# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
## Shri Vaishnav Institute of Technology and Science
## Choice Based Credit System (CBCS) in the Light of NEP-2020
## Diploma (Electrical Engineering)
## (2021-2024)

| COURSE CODE | CATEGORY | COURSE NAME | TEACHING &EVALUATION SCHEME | | | | | | | | |
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| | | | THEORY | | | PRACTICAL | | L | T | P | CREDITS |
| | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | |
| DTEE302 | DCC | DC Machines | 60 | 20 | 20 | 30 | 20 | 3 | 0 | 2 | 4 |

**Legends**: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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**Course Educational Objectives (CEOs):**

The objective of this course is -

1. To acquaint students with concept of D.C machine.
2. To understand D.C machines performance.
3. To apply the knowledge about testing and controlling D.C machines.

**Course Outcomes (COs):**

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

1. To get the knowledge of energy conversion process.
2. To comprehend the construction, operations and working of D.C generator.
3. To understand the characteristics of D.C generator.
4. To comprehend the construction, operations and working of D.C motor.
5. To representation of distinguish testing of D.C motor.
6. To acquaint knowledge of Speed control of motor.

**Syllabus**

**UNITI**

**D.C. Generator** **9 Hrs.**

Principle of D.C. generator, Construction- yoke, pole cores and pole shoes, pole coil, armature core, armature winding, brushes, pole-pitch, Conductor-coil and winding element, Coil pitch, Pitch of winding, Back pitch, Front pitch, Commutator pitch, One and two layer winding, Multiplex winding, Lap and wave winding, Simplex lap and wave winding, Types of generators, E.M.F. equation, Losses and power stages, Condition for maximum efficiency, Total losses in DC Generator, Commutation and Armature reaction, Demagnetizing and magnetizing, Demagnetizing and cross magnetizing.

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**UNIT II** **9 Hrs.**

**Generator Characteristics**

Characteristics of D.C. Generators: separately-excited Generator,no-load, Curve for self excited generator, Critical resistance, O.C.C. at different speeds, Critical speed, Voltage buildup of ashunt generator, Factors affecting voltage building of a D.C. generator, External characteristic, Voltage regulation, Internal ortotal characteristic, Series generator, Compound-wound generator, Uses of D.C. generators.

**UNIT III** **8 Hrs.**

**D.C. Motor**

Motor principle, Comparison of generator and motor action, Significance of the back e.m.f., Voltage equation of a motor, Conditions for maximum power, torque, armature torque of a motor, Shaft torque, Motor characteristics, Characteristics of series and shunt Motors, Compound motors, Performance curves, Comparison of shunt and series motors, Losses and Efficiency.

**UNIT IV** **9 Hrs.**

**Testing of D.C. Motor**

Brake test, Swinburne's test, Advantages and disadvantages of Swinburne's test, Regenerative or Hopkinson's test, Merits of Hopkinson's test, Retardation or Running down test, Field's test for series motor.

**UNITV** **8 Hrs.**

**Speed Control of D.C. Motor**

Types of speed control, Speed control of shunt and series motors, Merits and demerits of rheostatic control method, electric braking, electric braking of shunt and series motors.

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**Textbooks:**

1. B. L. Thereja – "A text book of Electrical Technology – Vol - II" – S. Chand Publications.

**References:**


1. J. B. Gupta – "Theory and Performance of Electrical Machines", S. K. Kataria andSons.
2. S. J. Chapman - "Electric Machinery Fundamentals", Mcgraw Hill.
3. M. G. Say - "The performance and Design of Alternating Current Machines", CBSPublishers & Distributors.
4. D. P. Kothari & I. J. Nagrath - "Electrical Machines", TMH publication.
5. A. E.Fitzerald, C. Kingsley, S. D. Umans - "Electric Machinery"- 6th Edition, TataMcgraw Hill.
6. Dr. P. S.Bimbhra – "Electrical Machinery", Khanna Publisher.
7. J. J. Winders, Jr. – "Power Transformers: Principles and Applications", CRC Press.


