaushik, New age international publishers.
2. "Environmental Studies by Benny Joseph", Tata McGraw Hill Co, New Delhi
3. "Environmental Science towards a sustainable future" by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.

4. "Environmental Engineering and science" by Gilbert M. Masters and Wendell P. Ela  
2008 PHI Learning Pvt Ltd.
5. "Fundamentals of Ecology" by Odum, E.P., Barrick, M. and Barret, G.W. Thomson  
Brooks/Cole Publisher, California, 2005.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.



## DETAILED SCHEME AND SYLLABUS

### SECOND SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
BSC-203EC	Engineering Calculations	3-0-0	3	25	75	BSC
BSC-204BS	Behavioral Skills	3-0-0	3	25	75	BSC
EL-201	Electrical Wiring	3-0-0	3	25	75	BSC
EL-202	Electrical Vehicle	3-0-0	3	25	75	PCC
EL-203	Electrical Machine - I	3-0-0	3	25	75	PCC
EL-205	Electrical Workshop - II	0-0-5	5	30	70	SDP
<b>Total</b>		<b>15-0-5</b>	<b>20</b>	<b>155</b>	<b>445</b>	

## **BSC-202EC: ENGINEERING CALCULATIONS**

### ***B. Voc. (Electrical) II Semester***

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Basic mathematics

**Successive:** Concepts of trigonometry, differentiation, and integration.

**Course Objectives:** The objective of studying this course is to:

1. Familiarize the prospective graduates with the basics of mathematics.
2. Provide knowledge on the application of trigonometry, integration, and differentiation.
3. Understand the use of matrices, trigonometry, integration, and differentiation to solve formulated mathematical problems.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Use trigonometry functions, ratios and their applications in real world scenarios.
- CO2 Use trigonometric identities to solve mathematical problems.
- CO3 Understand and use matrices to solve mathematical problems.
- CO4 Deal with differential and integral problems.

**Course Contents:**

#### **Unit 1: Trigonometry**

Introduction to trigonometric functions: Radian and degree measure, right triangle trigonometry, trigonometric functions of any angle, applications using right triangles; Graphs of sine and cosine functions, transformation of graphs of the sine and cosine functions, Trigonometric Identities, Quadrant Rule, Sum and difference identities for cosine, sine, and tangent, Double-angle identities, half-angle identities, Verifying trigonometric identities, Ratios of Complementary Angles.

#### **Unit 2: Matrices and Determinants**

Definition and Properties of Determinants, Definition and Types of Matrices, 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.

#### **Unit 3: Differentiation and Integration**

Introduction to Derivatives, Product Rule, Quotient Rule, Chain Rule, Derivatives of Algebraic

Function, Derivative of trigonometric functions, Derivative of inverse trigonometric functions, evaluation of simple differentials. Concepts of integration, integration of trigonometric functions, exponential and logarithmic functions, integration by parts, evaluation of simple integrals.

#### **Unit 4: Complex Numbers**

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.

#### **Text Books/ Reference Books:**

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", Pearson, 2002.
2. Advanced Engineering Mathematics by R.K. Jain.
3. A Basic course in Mathematics by Nabjyoti Dutta.
4. Skills in mathematics by Amit M Aggarwal.
5. Applied Mathematics for Polytechnics by H.K. Dass.
6. N.P. Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publications, Reprint, 2010.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## **BSC-204BS: BEHAVIORAL SKILLS**

### ***B. Voc. (Electrical) II Semester***

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Communication Skills.

**Successive:** Basic reading and writing skills.

**Course Objectives:** The objective of studying this course is to discuss Communication skills and their forms and how it is going to help the students. To acquire the practical knowledge of writing skills, along with group discussion and interview skills.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the basic concept of communication.
- CO2 To acquire better writing skills in formal communication.
- CO3 Actively participate in group discussion / meetings / interviews and prepare & deliver presentations.
- CO4 Fundamental knowledge about Speaking and reading skills.

**Course Contents:**

#### **Unit 1: Communication Skills**

Meaning of Communication, Importance, Function, Types, Communication barriers and its solutions.

#### **Unit 2: Writing Skills**

Letter writing: Formal letter, application letter, covering letter and business letter.

Report writing: Academic report, Business report, technical report, News report.

Mail writing and resume

#### **Unit 3: Soft Skills**

Definition and significance of soft skills, Group Discussions, basic knowledge of translator and Paraphrasing.

#### **Unit 4: Speaking and Reading Skills**

Importance of Literacy skills (Reading, Writing, Listening, Speaking), telephonic

communication skill, Levels of reading skills, process of skimming and scanning.

**Text Books/ Reference Books:**

1. Mishra. B, Sharma. S (2011) Communication Skills for Engineers and Scientists. PHI Learning Pvt. Ltd.
2. Chaturvedi P. D, Chaturvedi M. (2011) Business Communication: Concepts, Cases and Applications. Pearson Education India.

## EL-201: ELECTRICAL WIRING

### *B. Voc. (Electrical) II Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Successive:** Electromagnetics and Electrical Technology

**Course Objectives:** The objective of studying this course is to:

1. Understand basic wiring terminologies and guidelines.
2. Know essential tools required to deal with any wiring project/ installations.
3. Learn about various connections and their applications.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Practice residential and light commercial wiring in accordance with the codes and authorities for installation.
- CO2 Identify various wiring methodologies and their testing procedures.
- CO3 List the tools used in wiring.
- CO4 Recognize the different electrical accessories used in residential and light commercial wiring.

**Course Contents:**

#### **Unit 1: Introduction**

Definition, Selection of the wiring system, Indian Electricity Rules, Indian Standards for electrical wiring, National Electrical Code (NEC), Scope of the National Electrical Code, Graphical symbols, letters and signs for electrical wiring.

