

# **SWAMI VIVEKANAND UNIVERSITY, SIRONJA, SAGAR (M.P.)**



## **SYLLABUS**

**For**

**B.Tech. Electrical Engineering  
Semester - V**

**Swami Vivekanand University, Sironja Sagar  
2014-2015**

SWAMI VIVEKANAND UNIVERSITY SAGAR (M.P.)

## SCHEME OF B.TECH ELECTRICAL ENGG SEMESTER- V

SUBJECT CODE	SUBJECT
BT-501	MANAGEMENT-II
EE-502	ELECTRICAL POWER UTILIZATION AND TRACTION
EE-503	ELECTRICAL MACHINE-I
EE-504	POWER ELECTRONICS-I
EE-505	SWITCHGEAR AND PROTECTION
EE-506	SIMULATION LAB -I
EE-507	SELF STUDY (INTERNAL ASSESMENT)
EE-508	SEMINAR / GROUP DISCUSSION (INTERNAL ASSESMENT)

SUBJECT CODE	THEORY				PRACTICAL			CREDIT	TOTAL	TH- THEORY MS- MID SEM TW- THEORY TERM WORK PR- PRACTICAL LW- LAB WORK PQ- PRACTICAL QUIZ G - GRADE GP- GRADE POINT F\$-ABSENT #-GRACE
	TH	MS	TQ	TW	PR	LW	LQ			
	MAX MIN	MAX MIN	MAX MIN	MAX MIN	MAX MIN	MAX MIN	MAX MIN	TH PR	MAX	
BT-501	70 22	20 -	10 -	- -	- -	- -	- -	4 -	100	
EE-502	70 22	20 -	10 -	- -	- -	- -	- -	4 -	100	
EE-503	70 22	20 -	10 -	- -	30 9	20 -	- -	4 2	150	
EE-504	70 22	20 -	10 -	- -	30 9	20 -	- -	4 2	150	
EE-505	70 22	20 -	10 -	- -	30 9	20 -	- -	4 2	150	
EE-506	- -	- -	- -	- -	30 9	20 -	- -	- 2	50	
EE-507	- -	- -	- -	- -	- -	- -	50 -	- 2	50	
EE-508	- -	- -	- -	- -	- -	- -	50 -	- 2	50	

Subject Name: Electrical Power Utilization and Traction

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Internal Assessment (I)
4	0	0	4	70	30	0

Sr. No	Course content
1.	<p><b>Electric Drives:</b></p> <p>Introduction concept of electric drives, Classification of electric drives, Nature of load, Factors effecting selection of drive, Running characteristics of D.C, Series and shunt motor, 3-phase induction motor, 3-phase synchronous motor and A.C series motors, Starting methods of D.C series and shunt motors, Starting methods of 3-phase induction motors, Examples, starting methods of synchronous motors and single-phase induction motor. Speed control of D.C series and shunt motors, Examples. Speed control of 3-phase induction motor. Examples, Methods of electric braking, of D.C motor, examples. Braking of 3-phase induction motor, Mechanical features of electric drive, Load equalization, Flywheel calculations, examples. Temperatures rise of electric drives heating and cooling curves, Standard ratings of motors, Examples Applications of electric drives and selection of drives for particular service, Conservation approach to be considered. Energy efficient drives.</p>
2.	<p><b>Electrical Traction:</b></p> <p>Introductions, Different traction systems, Various systems of electric traction. Locomotives, Tramways, trolleys, Track electrification, Comparison between A.C and D.C systems of railway electrification, Types of speed and speed-time curves, Examples. Mechanics of train movement, Tractive effort, power, Output, examples., Energy output from driving axles, Energy output using simplified speed-time curves, Examples, Factors affecting energy consumption, dead weight, accelerating weight, Adhesion weight, examples., Traction motors and their characteristics, Starting and speed control of D.C series and shunt motors, Examples, Starting and speed control of A.C series and 3-phase induction motors, Braking of traction motors and mechanical considerations, Conservation approach to be considered.</p>
3.	<p><b>Electrical Heating &amp; Welding</b></p> <p>Advantages of electric heating, Modes of transfer of heat, Classification of electric heating methods, Resistances heating methods, Requirements of heating elements, Design of heating elements, Methods of temperature control, Problems, Induction heating: principle, types of induction furnaces, Direct core type, Vertical core type, Indirect core type, Core less type, Advantages and disadvantages, eddy current heating, Applications examples., Arc-furnace: principle, Types, direct and indirect arc furnaces, Power supply and control, Condition for maximum output, Examples., Dielectric heating: principles, advantages and disadvantages, Applications, Choice of frequency, Examples., Electric welding: different types of resistance welding and electric arc welding, Conservation approach to be considered. Energy efficient</p>