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**List of Experiments:**

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

1. To study the cross sectional view of DC machines.
2. To obtain open circuit characteristics of self excited DC shunt generator and to find its critical resistance.
3. Speed control of D.C. shunt motor by Field current control method & plot the curve for speed verses field current.
4. Speed control of D.C. shunt motor by Armature voltage control method & plot the curve for speed verses armature voltage.
5. To perform Swinburne's test on a DC shunt machine and to calculate efficiency at full load.
6. To perform Hopkinson's test on a DC shunt machine and to calculate full load efficiency (a) when running as motor and (b) when running as generator.

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| DTEE303 | DCC | Electrical and Electronics Measurement and Measuring Instruments | 60 | 20 | 20 | 30 | 20 | 3 | 0 | 2 | 4 |

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**Course Educational Objectives (CEOs):**
To introduce the students with the

1. Different types of measuring instruments.
2. Fundamental concepts of electrical instrumentation.
3. Monitoring/measuring electrical parameters encountered in domestic and industrial applications.

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

1. Identify various types of instrument.
2. Understand the operating principles of Energy and power meters.
3. Measure low, medium & high Resistances using suitable bridges.
4. Select proper instrument for measurement various Electrical quantities.

**Syllabus**

**UNIT I** **9 Hrs.**

**Classification of Measuring Instruments:** Indicating, recording and integrating types of meters. Errors and types of errors, accuracy, precision and sensitivity, Electrical measuring instruments - Construction, operation. Deflecting, controlling and damping forces, supporting systems, moving coil, electrodynamometer, moving iron, induction type and hot wire type instruments, vibration galvanometer, shunt and multipliers, CT & PT.

**UNIT II** **8 Hrs.**

**Wattmeter and Energy meters:** Dynamometer and induction type wattmeter, Induction type energy meters, measurement of 1-phase and 3-phase power in balanced and unbalanced load condition, 3 phase wattmeter.

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**UNIT III** **9 Hrs.**

**Measurement of Resistance**:Classification of resistance, measurement of low, medium, and high resistance -Kelvin's double bridge, wheatstone bridge, Ammeter voltmeter method and ohmmeter, multimeter, megger, Importance of earth resistance, Earth tester.

**UNIT IV** **8 Hrs.**

**A. C. Bridges:** Measurement of inductance and capacitance by A.C. bridges. Maxwell, Anderson, Hay's, De-sauty's and Wien's bridge,Dielectric measurementbySchering bridge, dielectric loss.

**UNIT V** **7 Hrs.**

**Cathode Ray Oscilloscope:** CRT, Electrostatic and magnetic deflection, time base X and Y amplifiers, controls on the C.R.O. Dual beam oscilloscope.Digital storage and multi-channel CRO.

**Textbooks:**


1. Electrical and Electronic Measurements and Instrumentation byA.K.Sawhney, Dhanpat Rai & Co.
2. Electrical and Electronic Measurements & Instrumentation by J.B Gupta, S.K. Kataria& sons.
3. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.


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**References:**


1. Helfrick and Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice-Hall of India, Reprint 1988.
2. Jones, B.E., "Instrumentation Measurement and Feedback", Tata McGraw-Hill, 1986.
3. Golding, E.W., "Electrical Measurement and Measuring Instruments", 3rd Edition, Sir Issac Pitman and Sons, 1960.


**List of Experiments:**

1. Study of various types of Indicating Instruments.
2. Measurement of low resistance by Kelvin Double bridge.
3. Measurement of medium resistance by Wheatstone bridge.
4. Measurement of insulation resistance by megger.
5. Measurement of inductance by Maxwell's bridge
6. Calibration of Voltmeter, Ammeter, Wattmeter, Energy meter.
7. Measurement of P.F. by ammeter, voltmeter and wattmeter method.
8. Use of CRO for measurement of voltage, current, phase and frequency etc.
9. Measurement of 3-phase power by two wattmeter method.
10. Study and use of C.T. & P.T. for extension of instrument range.
11. Use of multi meter in a circuit for measurement of voltage, current and resistance.