#### **Unit 2: Domestic and Industrial Wiring**

Megger, Material Required for Wiring, Wiring Safety and Precautions, Preparation/ Planning for wiring, Methods of wiring: Domestic Wiring Methods, Advantages, Disadvantages, Uses and Precautions Regarding various Domestic wirings, Tests for wiring as per I.E. Rules before and after supplying mains, General faults of Electrical Installations.

#### **Unit 3: Cutting tools and Fasteners**

Gauges, limit gauges and fixed gauges, Drilling, Uses of drilling machines, Safety with drill machines, Hand Drilling Machines, Fasteners, Threaded, non-threaded fasteners and adhesives, Fastener safety, Hand taps, Care in tapping, Threads, different types of threads, measuring

threads.

#### **Unit 4: Electrical Accessories**

Switches and their types, Wiring switches in series and parallel, Bulbs and their types, Lamp holders and their types, Ceiling Rose and their types, Pin Plug, Socket and Adapter, Fuse outlets and their types.

#### **Text Books/ Reference Books:**

1. Frederic P. Hartwell and H. P Richter; Practical Electrical Wiring: Residential, Farm, Commercial, and Industrial, Park Publishing, 2014
2. A. J. Coker and W. Turner, "Electric Wiring Domestic", Newnes, 10<sup>th</sup> Edition.
3. Electrical Wiring Commercial, 17E Ry C. Mullin, Phil Simmons NEC 2020.
4. Rex Cauldwell; Wiring a House, Published by The Taunton Press, 2002.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-202: ELECTRICAL VEHICLE

### *B. Voc. (Electrical) II Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Network theory.

**Successive:** Electrified Transportation, power-derived vehicle, energy derived vehicle.

**Course Objectives:** The objective of studying this course is to:

1. To familiarize students with structure, configuration and working of a power derived vehicle.
2. Understand the concept of Electric vehicle and Hybrid electric vehicle.
3. To get familiarized with the various components and their application inside an electric vehicle.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Mathematically design and model the configuration and structure of electric vehicles.
- CO2 Understand the difference between a fuel derived vehicle and an electric vehicle.
- CO3 Understand the electrical and mechanical part of an electric vehicle.
- CO4 Understand the various modes of operation of Electric vehicle and Hybrid electric vehicle.

**Course Contents:**

#### **Unit 1: Introduction of Electric Vehicles**

Definition of Electric vehicle (EV), Electric vehicle Architecture, Major components of electric vehicle, Comparison between an IC engines derived vehicle and an electric vehicle, Essential factors for the growth of EV, Hybrid Electric vehicles (HEV), Types of HEV, Modes of operation of HEV's.

#### **Unit 2: Battery**

Fundamentals of batteries, electrochemical batteries, battery parameters, different types of batteries, dry cell and wet cell, lead acid and lithium-Ion batteries: construction and working, tools for checking the battery, In-vehicle Removal and reinstallation of battery, Battery management system, Electric vehicle cooling system, Electric vehicle management unit, Safety precautions for handling a high voltage battery.



### **Unit 3: Introduction to Components in EV**

Traction controller, Parameters responsible for selection of traction motors: Vehicle resistance, Tire rolling resistance, aerodynamic drag, grading resistance, acceleration force, vehicle mass, vehicle power output, vehicle speed, gear ratio; Vehicle dynamics.

### **Unit 4: EV Charging System**

EV Charger, On-board charger, off-board charger, Main components of EV Charger, EV charging technologies, Classification of EV charging technologies, Power levels of vehicle charging, Plug-In charging system, Wireless charging system, EV charging system faults, Safety precautions for EV charging.

### **Text Books/ 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.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-203: ELECTRICAL MACHINE - I

### *B. Voc. (Electrical) II Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Network theorem, Electric circuitry, Electromagnetism.

**Successive:** Transformer, DC Machine.

**Course Objectives:** The objective of studying this course is to:

1. Understand the concept, construction, working and applications of electrical machines.
2. Understand about the energy conversion process in an electrical machine.
3. Know about the various types of losses related to rotational and static machines.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the factors that have a significant role in the operation of an electrical machine.
- CO2 Understand concept, construction, working and applications of a single phase and a three-phase transformer.
- CO3 Understand concept, construction, working and applications of a DC Machine.
- CO4 Analyze the factors that have significant influence on the efficient operation 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: 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, 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.

### **Unit 3: 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 4: Single Phase Induction Motor**

Introduction to single phase induction motor, working principle and construction of single-phase IM, Capacitor Start IM, Capacitor Start- Capacitor Run IM, Shaded Pole Single phase IM and Universal motor and applications of single-phase IM.

#### **Text Books/ Reference Books:**

1. "Electric Machines" by Ashfaq Husain.
2. P. S. Bimbhra, "Electrical Machines - I", Khanna Book Publishing, 2019.
3. D. P. Kothari and I. J. Nagrath, "Electric Machine", The McGraw Hill companies, Third Edition.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-205: ELECTRICAL WORKSHOP – II

### *B. Voc. (Electrical) II Semester*

No. of Credits:	5	Sessional:	30 Marks		
L	T	P	Total	Practical:	70 Marks
0	0	5	5	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Electrical technology, Network theorem, electromagnetism.

**Successive:** Electrical machine

**Course Objectives:** The objective of this course is to:

1. Understand the structure and working of various types of electric machine.
2. Provide the fundamentals of DC generators, DC motors and transformers.
3. Give emphasis to applications of various machines in the industrial field.

**Course Outcomes:** After the completion of this course, the students will be able to:

- CO1 Acquire knowledge about constructional details of electrical machines.
- CO2 Describe the constructional details and modes of operation of single phase and three-phase transformers.
- CO3 Describe the principle of operation of DC motors and select appropriate motor types for different applications.
- CO4 Acquire knowledge in testing of DC machines to assess its performance.

