Shri Vaishnav Vidyapeeth Vishwavidyalaya

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SEMESTER VI

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
DTEE603		**ELECTRIC TRACTION**	3	1	0	4	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To provide the students the fundamental concepts of drives and types of drives used in traction.
2. To train the students with a good engineering breadth so as to analyzethe accessing techniques for braking system implementation in traction.

Course Outcomes:

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

1. Express working of Electric Drives.
2. Understand the function of the various traction system equipment.
3. Evaluate the Constituents of Supply systems in traction.
4. Select and understand the various train lighting systems.

Syllabus

UNIT I

General Description of Electric Traction System

Electric Traction – Advantages and Disadvantages. Choice of traction system in India.

UNIT II

System of Track Electrification

Description of various systems - D.C., 1-Phase low frequency A.C., 1-Phase high frequency, 3-Phase A.C. and Composite System, 25 K.V. A.C., 50 Hz System-Advantages and disadvantages, Problems associated with A.C traction system, current and voltage unbalance, production of harmonics and induction effects, comparison between A.C. and D.C. system

UNIT III

Power Supply Arrangements

High Voltage Supply, Constituents of supply system substation, feeding post, feeding and sectioning arrangements, sectioning post, elementary section, Miscellaneous equipment at control posts and switching station, Major equipment at substation, transformer, circuit breaker, interrupters, Protection system for A.C. Traction.

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UNIT IV

A.C. Electric Locomotive

Block diagram of A.C. electric locomotive, Overhead equipment (O.H.E.), Pentagonal O.H.E.-catanery construction, OHE Supporting structure, Current collection system, current collection gear for OHE, pole collection bow collection, pantograph collector, Air blast C.B, Tap Changer (on load), Transformer, Rectifier connection, Traction motor connection.

UNIT V

Rail Locomotive Signaling

System of train lighting, special requirements of train lighting, methods of obtaining unidirectional polarity and constant output, Battery System, Failure of under frame generating equipment.

Text Books:

1. S. K. Pillai, "A first course on Electric Drives", 3rd edition, New Age International Publishers.
2. M. V. Deshpande, "Electrical Motors applications and control", PHI, 2010

Reference Books:

1. S. L. Uppal, "Electrical power", Khanna Publishers.
2. J. B. Gupta, "Electrical Power", S.K Kataria & Sons, New Delhi, 2013.
3. H. Pratab, "Modern Electric Traction", Dhanpat Rai & Sons
4. J. Upadhyay, S. N. Mahendra , "Electric Traction", Allied Publishers Ltd.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
DTEE601		CONTROL SYSTEM	3	1	2	5	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To give the concept of control system & its applications in various fields.
2. To learn concept of modeling of various physical systems.
3. To learn about the performance characteristics and limitations associated with various devices.

Course Outcomes:

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

1. Demonstrate an understanding of the fundamentals of (feedback) control systems.
2. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
3. Apply root-locus technique to analyze and design control systems.
4. Determine the (absolute) stability of a closed-loop control system.

Syllabus

UNIT I

Introduction

Basic concept of open loop and closed loop control system and their comparison-Transfer function definition-Simple Mathematical problems on block diagram and signal flow graphs.-Simple Mathematical model of physical systems-Analogy between different systems-Mechanical, Electrical and Thermal.

UNIT II

Control System Representation

Transfer function, block diagram, reduction of block diagram, problems on block diagram, Mason's formula signal flow graph.

UNIT III

Time Domain Analysis

First and Second order control System (Without mathematical treatment)-Definition of different performance indices as delay time, rise time, peak time, percentage peak overshoot, Settling time, steady state error.-Type-0, Type -1, type-2, system definition-Concept of stability: absolute stability, relative stability-Routh and Hurwitz Criteria for stability.

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UNIT IV

Root Locus Techniques

Introduction-Root Locus concept, Construction of Root Loci.

UNIT V

Frequency Domain Analysis

Introduction- Nyquist Stability Criteria and Bode plots of simple control system.

Text Books:

1 I.J. Nagrath and M. Gopal, "Control system Engineering", New Age International.
2 Gopal M., Control System : Principles & Design, TMH.

Reference Books:

1 Krishna. K. Singh & Gayatri Agnihotri, System Design through MATLAB control tool & Simulink, Stringer Verlag, U.K.
2 Rudra Pratap, Getting Started with MATLAB, Oxford.
3 Modern Control Systems by Roy Chaudhary. PHI

List of Practical

1. Determination of transfer function of A-C servomotor
2. Determination of transfer function of D-C motor.
3. Study of Block diagram reduction Method using MATLAB
4. To Plot Root Locus using MATLAB.
5. To Plot Nyquist plot using MATLAB
6. To Plot Bode plot using MATLAB
7. Effect of adding poles on root loci of type-1, type-2 systems through MATLAB.
8. Effect of adding zeros on root loci of type-1, type-2 systems through MATLAB.
9. Effect of adding poles on bode plots of type-1, type-2 systems through MATLAB.
10. Effect of adding zeros on bode plots of type-1, type-2 systems through MATLAB.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
DTEE602		INSTALLATION MAINTENANCE AND TESTING	2	1	2	4	60	20	20	30	20

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

Course Objectives:

1. Identify safety measures & safety precautions.
2. Testing of single phase, three phase transformer, DC & AC machine as per IS.
3. Planning of routine & preventive maintenance.
4. Analyze the condition of insulation & varnishing if necessary.