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| DTEE304 | DCC | Electrical Engineering Drawing | 60 | 20 | 20 | 30 | 20 | 2 | 0 | 2 | 3 |

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**Course Educational Objectives(CEOs):**

1. To draw assembled view of dissembled parts of electrical machines and transformers.
2. To develop the ability to identify different parts of electrical machines and prepare list of materials for various parts.
3. To draw circuit diagram for different AC motor starters.
4. To follow BIS and REC standard to draw earthing installation and SP and DP Structures and stay sets for line supports.
5. To use various symbols to draw the single line diagram of 33/11kV substations.

**Course Outcomes(COs):**

After the successful completion of this course students will be able to

1. A technical person takes help of an engineering drawing to understand the constructional features of machines and accessories.
2. Electrical drawing is introduced for the Diploma students to be familiar with different assembled and dissembled views of electrical machine like: Three phase alternator, Induction motors, Transformers, Circuit diagrams of AC motors starters, Development of stator windings of single phase and three phase motors and alternators, with conventional symbols.
3. Sketching as to BIS and REC specification and symbol of electrical earthing installations, SP and DP structures and substations of 132/33 kV and 33/11 kV type.
4. This will enable them to follow engineering drawing in the working environment.

**Syllabus**

**UNIT I** **9 Hrs.**

**Symbols and Notations** - Symbols of practical units, multiples and submultiples, types of supplies, single phase, three phase three wire, three phase four wire, D.C. supply etc. Accessories like main switches, distribution boards, fans, light fixtures, bell, buzzer, lighting arrestor. All types of motor starters, instruments, electronic components etc. Name plate Rating of machines.

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| Shri Vaishnav Vidyapeeth | Shri Vaishnav Vidyapeeth | Vishwavidyalaya, Indore | Vishwavidyalaya, Indore |
| Vishwavidyalaya, Indore | Vishwavidyalaya, Indore | | |

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**UNIT II** **9 Hrs.**

**Domestic Wiring** - All types of light circuits: Fluorescent tube circuits, intermediate switch circuits, fan circuits. Wiring of a residential building. Sodium vapor lamp, mercury vapor lamp.
**Instrument Circuits** - Connection of meters in circuits. Ammeter, voltmeter, wattmeter, energy meter, Power factor meter, frequency meter, synchroscope etc.
**Winding Diagrams** - Simplex type lap and wave diagrams for D. C. Machines. Single phase and three phase motor winding diagrams.

**UNIT III** **7 Hrs.**

**Electrical Machine Drawing** - Parts of D.C. machines like, magnetic poles, commutator, armature etc. A.C. machines rotor, slip rings, etc. Various cable sections. Bushing of the transformer. Assembly diagrams of D.C. machine, A.C. machine, and transformer.

**UNIT IV** **8 Hrs.**

**Power Wiring** - Internal wiring diagrams of single phase motor. wiring diagrams of D.C. and A.C. motor starters like three point shunt motor starter, four point compound motor starter, direct on line (D.O.L.) starter, star- delta starter, contactor type and auto transformer starter. Internal connections of D.C. series, shunt and compound motors. Three phase motors: squirrel cage, slip ring, synchronous etc. Plate earthing and Pipe earthing as per I.S.S.

**UNIT V** **9 Hrs.**

**Alternator Panel Diagrams** - Panel diagram with circuit breaker, isolator, measuring instruments, synchroscope, over current and earth fault protection, differential protection, voltage regulator etc.
**Transmission And Distribution** - All types of transmission towers and distribution poles. Arrangement of various types of cross arms, with insulators, jumpers. Electrical layout of 33KV/ 11KV substation, 11KV/415V pole mounted substations with all protective devices etc.