#### **List of Experiments:**

1. To derive the EMF equation of a single-phase transformer.
2. To perform no load and short circuit test on a single-phase transformer.
3. To perform Sumpner's test on transformers.
4. To derive necessary conditions for parallel operation of a single phase and three phase transformers.
5. Describe the functions of individual parts of DC machines.
6. Practicing dismantling and assembling in D.C. Machine.
7. Load test on dc shunt motor to draw speed – torque and horsepower – efficiency characteristics.
8. Field test on dc series machines.
9. Speed control of dc shunt motor by armature and field control.
10. Swinburne's test on dc motor.
11. Retardation test on dc series motor.
12. Regenerative test on dc shunt machines.

**THIRD SEMESTER**

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
BSC-302ES	Employability Skills	3-0-0	3	25	75	BSC
EL-301	Power Plant Engineering	3-0-0	3	25	75	PCC
EL-302	Transmission and Distribution of Electrical Power	3-0-0	3	25	75	PCC
EL-303	Electrical Machine - II	3-0-0	3	25	75	PCC
EL-304	Basic Electronics	3-0-0	3	25	75	PCC
EL-306	Electrical Workshop - III	0-0-5	5	30	70	SDP
<b>Total</b>		<b>15-0-5</b>	<b>20</b>	<b>155</b>	<b>445</b>	

## **BSC-302ES: EMPLOYABILITY SKILLS**

### ***B. Voc. (Electrical) III Semester***

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Communication skills, soft skills.

**Successive:** Professional and personal development.

**Course Objectives:** The objective of studying this course is to encourage the all-round development of students by focusing on behavioral skills and to make the students aware of the importance, the role and the content of behavioral skills through instructions, knowledge acquisition, demonstration and practice.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the importance of behavioral skills.
- CO2 Effectively communicate through verbal and nonverbal communication.
- CO3 Function effectively in multi dialects.
- CO4 To acquire knowledge on Voices and Sentence Making.

#### **Course Contents:**

##### **Unit 1: Introduction to Employability Skills**

Definition, Importance of employability skills, function and advantages.

##### **Unit 2: Parts of Employability Skills**

Communication and Oral skills, teamwork and collaboration, leadership skills, critical thinking and Problem solving, professionalism and work ethics.

##### **Unit 3: Teamwork and PDP**

Brainstorming, group discussions, organizational skills, conflict management, decision making.

##### **Unit4: Basic self-building**

Adaptability skills, Work under pressure, Interview skills, Powerpoint presentation.

**Text Books/ 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.
3. Malhotra, Perna and Halder, Deb. Communication Skills: Theory and Practice.

## EL-301: POWER PLANT ENGINEERING

### *B. Voc. (Electrical) III Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Electromagnetism, DC and AC Fundamentals

**Successive:** Power Generation.

**Course Objectives:** The objective of studying this course is to:

1. To acquaint the student with different sources of energy and its utilization to obtain mechanical work.
2. To introduce the principles of steam generation, hydro-power generation and nuclear power generation.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Choose the appropriate type of power generating station following norms and guidelines related to it.
- CO2 Explain the economics involved in Power Plant and identify the factors related to selection of plants.
- CO3 Explain the components, principles and working of nuclear & non-conventional power plants.
- CO4 Describe the working of various components of Conventional and Non-Conventional Methods of Power Generation.

**Course Contents:**

#### **Unit 1: Introduction to Power System**

Power System, Definition of Generation, transmission and distribution, various sources of energy, Conventional and Non-Conventional Methods of Power Generation.

#### **Unit 2: Conventional Source of Power Generation**

**Hydro-Electric Power Station:** Schematic Arrangement of Hydroelectric Power station, Selection of sites for Hydroelectric power plant, Constituent of Hydroelectric Power Plant, Merits and Demerits of Hydroelectric power plant, Classification of Hydroelectric Power Plant.

**Thermal power plant:** Schematic Arrangement of Thermal Power Plant, combustion, problem of ash disposal, circulating water schemes, choice of pressure of steam generation and steam temperature, economizer, air preheater, feed water heaters and dust collection.



**Nuclear Power Plant:** Nuclear Reactor, radioactive decay, Moderator, Schematic Arrangement of Nuclear Power Plant, Merits and Demerits of Nuclear Power Plants, Selection of sites for Nuclear Power Plant.

### **Unit 3: Non-Conventional Source of Power Generation**

Introduction, Concept of Solar Power Generation, Wind Energy, Tidal Energy, Geothermal Energy, Biodiesel Energy.

### **Unit 4: Combined Working of Power Plants**

Advantages of combined working of different types of power plants, Need for coordination of various types of power plants in power systems, base load stations and peak load stations.

### **Text Books/ Reference Books:**

1. Electrical power system, Subir Roy, Prentice Hall.
2. Power System Engineering, Nagrath & Kothery, TMH.
3. Elements of power system analysis, C.L Wadwa, New age international.
4. Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## **EL-302: TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER**

### ***B. Voc. (Electrical) III Semester***

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Electromagnetism, DC and AC Fundamentals

**Successive:** Power transmission and distribution.

**Course Objectives:** The objective of studying this course is to:

1. Introduce the students to the general structure of the network for transferring power from generating stations to the consumers.
2. Enable the students to understand electrical & mechanical aspects of the power network along with its environmental and safety constraints.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Design and analyze the real time electrical transmission system with respect to various electrical parameters considering environmental and economic obligations.
- CO2 To implement the knowledge of basic mathematical, physical and electrical principles to formulate a significant power system.
- CO3 Judge the suitability of installing overhead and underground power transmission strategies considering electrical, mechanical, environmental, performance, safety and economic constraints.
- CO4 Identify the faults in the transmission and distribution line.

**Course Contents:**

#### **Unit 1: Overhead and Underground Transmission System**

Transmission, Overhead and underground transmission system, Advantages and Disadvantages of Overhead Line, Advantages and Disadvantages of underground lines, Materials used in transmission Lines, transmission line parameters, Symmetrical system and unsymmetrical system, Construction of Under-ground Cables.