4.	<p><b>Electrolytic Process:</b></p> <p>Principle, Faradays laws of electrolysis, Current efficiency, Energy efficiency etc., Rating of metals, Production of chemicals, Electro-deposition, Electroplating, Power supply for electrolytic processes.</p>
5.	<p><b>Illumination</b></p> <p><b>s:</b></p> <p>Nature of light, Definitions, Laws of illumination, Different types of lamps, Tungsten lamp, discharge lamp, Sodium vapour lamp, Fluorescent lamp, Design of lighting scheme, methods of lighting, Calculations, examples., Flood lighting, Factory lighting and street lighting, Examples., Conservation approach to be considered.</p>

#### Reference Books:

3. Electrical Power Utilization – Taylor. O Longman Publications.
4. Electrical Power Utilization – J. B. Gupta. ( S.K.Kataria & Sons).
5. Electric Traction – H. Partab.Dhanpatrai & sons.
6. Electrical Power Utilization – B.L. Theraja.S chand pub.
7. A text book on Power System Engg. – Soni, Gupta, Bhatnagar, Dhanpatrai & sons.
8. Generation Utilization of Electrical Energy, Pearson Publication.

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Internal Assessment (I)
3	0	2	5	70	30	50

Sr. No	Course content
1.	<p><b>Polyphase Transformer:</b></p> <p>Polarity, Star/star, Star/delta, Delta/delta, delta/zigzag, terminal marking, Nomenclature, Vector diagram, Phase groups, Parallel operation, Scott connection, V-V connections tertiary winding, Testing of transformers, Sumpner's test - efficiency - transients in transformers - voltage regulation - off load and on load tap changers.</p>
2.	<p><b>Polyphase Induction Motor:</b></p> <p>Introduction, No-load &amp; blocked rotor test, equivalent circuit, Phasor diagram, Circle diagram, Efficiency and slip scale with the help of circle diagram, Analogy of an I.M. to a transformer, Effect of rotor resistance on performance of I.M., Double cage squirrel cage IM and its equivalent circuit, Induction machine dynamics.</p> <p>Starters of I.M Principles &amp; Methods of speed control of 3- phase I.M. , Electrical transients in induction machine, Magnetic levitations, Principle, advantages &amp; application of linear induction motor, Effect of harmonics, Harmonic torques, Cogging &amp; Crawling, effect of unbalance voltages &amp; frequency variation on operation of I..M. Testing of induction motor as per IS, Energy efficient motors.</p>
3.	<p><b>Induction Generator,</b></p> <p>Principle of operation and application, Its load and p. f. control,</p>
4.	<p><b>Single phase A. C. motors:</b></p> <p>Types of single phase motors, Principle and operation of split phase, Resistance start, Capacitor start and capacitor start &amp; run induction motor, Shaded pole induction motor, Fractional horse power motors, Double field revolving theory, Equivalent circuit of 1- phase induction motor, Starting &amp; running performance of 1-phase induction Motor, Losses and efficiency.</p>
5.	<p>Commutator- Action of commutator as a frequency converter, Construction and principles of following commutator motors: Repulsion motor, Schrage motor, AC series motor, Universal Motor.</p>

## Reference Books:

1. Electrical Machines, by Nagarath & Kothari Tata Macgraw hill Pub.
2. Electrical Machines by J. B. Gupta, ( S.K.Kataria & Sons).
3. Electrical Technology Vol II. B. L. Theraja. S chand publication.
4. Electrical Machines by P S Bhimbra, Khanna Pub.
5. Performance and Design of A.C. machines by M. G. Say,CBS pub.

Subject Name: Power Electronics-I

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Internal Assessment (I)
3	0	2	5	70	30	50

**Sr. No.**      **Course content**

1.      **Power                  Semiconductor**

**Devices:**

Construction and Characteristics of Power diodes, Power Transistors, Uni Junction transistors (UJT), Programmable UJT, Power MOSFET, Insulated Gate Bipolar transistors (IGBTs), Static Induction Transistors.

**Thyristors                  and  
family :**

SCR, DIACs, TRIACs, Light Activated SCRs (LASCRs), Reverse Conducting Thyristor (RCT), Asymmetrical SCR (ASCR), Gate turn-off Thyristors (GTOs), Integrated Gate- Commutated Thyristors (IGCTs), MOS controlled Thyristors (MCTs), Power Integrated circuits (PICs), Intelligent Modules, etc.