Course Outcomes:

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

1. Inspect, test, install & commission electrical machines as per IS
2. Understand the fundaments of different electrical wiring.
3. Understand concepts of commissioning, maintenance, electrical safety, installation and maintenance of domestic appliances.
4. Design earthing system for residential and commercial.
5. Study the maintenance and testing of transformer and induction motor.

Syllabus

UNIT I

Safety & Prevention of Accidents

Definition of terminology used in safety, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don'ts for substation operators as listed in IS., Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.

UNIT II

General Introduction

Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing a) Direct, b) Indirect, c) Regenerative., Classification and need of maintenance, Advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule, Introduction to total productive maintenance.

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UNIT III

Testing & Maintenance of Rotating Machines

Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992.

Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968, Brake test on DC Series motor.

Testing & maintenance of Transformers: Listing type test, routine test & special test as per I.S. 2026-1981, Procedure for conducting following tests: Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, open delta (delta – delta) test., Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028(part III): 1981

UNIT IV

Trouble shooting of Electrical Machines & Switch gear

Significance of trouble shooting of various electrical machines and describes the procedure for the same, Various types of faults (mechanical, electrical & magnetic) in electrical machines and reason for their occurrence, Use of following tools: Bearing puller, Filler gauge, dial indicator, spirit level, growler, Trouble shooting charts for Single & 3-phase induction motor, Single & 3-phase transformer, List the common troubles in HV and LV switchgear, contactors & batteries

UNIT V

Installation

Inspection procedure of Machine Installation, Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment, Installation of rotating machines as per I.S. 900-1992, Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment, Method of drying out of Machines, Classification of transmission tower, Installation of Transmission Tower (From foundation to complete erection).

Earthing

Introduction & importance, Step potential & Touch potential, Factors affecting Earth Resistance, Methods of earthing, Substation and Transmission Tower earthing, Transformer Neutral Earthing.

Text Books:

1. Tarlok Sibgh Installation, Commissioning & Maintenance of Electrical Equipment S.K.Kataria & Sons
2. B.V.S.Rao Operatin & Maintenance of Electrical Machines Vol I & II Media Promoters & Publisher Ltd. Mumbai

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Reference Books:

1. Surjit Singh Electrical Installation and Estimating Dhanpatrai and sons
2. J B Gupta A course in Electrical Installation, Estimating and costing S K Kataria and Sons
3. Tarlok Singh Installation Commissioning & Maintenance of Electrical Equipments S. K. Kataria & Sons, second edition
4. S Rao Testing Commissioning Operation and Maintenance of Electrical Equipments Khanna Publisher
5. Er. R. N. Sahoo Hand book of Inspection, for all type of Electrical Instruments Orissa Power Generation consultants and services.

List of Practical

1. Introduction of tools and accessories for installation of electrical equipment.
2. Measurement of earth resistance by earth tester.
3. To prepare trouble-shooting chart & carry out maintenance of a single and three phase transformers.
4. Disassembling and assembling of electrical machines e.g. electric iron, electric fan.
5. Testing of transformer oil.
6. To prepare a report on specifications of earthing at different substations/different locations & new trends in earthing schemes.
7. Repair and maintenance of circuit breakers up to 11 kV.
8. Fault finding and repairing of different types of electrical wiring.
9. Trouble shooting and repair of direct on line and star delta starter.
10. To observe & carry out periodic maintenance of D.C & A.C. motor in your workshop or laboratories & prepare its report.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
DTEE604		ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

The aim of this course is to impart the basic knowledge of different types of energy audits, and to equip them with waste heat recovery techniques, HVAC system, DSM and EEM and Drives.

Course Outcomes:

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

1. Understand the various types of renewable and non-renewable energy sources.
2. Identify the causes of low power factor and advantages of power factor improvement.
3. Understand the demand side management tariff techniques.

Syllabus

UNIT I

Energy Scenario

Various types of renewable and non-renewable energy, energy consumption and use pattern, energy consumption and environment. Energy Management and audit-Energy Management and its objectives, energy audit, need of energy audit, types of energy audit, energy auditing instruments.

UNIT II

Waste Heat Recovery

Sources of waste heat, advantages of waste heat recovery, commercial waste heat recovery devices- Recuperators, Heat regenerators, heat pumps etc. Agricultural use of waste heat.

UNIT III

Heating Ventilation and Air Conditioning

Definition of Heating, ventilation and air conditioning, Energy saving opportunities in heating ventilation and air conditioning, Conducting Audit in heating ventilation and air conditioning.