#### **Unit 2: Distribution System**

Introduction, radial and ring main distribution, A.C. distributors fed from one end and both ends, Construction of distribution lines i.e. erection of pole, fixing of insulators and conductors, testing, operation and maintenance of lines.

### **Unit 3: Electrical and Mechanical design of lines**

Corona effect, Reason of Corona Formation, Corona loss, Advantage and disadvantages of corona, Factors Responsible for Corona, How to Reduce the Corona Effect; Sag, Bundling of conductor, Skin effect.

### **Unit 4: Faults and Protection**

Requirement of power system protection, Methods for protection, relay, Overcurrent relay, directional overcurrent relay, differential relay, distance relay, Circuit breakers: Operating principle, arc phenomena, arc extinction, duties of circuit breaker; Isolator.

#### **Text Books/ Reference Books:**

1. Electrical power system, Subir Roy, Prentice Hall.
2. Power System Engineering, Nagrath & Kothari, TMH.
3. Elements of power system analysis, C.L Wadwa, New age international.
4. Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-303: ELECTRICAL MACHINE - II

### *B. Voc. (Electrical) III Semester*

No. of Credits:	3			Sessional:	25 Marks
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Network theorem, Electric circuitry, Electromagnetism.

**Successive:** Alternator, Induction Motor, Synchronous Motor.

**Course Objectives:** As an extension to Electrical Machine - I the objective of studying this course is to study the performance of induction motors and synchronous machines which are the major part of industrial drives and agricultural drive sets.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the concept, structure and working of an Induction motor.
- CO2 Understand the concept, structure and working of a Synchronous machine.
- CO3 Utilize the motor efficiently.
- CO4 Differentiate the use of various motors based on the sectors required.

#### **Course Contents:**

##### **Unit 1: Induction Motors**

Salient constructional features of squirrel cage and slip ring 3-phase induction motors, Principle of operation, slip and its significance, 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, Effect of rotor resistance upon the torque slip relationship, 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.

##### **Unit 2: 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 3: DC Generator**

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

### **Unit 4: Special Purpose Machines**

Construction and working principle of linear induction motor, stepper motor, Schrage motor, DC Generator.

### **Text Books/ Reference Books:**

1. "Electric Machines" by Ashfaq Husain.
2. P. S. Bimbhra, "Electrical Machines - I", Khanna Book Publishing, 2019.
3. D. P. Kothari and I. J. Nagrath, "Electric Machine", The McGraw Hill companies, Third Edition.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-304: BASIC ELECTRONICS

### *B. Voc. (Electrical) III Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Number system, Electrical Technology.

**Successive:** Electronic circuitry, Digital electronics.

**Course Objectives:** The objective of studying this course is:

1. To provide students with the fundamental skills to understand the basics of semiconductor and components like diode and transistor.
2. It will build mathematical and numerical background for design of electronics circuit & component value.
3. To impart knowledge on design and operations of digital circuits.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the structure and operation of semiconductors devices.
- CO2 To study different biasing techniques to operate diodes and transistors.
- CO3 To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- CO4 To understand the design of Digital Circuits.

**Course Contents:**

#### **Unit 1: Basics of Semiconductors**

Introduction to semiconductors, anode, cathode, P-type semiconductor, N-type semiconductor, Diode, Structure of diode, operation of diode, Diode biasing, Forward bias and reverse bias.

#### **Unit 2: Transistors and rectifiers**

Basic theory and operation of PNP and NPN transistors, characteristics of Common base (CB), Common emitter (CE) and Common Collector (CC) configuration, Base bias, emitter feedback bias, voltage divider bias, load line, operating point, Half wave and full wave rectifiers.

#### **Unit 3: Number System and Boolean algebra**

Binary, Octal and Hexadecimal representation and their conversion, BCD, Gray codes and their conversion, Signed binary numbers representation with 1's and 2's complement methods,

Binary arithmetic, Various logic gates and their truth tables and circuits, Representation in SOP and POS forms, Minimization of logic expressions by algebraic method, K-map method.

#### **Unit 4: Combinational and Sequential Circuits**

Adder and subtractor circuit, Circuit of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and parity Generator; Basic memory elements, S-R, J-K, D, and T Flipflop, various types of Registers, Counters & their design, Irregular counter, State table & State transition diagram, Sequential circuit design methodology.

#### **Text Books/ Reference Books:**

1. “Electronic devices and circuit theory” by Boylestad and Nashelsky, Pearson.
2. “Principles of electronics” by V K Mehta and Rohit Mehta, Chand.
3. Fundamentals of Digital Circuits, A. Anand Kumar, PHI.
4. Digital Logic Design, Morris Mano, PHI.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-306: ELECTRICAL WORKSHOP – III

### *B. Voc. (Electrical) III Semester*

No. of Credits:	5	Sessional:	30 Marks		
L	T	P	Total	Practical:	70 Marks
0	0	5	5	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Electrical technology, Network theorem, electromagnetism.

**Successive:** Electrical machine

**Course Objectives:** The objective of this course is to:

1. Understand the structure and working of various types of electric machine.
2. Provide the fundamentals of AC motors.
3. Give emphasis to applications of various machines in the industrial field.

**Course Outcomes:** After the completion of this course, the students will be able to:

- CO1 Learn the construction and principle of operation of different kinds of rotating AC machines.
- CO2 Distinguish the operational features of synchronous machines and induction machines.
- CO3 Compare the different methods of starting and speed control of ac motors.
- CO4 Classify various losses in a three-phase induction motor and synchronous motor.