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**Textbooks:**

1. A Text book of Electrical Drawing .by S.L. Uppal (Khanna pub.)
2. Electrical Drawing by K.L. Narang.
3. Electrical Drawing by C.R. Bargan.

**References:**

1. Electrical Design and Drawing Surjit Singh Dhanpat Rai & Sons.
2. Electrical Engineering Drawing C.R. Dargan Asian Publication.

**List of Experiments:**

1. Draw the winding diagram of a Single Layer Lap and Single Layer Wave connected D C Machine.
2. Draw the different Industrial Electrical symbols.
3. Draw the different types of poles and Towers with feeders and Distributors and Lightning Arrestors.
4. Draw the different types of earthings.
5. Draw different core sections of a transformer
6. Draw the Battery Charging Circuit with Battery.
7. Draw the Single, Double and Triple pole types, Main Switches, Energy meters.
8. Sketches of C.T., P.T. and other Relays with feeders and distributors.
9. Draw the single line diagram of 33/11 kV substation.
10. Stay Arrangement and guard wires arrangement for roads and rail lines crossing.

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|---|---|---|---|
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| DTEE305 | DCC | Generation Transmission and Distribution | 60 | 20 | 20 | 0 | 0 | 3 | 0 | 0 | 3 |

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**Course Educational Objectives (CEOs):**
The main aim of this course is to understand:
1. Electric power generation from conventional and non conventional energy source.
2. Analyze the performance of short, medium and long transmission lines.
3. To discuss the operation of HVAC & HVDC transmission, insulator strings, cables and different distribution schemes.

**Course Outcomes (COs):**
Students will be able to-
1. Understand the importance of non-conventional source of energy and different power plants like solar, wind, tidal, hydro, nuclear, thermal etc.
2. Compare A.C transmission and D.C transmission and derive the expression of transmission line parameters.
3. Determine the equivalent circuits for the transmission lines based on distance and operating voltage for determining voltage regulation and efficiency.
4. Discuss the various insulator materials & their testing and underground cable.
5. Explain the A.C and D.C distribution System and its classification.

**Syllabus**

**UNIT-I** **9 Hrs.**

**Electric Power Generation**

**Introduction**-Structure of electric power system, Conventional methods of power generations, schematic arrangement and choice of site for Hydro, thermal, Nuclear power plants, General layout & operation, Advantages and Disadvantages, comparison of these power plants.

**Non-conventional Energy Source:** solar energy its radiation, collection, storage and application. Wind energy, Biomass energy, geothermal energy and ocean energy as alternative energy sources.

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# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
## Shri Vaishnav Institute of Technology and Science
## Choice Based Credit System (CBCS) in the Light of NEP-2020
## Diploma (Electrical Engineering)
## (2021-2024)

| COURSE CODE | CATEGORY | COURSE NAME | TEACHING &EVALUATION SCHEME | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | THEORY | | | PRACTICAL | | L | T | P | CREDITS |
| | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | |
| DTEE305 | DCC | Generation Transmission and Distribution | 60 | 20 | 20 | 0 | 0 | 3 | 0 | 0 | 3 |

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

**Electric Power Transmission**

**AC Transmission:** Introduction-Typical Layout of A.C. Power supply scheme various of power Transmission-Advantages and Disadvantages of A.C Transmission.

**Transmission Line Parameters**: Parameters of single and three phase transmission lines with single and double circuits – Resistance, inductance and capacitance of conductors, transposition, application of self and mutual GMD, skin and proximity effect.

**H.V.D.C Transmission:** Advantages and Disadvantages of D.C Transmission-Layout Scheme and principle of High Voltage D.C Transmission, Comparison with AC transmission.