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UNIT IV

Demand Side Management

Benefits, Demand side management Techniques, implementation of Demand side management program, Tariff options of Demand side management.

UNIT V

Energy Efficient Motor and Drives

Motor efficiency, energy efficient motors, energy efficient electric drives, use of variable speed drives, Power factor improvement-Causes of low power factor, advantages of power factor improvement, methods of power factor improvement.

Text Books:

1. Energy Conservation and Management by S. K. Soni and Manoj Nair, Satya Prakashan, New Delhi
2. Energy management- W.R. Murphy & G.M. ckey, Butter worths.

Reference Books:

1. Electrical Energy utilization & conservation – Dr. S.C.Tripathi

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
DTEE605		ELECTRIC SUBSTATION PRACTICES	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

The aim of this course is to empower the students with the necessary knowledge of substation operations and maintenance of substation equipment. This course will also be useful for students to observe the safety while working in substations as well as to improve the quality of power system.

Course Outcomes:

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

1. Apply the safety rules in substation.
2. Maintain substation earthing and neutral grounding.
3. Understand the functions and ratings of equipment connected in substation.
4. Interpret single line diagram and layout of substation.
5. Analyze the Gas Insulated Substation.

Syllabus

UNIT I

Sub-stations and its Safety

Need of electrical Substation, Classification of Substation, selection of the site of substation, Single line diagram, conductors used, Typical earth resistance values of various substation, Structure as per as IE rules: 11 KV, 33 KV & 132 KV substation, double pole structure & transmission tower, Requirements of Electrical safety, General Safety rules.

UNIT II

11 KV Substation

Need for pole mounted and plinth mounted substation, 11KV/440 V pole mounted substation equipment and accessories, Functions and ratings of equipment connected in 11 KV substation, Layout and Single line diagram of pole mounted substation, Insulation resistance measurement, Earthing: Equipment earthing and system earthing, Earth resistance measurement and methods to improve earth resistance, Safety practices during routine, preventive and breakdown maintenance.

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UNIT III

33 KV Substation

Need of 33KV/11KV substation, 33KV/11KV substation equipment and accessories, Functions and ratings of equipment connected in 33 KV substation, Layout and Single line diagram of 33KV substation, Breakdown voltage test on power transformer oil, Earthing: Equipment earthing and system earthing, Safety practices during routine, preventive and breakdown maintenance, Fire fighting equipment for different situations in substation.

UNIT IV

132 KV Substation

Need of 132KV/33KV substation, 132KV/33KV substation equipment and accessories, Functions and ratings of equipment connected in 33 KV substation, Layout and Single line diagram of 132KV/33KV substation, Step potential, mesh potential, touch potential, transferred potential, earth mat or grid, Earthing: Equipment earthing and system earthing, Safety practices during routine, preventive and breakdown maintenance, Non contact type thermal sensor to locate and record hotspots in substation.

UNIT V

Gas Insulated Substation

Need of Gas Insulated substation (GIS), GIS: Essential parts, advantages, drawbacks and single line diagram, partial discharge monitoring, Safety practices during routine, preventive and breakdown maintenance of GIS, Fire fighting equipment used in GIS.

Text Books:

1. S.Rao, "Electrical Substation Engineering and Practice Engineering & Practice EHV-AC, HVDC and SF6-GIS", Khanna Publishers Pvt. Ltd, Third edition.
2. Mcdonald J D, "Electrical Power Substation Engineering", CRC Press, Taylor and Francis, Third Edition, 2012
3. M.V Deshpande, "Elements of Electrical Power Station Design", PHI Learning Pvt Limited, New Delhi 2009
4. V.K. Mehta "Principles Of Power System", S.Chand & Co.Ltd, New Delhi, 2011.
5. B.R Gupta," Generation Of Electrical Energy" Eurasia Publishing House (Pvt.) Ltd, Third Edition, 1996

Reference Books:

1. M.L Soni, P.V Gupta and U.S Bhatnagar, "A Course in Electrical Power", Dhantpat rai and Co (P) Ltd., New Delhi, 2016.
2. G.R Nagpal, S.C Sharma, "Power Plant Engineering", Khanna Publishers, Delhi 2012.
3. Sunil S. Rao, "Switchgear Protection and Power Systems", Khanna Publishers, New Delhi 2008.

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List of Practical

1. Prepare report on safety precautions to be observed in substation.
2. Draw layout and prepare report on 11KV pole mounted substation earthing after seeing the relevant video clip.
3. Draw single line diagram of 11KV substation and list detailed specifications of equipment used.
4. Prepare visit report of 33KV/11KV substation and draw the layout diagram.
5. Draw single line diagram of 33KV substation and list detailed specifications of equipment used.
6. Measure the earth resistance and insulation resistance of 33KV/11KV substation.
7. Prepare Maintenance schedule of 33KV/11KV substation.
8. Draw single line diagram of 132KV substation and list detailed specifications of equipment used.
9. Draw single line diagram of 33KV Gas Insulated substation.
10. Prepare a report on maintenance of SF6 circuit breakers in substation.

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