#### **List of Experiments:**

1. Direct Load test on Alternator.
2. Voltage Regulation of an Alternator by Synchronous Impedance Method.
3. Voltage Regulation of an Alternator by Ampere-turn or MMF method.
4. Voltage Regulation of an Alternator by Zero Power Factor (ZPF) Method.
5. Short Circuit Ratio (SCR) of a Synchronous machine.
6. Slip test on Synchronous machine.
7. Synchronization of an alternator.
8. Construction and Study of Synchronous Motor.
9. V-curves of Synchronous Machine.
10. Direct load test on 3-Phase Induction Motors.
11. No-load test and Blocked rotor test on 3-phase Induction motor.



### FOURTH SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
EL-401	Industrial Electronics and control of drives	3-0-0	3	25	75	PCC
EL-402	Basics of Measuring Instruments	3-0-0	3	25	75	PCC
EL-404	PLC Workshop	0-0-5	5	30	70	SDP
BSC-401P	Project	3-0-0	3	30	70	SDP
OEC-401 to 404	Open Elective Course	3-0-0	3	25	75	OEC
PEC-EL-401 to 404	Program Elective Course	3-0-0	3	25	75	PEC
<b>Total</b>		<b>15-0-5</b>	<b>20</b>	<b>160</b>	<b>440</b>	

#### LIST OF OPEN ELECTIVE COURSES

Course Code	Course Name
OEC-401	Entrepreneurship
OEC-402	Trends in Technology
OEC-403	Waste Management
OEC-404	Industry 4.0

#### LIST OF PROGRAM ELECTIVE COURSES

Course Code	Course Name
PEC-EL-401	Restructured Power System
PEC-EL-402	Network Analysis and Synthesis
PEC-EL-403	Waste to Energy
PEC-EL-404	Special Purpose Machines

## EL-401: INDUSTRIAL ELECTRONICS AND CONTROL OF DRIVES

### *B. Voc. (Electrical) IV Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Electrical technology, Basic Electronics.

**Successive:** SCR, Rectifiers, Choppers, Inverters, Cycloconverters.

**Course Objectives:** The objective of studying this course is to understand and acquire knowledge about various power semiconductor devices and to analyze and design different power converter circuits.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the structure and operation of a Thyristor.
- CO2 Acquire knowledge about fundamental concepts and techniques used in power conversion.
- CO3 Ability to analyze various single phase and three phase power converter circuits and understand their applications.
- CO4 Recognize the role power electronics play in the improvement of energy usage efficiency and the applications of power electronics in emerging areas.

### **Course Contents:**

#### **Unit 1: Introduction to Thyristor**

Thyristor or Silicon Controlled rectifier (SCR), Basic structure and operation of a Thyristor, two transistor analogy of Thyristor, V-I characteristics of Thyristor, Methods of triggering a Thyristor, Applications of thyristor, dv/dt and di/dt protection of thyristor, Snubber Circuits and Gate Circuits.

#### **Unit 2: 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 3: 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

discontinuous conduction mode.

#### **Unit 4: 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.

#### **Text Books/ Reference Books:**

1. P S Bimbhra, "Power Electronics", Khanna Publishers.
2. Power Electronics by M.H. Rashid, PHI.
3. Power Electronics by M.D. Singh and K.B. Khanchandani, TMH.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## EL-402: BASICS OF MEASURING INSTRUMENTS

### *B. Voc. (Electrical) IV Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Basic Electrical Engineering and Basic Electronics

**Successive:** Electrical Instruments, Electronics Instruments.

**Course Objectives:** The objective of studying this course is to introduce the fundamentals of Electronics Instruments and Measurement providing an in-depth understanding of Measurement errors, Bridge measurements, Digital Storage Oscilloscope, Function Generator and Analyzer, Display devices, Data acquisition systems and transducers.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the concept behind the construction and working of various measuring instruments.
- CO2 Measure R, L, C, Voltage, Current, Power factor, Power, Energy using the right instrument.
- CO3 Balance Bridges to find unknown values
- CO4 Use instruments efficiently to measure the electrical and electronics quantities.

**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 wattmeter.

#### **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)

#### **Text Books/ Reference Books:**

1. K. Sawhney & Puneet Sawhney, “A Course in Electrical and Electronic measurements and Instrumentation”, 7/e, DhanpatRai& Co.(P) Ltd., 2005.
2. Albert D. Helfrick & William D. Cooper, “Modern Electronic Instrumentation and Measurement Technique”, Low Price Edition, Pearson Education, 2005.
3. Ernest O.Doebelin, “Measurement Systems Application and Design”, 5/e, Tata McGraw – Hill Publishing Company Ltd., 2004.
4. H.S.Kalsi, “Electronic Instrumentation”, Technical Education Series, Tata McGraw – Hill Publishing Company Ltd., 2001.
5. Alan S.Morris, “The Essence of Measurement”, Eastern Economic Edition, Prentice Hall of India Private Limited., 1997

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

**EL-404: PLC WORKSHOP**  
***B. Voc. (Electrical) IV Semester***

No. of Credits:	5	Sessional:	30 Marks		
L	T	P	Total	Practical:	70 Marks
0	0	5	5	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Successive:** PLC

**Course Objectives:** The objective of this course is to enable students to learn the principles of Programmable Logic Controls (PLC) including hardware, programming, and troubleshooting.

**Course Outcomes:** After the completion of this course, the students will be able to:

- CO1 To describe typical components and basics concepts of a Programmable Logic Controller.
- CO2 To state basic PLC terminology and their meanings.
- CO3 Explain the concept of basic digital electronics and data manipulation.
- CO4 To use timer, counter, and other intermediate programming functions.