**UNIT-III** **8 Hrs.**

**Performance of Transmission Lines:** Classification of lines – short line, medium line and long line – equivalent circuits, phasor diagram, real and reactive power flow in lines, transmission efficiency and voltage regulation, simple problems, Ferranti effect., Corona-formation and corona loss-Factors affecting Corona.

**UNIT-IV** **9 Hrs.**

**Line Insulators and Cables:** Introduction-Line Insulator materials-Properties of Insulators-Types, causes of failure of Insulators, voltage distribution in insulator string, improvement of string efficiency, testing of insulators. Underground cables – Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3-core belted cable, D.C cables.

**UNIT-V** **8 Hrs.**

**Electric Distribution System:** Introduction to distribution systems, Different types of supply system and their comparison, DC/AC Distribution system, their types.

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**Textbooks:**

1. Leonard L. Grigsby, 'Electric Power Generation, Transmission, and Distribution', CRC Press, 3rd edition, 2012.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

**References:**


1. Soni, Gupta, Bhatnagar, Electrical Power (Generation, Transmission, Distribution, Protection and Utilization), Dhanpath Rai And Sons, Delhi.
2. B.R.Gupta, S.Chand, 'Power System Analysis And Design' New Delhi, Fifth Edition, 2008.
3. C.L.Wadhwa, 'Electrical Power Systems', New Age International Publishers.
4. D.P.Kothari, I.J. Nagarath, 'Power System Engineering', Tata McGraw-Hill Publishing Company Limited, New Delhi, Second Edition, 2008.


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| | | | THEORY | | | PRACTICAL | | L | T | P | CREDITS |
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| DTEE307 | SEC | Electrical Power System Protection Laboratory | 0 | 0 | 0 | 30 | 20 | 0 | 0 | 2 | 1 |

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**Course Educational Objectives (CEOs):**

1. To distinguish all kinds of circuit breakers and relays for protection of generators.
2. Transformers and feeder bus bars from over voltages and other hazards.
3. To generalize neutral grounding for overall protection.
4. To illustrate the phenomenon of over voltages and its classification.

**Course Outcomes (COs):**

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

1. Understand the basic function of a circuit breaker, all kinds of circuit breakers and differentiate fuse and circuit breakers under fault condition.
2. Describe the necessity for the protection of alternators, transformers and feeder bus bars from over voltages and other hazards.
3. Illustrate neutral grounding, and how over voltages can be generated and how system can be protected against lightning and switching transient over voltages with various protective schemes.
4. Identify operation and control of microprocessor-based relays.

**List of Experiments:**

1. Identify various switchgears in the laboratory and write their specifications.
2. To study the characteristics of the operation of Buchholz relay.
3. To study the characteristics of Electromechanical over current relay.
4. To study characteristics of electromechanical earth fault relay.
5. To plot the characteristics of miniature circuit breaker (MCB).
6. To study the characteristics of High Rupturing Capacity (HRC) fuse and tripping of bimetallic thermal overload protection and its characteristics.

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7. To study the working principle of impedance relay and its effect during faults in a transmission line.
8. To study the working principle of over-current relay and its effect during faults in a transmission line.
9. To study the Operation of a Non- Directional (IDMT relay) and plot the inverse time current characteristics.
10. To study the operation of Microprocessor Based over Voltage/Under Voltage and hence to obtain inverse time/voltage characteristics.
11. Carry out plug and time setting (with PSM, TSM) of induction type electromagnetic relay.
12. Study of SF6 circuit breaker and vacuum circuit breaker.

**Textbooks:**


1. Switchgear & protection, by Sunil S. Rao. Khanna Publication, 2008.
2. Electrical Power systems, by CL Wadhwa, New age International, 2009.
3. D.P. Kothari, I.J. Nagrath, Modern Power System Analysis TMH, III Ed. Reprint 2008.


**References:**


1. B. Ravindran and M Chander, Power System protection and Switchgear, New Age International reprint 2006.
2. Ashfaq Husain, Electrical Power Systems, Vikas Publishing House.


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