**List of Experiments:**

1. Concept of PLC, building block of PLC, function of various blocks.
2. Different programming languages.
3. PLC manufacturer, working of PLC, basic operation and principles of PLC, architectural details.
4. Components / sub components of a PLC, learning functions of different modules of a PLCs.
5. Practical steps in programming a PLC
  - (a) Using hand held programmer
  - (b) Using computer interface.
6. Basic instructions like latch, master control self-holding relays, timer instruction like retentive timers, resetting of timers, counter instructions like up counter, resetting of counters and instruction list syntax.
7. Introduction to step programming language.
8. Ladder diagram Programming, ladder diagram concepts, programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder program.
9. Basic logic operations, AND, NOT, OR functions
10. Use of PLC for an application Car parking, doorbell operation, traffic light control, washing machine, motor in forward and reverse direction

**BSC-401P: PROJECT**  
***B. Voc. (Electrical) IV Semester***

No. of Credits:	5	Sessional:	30 Marks		
L	T	P	Total	Practical:	70 Marks
0	0	5	5	Total:	100 Marks
				Duration of Exam:	3 Hours

The student individually works on a specific topic approved by a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programmer. The topic may be experimental or analytical. At the end of the semester, a detailed report on the work done should be submitted which contains a clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

## **OEC-401: ENTREPRENEURSHIP**

### ***B. Voc. (Electrical) IV Semester***

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Communication Skills, soft skills.

**Successive:** Business and Industrial management.

**Course Objectives:** The objective of studying this course is that the students acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities, to develop the ability of analyzing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Apply the concepts of entrepreneurship development and significance of entrepreneurship in economic development.
- CO2 Understand the key resources required to develop an existing business such as ideas and finance, launch a new venture, or initiate a business enterprise.
- CO3 Understand the central role of opportunity recognition and marketing to business development.
- CO4 Acknowledge the support available from the Government to start a new venture.

**Course Contents:**

#### **Unit 1: Entrepreneurship and entrepreneur**

Entrepreneurship concept and process, Entrepreneur, Essential Characteristics of a good Entrepreneur, Types of entrepreneurs, Industrial Policy, Classification of industries- Micro, small scale, medium scale, large scale, Product identification/ selection, Site selection, Plant layout, Pre-market survey.

#### **Unit 2: 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 3: Introduction to Tax System, and Acts**

Idea of income tax, Goods and Services Tax and custom duty, Introduction to Industrial Acts, factory Act, Workmen's Compensation Act 1923, Apprentices Act 1961, Environmental Protection Act 1986.

### **Unit 4: 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

#### **Text Books/ Reference Books:**

1. Khanka S.S., "Entrepreneurship Development" S. Chand.
2. Desai, A N. "Entrepreneur & 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.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## OEC-402: TRENDS IN TECHNOLOGY

### *B. Voc. (Electrical) IV Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Course Objectives:** The objective of studying this course is to make students aware of the changes in technologies, applications, and Systems around us.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Familiarize with the central concepts in innovation.
- CO2 Learn about critical digitized components.
- CO3 Know about the future trends based on technology outlooks – where are we now and where are we heading.
- CO4 Critically analyze, even practice “how to enable” innovation.

**Course Contents:**

#### **Unit 1: E-Commerce**

Introduction: E-commerce as Business need-commerce, Types, Advantages, Disadvantages, e-Commerce Architecture; Internet Payment Systems, Characteristics, 4C Payment Methods, SET Protocol for Credit Card Payment, E-Cash, E-Check, Overview of Smart Card,

#### **Unit 2: E-mail & Internet**

Introduction, E-mail Account & Its Functions, Search Engine, Surfing Web Pages, Basics of Social Networking Site.

#### **Unit 3: E-Banking Transactions**

Inter Banking, Intra Banking, Electronic Payments, (Payment – Gateway Example), Securities in E-banking (SSL, Digital Signatures – Examples), Services Provided: ATM, Smart Card ECS(Electronic Clearing System), e.g., Telephone, Electricity Bills.

#### **Unit 4: E – Governance & E – Agriculture**

E –Governance Models: (G2B,G2C,C2G,G2G), Challenges to E – Governance, Strategies and tactics for implementation of E – Governance, Types of Agriculture information (Soil, Water, Seeds, Market rate) & Technique dissemination, Future trade marketing, Corp Management, Query redressal System, (Information Kiosk, IVR, etc.), Case Study.

## **Unit 5: E-learning**

Models WBT, CBT, Virtual Campus, LMS & LCMS, Video Conferencing, Chatting Bulletin, Building Online Community, Asynchronous / Synchronous Learning, Case Study.

### **Text Books/ Reference Books:**

1. Internet (Use of Search Engines Google & yahoo etc.).
2. E-Commerce: C.V.S. Murty.
3. FireWall and Internet Security: William Cheswick, Stevens, Aviel, Rubin.
4. The Essential Guide to Knowledge management: Amrit Tiwana.
5. The GIS Book: George B. Karte.
6. Management Information System: Laudon & Laudon

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## **OEC-403: WASTE MANAGEMENT**

### ***B. Voc. (Electrical) IV Semester***

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Course Objectives:** The objective of studying this course is to:

1. Introduction about Sources of solid and hazardous wastes.
2. Study about Waste exchange.
3. Understand storage and collection of municipal solid wastes.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Learn various sources of the solid waste.
- CO2 Improve understanding of handling of waste.
- CO3 Acquire knowledge about steering and suspension systems.
- CO4 Understand Disposal in landfills.

**Course Contents:**

#### **Unit 1: Sources, Classification and Regulatory Framework**

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, electronic wastes, plastics and fly ash – Financing waste management.

#### **Unit 2: Waste Characterization and Source Reduction**

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse Practical: Composition of MSW, Determination of Physical and Chemical Properties of MSW.

#### **Unit 3: Storage, Collection and Transport of Wastes**

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport.

#### **Unit 4: Waste Processing Technologies**

Objectives of waste processing – material separation and processing technologies – biological & chemical conversion technologies – methods and controls of Composting - thermal conversion technologies, energy recovery – incineration – solidification & stabilization of hazardous wastes- treatment of biomedical wastes

#### **Unit 5: Waste Disposal**

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation.

#### **Text Books/ Reference Books:**

1. George Tchobanoglous et al, “Integrated Solid Waste Management”, McGraw - Hill, 2014.
2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi, 2000.
3. Tchobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.
4. R. E. Landrefh and P. A. Rebers, “Municipal Solid Wastes-Problems & Solutions”, Lewis, 1997.
5. Blide A.D.& Sundaresan, B.B, “Solid Waste Management in Developing Countries”, INSDOC, 1993.
6. Georges E. Ekosse, Rogers W'O Okut-Uma, Pollution control & Waste management in Developing Countries, Commonwealth Publishers, New Delhi, 2000.
7. B. B. Sundaresan, A. D. Bhide – Solid Waste Management, Collection, Processing and Disposal, Mudrashilpa Offset Printers, 2001.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

**OEC-404: INDUSTRY 4.0**  
**B. Voc. (Electrical) IV Semester**

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Nil

**Course Objectives:** To introduce Industry 4.0, Internet of Things (IoT) and related topics. This subject will introduce students about technological and business challenges and opportunities as well as ethical concerns related to IoT.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Understand the concept of Industry 4.0.
- CO2 Learn about Industry 4.0 Technologies.
- CO3 Understand the concepts of Internet of Things.
- CO4 Understand the concepts AI.

**Course Contents:**

**Unit 1: Introduction of Industry 4.0**

Industry 4.0 definition, Benefits of Industry 4.0, Industrial Revolutions and Future View, The digital transformation of industry and the fourth industrial revolution, Principles of “Smart Factory”, Industry 4.0 strategy and implementation, Industry 4.0 challenges and risks.

**Unit 2: Industry 4.0 Technologies**

Articulate how key IoT technologies can improve organizational productivity and add value, Human-machine interaction, Advanced robotics and 3-D printing, Lean Manufacturing Touch interfaces, virtual reality and augmented-reality systems, Cloud Computing.

**Unit 3: Introduction to IoT**

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT.

**Unit 4: IoT & M2M**

Machine to Machine, Difference between IoT and M2M, Software define Network.

**Unit 5: Introduction of Artificial intelligence**

Foundations, scope, problems, and approaches of AI, Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents.

**Text Books/ Reference Books:**

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach".
2. Waltenequs Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

## PEC-EL-401: RESTRUCTURED POWER SYSTEM

### *B. Voc. (Electrical) IV Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Power Generation and transmission.

**Successive:** Power System faults and Protection.

**Course Objectives:** The objective of studying this course is to explain basic concepts and issues related with restructuring and deregulation of the power industry.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Grasp the knowledge of the need of restructuring of power systems, different entities in a deregulated environment, different marketplace mechanisms and reasons and objectives of deregulation of various power systems across all.
- CO2 Acquire knowledge of basic concepts of economics and apply them to solve practical applications through numerical analysis.
- CO3 Grasp the knowledge of various market models, levels of competition exist among these models and features of electricity as a commodity.
- CO4 Gain the information about various ancillary services and markets for these services in National and International scenarios.

**Course Contents:**

#### **Unit 1: Introduction**

Understanding Restructuring, Reasons for restructuring/ deregulation of power industry, Understanding the restructuring process, Introduction to issues involved in deregulation, Reasons and objectives of deregulation of various power systems across the world.

#### **Unit 2: Fundamental of economics**

Introduction, Consumer behaviour, Supplier behaviour, Market equilibrium, Short-run and Long-run costs, Various costs of production, perfectly competitive market, Philosophy of Market Models, Market models based on contractual arrangements, Comparison of various market models, Market architecture.

#### **Unit 3: Transmission Congestion Management and Locational Marginal Prices**

Introduction, Classification of congestion management methods, Calculation of ATC, Non-market methods, Nodal pricing, Inter-zonal Intra-zonal congestion management, Price area



congestion management, Capacity alleviation method, fundamentals of Locational Marginal Pricing (LMP), LMP formulation and implementation, LMP using DCOPF.

#### **Unit 4: Reforms of Indian Power sector**

Introduction, Framework of Indian power sector, Reform initiatives during 1990-1995, The availability-based tariff (ABT), The Electricity Act 2003, Open Access issues, Power exchange.

#### **Text Books/ Reference Books:**

1. S. A. Khaparde and A. R. Abhyankar, "Restructured Power Systems", Alpha Science, U.K., 2011.
2. PRAYAS Energy Group, "Know Your Power, A citizens Primer on the Electricity Sector", Second Edition, PRAYAS Energy Group, Pune, 2006.
3. S. R. Paranjothi, "Modern Power Systems – The Economics of Restructuring", 1st Edition, New Age International Pvt. Ltd., 2017.
4. Lo Lei Lai, "Power System Restructuring and Deregulation: Trading, Performance and Information Technology", Indian Edition, Wiley India Ltd., 2001.
5. Mohammad Shahidehpour, Muwaffaq Alomoush, "Restructured Electrical Power Systems: Operation, Trading and Volatility", CRC Press, 2001

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## PEC-EL-402: NETWORK ANALYSIS AND SYNTHESIS

### *B. Voc. (Electrical) IV Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Network theorem, Electric circuitry.

**Successive:** Network transform theory.

**Course Objectives:** The objective of studying this course is to expand the student's knowledge in network analysis beyond the basic topics. It includes advanced topics in network analysis, signals and network synthesis concepts. This course would help students to explore more advanced concepts in the analysis of complex networks.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Apply network topology concepts in the formulation and solution of electric network problems.
- CO2 Apply two-port network analysis in the design and analysis of filter and attenuator networks.
- CO3 Identify the properties and characteristics of network functions, and verify the mathematical constraints for their physical realization.
- CO4 Transform circuits into simpler and synthesized form.

**Course Contents:**

#### **Unit 1: Two Port Network**

Introduction, Two port network parameters: Z parameter, Y parameter, Hybrid Parameter, ABCD parameter and T parameter; Conversion of simple circuit into two port networks, relation between various two port network parameters, series and parallel connection of two port network, cascade connection.

#### **Unit 2: Signal and system**

Definition of Signal, Classification of signal: Linear and non-linear signal, periodic and non-periodic signal, Time variant and time invariant signal, causal and non-causal, stable and unstable, static and dynamic signal; Analysis of various signals.

#### **Unit 3: Laplace Transform**

Introduction, Conditions for existence of Laplace transform, properties of Laplace transform, Laplace transform of unit step, unit ramp, parabolic, rectangular, triangular, linear and

exponential function, application of Laplace transform in network analysis, Inverse Laplace transform, Inverse Laplace transform of unit step, unit ramp, parabolic, rectangular, triangular, linear and exponential function, Mathematical problems related to inverse Laplace transform.

#### **Unit 4: Fourier Transform**

Introduction, Conditions for existence of Fourier transform, properties of Fourier transform, Fourier transform of unit step, unit ramp, parabolic, rectangular, triangular, linear and exponential function, application of Fourier transform in network analysis, Inverse Fourier transform, Inverse Fourier transform of unit step, unit ramp, parabolic, rectangular, triangular, linear and exponential function, Mathematical problems related to inverse Fourier transform.

#### **Text Books/ Reference Books:**

1. K. S. Suresh Kumar, "Electric Circuit Analysis" Pearson Publications, 2013.
2. Ravish R. Singh, "Network Analysis and Synthesis", McGraw-Hill Education, 2013.
3. Chakrabarti, A., "Circuit Theory Analysis and Synthesis", DhanpatRai& Co., Seventh - Revised edition, 2018.
4. S. K. Bhattacharya, "Network Analysis and Synthesis", Pearson Education India.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## PEC-EL-403: WASTE TO ENERGY

### *B. Voc. (Electrical) IV Semester*

No. of Credits:	3			Sessional:	25 Marks
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Electrical Machine, Power system.

**Course Objectives:** The objective of studying this course is to understand the concept of utilization and generation of energy from waste materials.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Apply the knowledge about the operations of Waste to Energy Plants.
- CO2 Analyze the various aspects of Waste to Energy Management Systems.
- CO3 Carry out Techno-economic feasibility for Waste to Energy Plants.
- CO4 Apply the knowledge in planning and operations of Waste to Energy plants.

**Course Contents:**

#### **Unit 1: Introduction**

The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.

#### **Unit 2: Waste Sources & Characterization**

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro-based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

#### **Unit 3: Technologies for Waste to Energy**

**Biochemical Conversion:** Energy production from organic waste through anaerobic digestion and fermentation.

**Thermo-chemical Conversion:** Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

#### **Unit 4: Waste to Energy Options**

Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to fuel resources for other useful energy applications. Energy from Plastic Wastes – Non-recyclable plastic wastes for energy recovery.

**Text Books/ Reference Books:**

1. Industrial and Urban Waste Management in India, TERI Press.
2. Wealth from Waste: Trends and Technologies by Banwari Lal and Patwardhan, TERI Press.
3. Fundamentals of waste and Environmental Engineering, S.N Mukhopadhyay, TERIPress.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode.

## PEC-EL-404: SPECIAL PURPOSE MACHINES

### *B. Voc. (Electrical) IV Semester*

No. of Credits:	3	Sessional:	25 Marks		
L	T	P	Total	Theory:	75 Marks
3	0	0	3	Total:	100 Marks
				Duration of Exam:	3 Hours

**Pre- Requisite:** Electrical machines

**Course Objectives:** The objective of studying this course is to develop required skills so that students can acquire competency in maintaining different types of special electric machines.

**Course Outcomes:** At the end of the course, the student shall be able to:

- CO1 Use different types of transformers efficiently for various applications.
- CO2 Maintain different types induction machines for different applications.
- CO3 Maintain different types synchronous machines for different applications.
- CO4 Maintain various types of Small specialized electric machines.

**Course Contents:**

#### **Unit 1: Special Transformer Types**

Different types of connections of power and distribution transformers, Welding transformers, Isolation transformer, Pulse transformer, Audio transformers and microphone transformers.

#### **Unit 2: Special Induction Machines**

Dual winding Squirrel cage induction generator, soft starters, Reactive power compensation.

#### **Unit 3: Special Synchronous Machines**

Wound rotor synchronous generators for renewable energy applications, Wound rotor synchronous generators in large and small direct drive wind turbines, Permanent magnet synchronous generators in large and small direct drive wind turbines.

#### **Unit 4: Other Special Motors**

Fractional horse power (FHP) motor, Hysteresis motor, Permanent magnet motor, Reluctance motor, Switched reluctance motor, Servomotors.

**Text Books/ Reference Books:**

1. Electrical Machines by Smarajit Ghosh, Pearson Learning, New Delhi.
2. "Electric Machines" by Ashfaq Husain, Dhanpat Rai and Company, New Delhi.

3. Theory and performance of Electrical Machines by J. B. Gupta, S.K. Kataria and sons, New Delhi.

**Note:** It is recommended that some part of the syllabus is to be covered in online mode

## DETAILED SCHEME AND SYLLABUS

### FIFTH SEMESTER

Subject Code	Subject Name	Credits	Marks Weightage		Course Type
			Internal	External	
EL-501	On Job Training (OJT)/ Internship	20	150	350	OJT
<b>Total</b>		<b>20</b>	<b>150</b>	<b>350</b>	

Students will go into industries for **On Job Training**. Students will be evaluated **based upon On Job Training (OJT)/Internship** including report and presentation.

### SIXTH SEMESTER

Subject Code	Subject Name	Credits	Marks Weightage		Course Type
			Internal	External	
EL-601	On Job Training (OJT)/ Internship	20	150	350	OJT
<b>Total</b>		<b>20</b>	<b>150</b>	<b>350</b>	

Students will go into industries for **On Job Training**. Students will be evaluated **based upon On Job Training (OJT)/Internship** including report and presentation.