**2 Thyristor**

**Fundamentals:**

Construction, working, two transistor analogy, Static & dynamic characteristics, Gate characteristics, Turn on & turn off methods (Commutation methods), Ratings, Series & Parallel operations.

**Thyristor**

**Protections:**

Cooling and Heat sinks, Thermal Modelling, di/dt and dv/dt protection, Design of Snubber Circuit, Over Voltage and Over Current protections, Gate protections, Electro Magnetic Interference(EMI) and Shielding.

**Thyristor firing (gate drive)**

**circuits:**

Gate circuit requirements, Isolation of gate and base drives using Pulse transformer and

Opto-couplers, Gate drive circuits like: Resistance trigger,

R-C trigger, DIAC trigger, UJT based trigger, Programmable UJT trigger, IC based advance trigger, Microprocessor based trigger circuits.

**3 Phase Controlled (AC to DC) Converters:**

Principle of phase controlled converter operation- Single phase full wave converter, Single phase dual converters, Three phase half wave converters, Three phase full converters, Three phase dual converters, power factor improvement techniques, Single phase and three phase semi converters, Effect of source and load inductances, Operation of all above converters with R, RL, RLE load.

#### 4. **DC to DC**

##### **Converters:**

The chopper, Basic principle of DC chopper, Classification of DC choppers, Control strategies, Chopper configurations, Thyristor chopper circuits, Jones chopper, Morgans chopper, Multiphase chopper, Flyback converters/Switching regulators like step down (buck), Step up (boost) and step down/step up (buck/boost) converters and Cuk converter etc.

#### 5. **DC Drives with phase controlled**

##### **converters:**

Basic characteristics of DC motors, Principles of DC motor speed control, Operating modes, Single phase and three phase Half, Semi, Full, Dual converter based dc drives, Phase locked loop control of DC drives, Microcomputer control of DC drives.

#### 6. **DC drives with dc-dc**

##### **converters:**

Principle of power control, Principle of Regenerative, rheostatic and combined regenerative and rheostatic brake control, Two and four quadrant DC-DC converter drives. Principle of Motoring operation of separately excited and series motor with DC-DC Converter, Steady- state analysis for time ratio control and current limit control.

#### Reference Books:

1. Power electronics By M D Singh and K B Khanchandani by TMH publication 2<sup>nd</sup> edition.  
“Power Electronics - circuits, devices and applications”, Prentice Hall of India, 2nd ed., 2000- Muhammad H. Rashid.
3. Power Electronics – Devices, Converters and Applications”, by Vedam Subramanyam Revised 2nd edition, New Age Publications.
4. Power Electronics By P. S. Bimbhra, Khanna Publications.
5. Power Electronics, Converters, Applications and Design- Ned Mohan, Undeland and Robbins, Second Edition, John Wiley Publications.
6. Power Electronics- M. S. Jamil Asghar, PHI Learning Pvt. Ltd.
7. Power Electronics by V.R.Moorthi, Oxford University press.
8. Thyristorised controller by Dubey Joshi & Doralda, New age Publication.

Subject Name: Switchgear & Protection

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Internal Assessment (I)
2	0	0	2	70	30	50

Sr.	Course content
<b>No.</b>	
1.	<p><b>Theory of Circuit Interruption:</b></p> <p>Introduction, Physics of arc phenomena , Maintenance of the arc, Losses from plasma, Essential properties of arc, Arc interruption theories .</p>
2.	<p><b>Circuit Constants in Relation to Circuit Breaking:</b></p> <p>Introduction, Circuit breaker rating, Circuit constants and circuit conditions Restriking voltage transient Characteristics of restriking voltage, Interaction between the breaker and circuit, Current chopping, The duties of switchgear.</p>
3.	<p><b>Theory and Practice of Conventional Circuit Breakers:</b></p> <p>Automatic switch, Air-break circuit breakers, Oil circuit breakers, Single and multi break construction, Air-blast circuit breaker, Performance of circuit breakers and system requirements, Modification of circuit breaker duty by shunt resistors, Power factor correction by series resistance, Comparative merits of different types of conventional circuit breakers.</p>
4.	<p><b>Recent Developments in Circuit Breakers:</b></p> <p>Modern trends, Vacuum circuit breakers, Sulphur hexafluoride (SF6) circuit breakers D.C. circuit breaker.</p>
5.	<p><b>Testing of Circuit Breakers:</b></p> <p>Introduction, Classification, Description of a simple testing station, Equipments used in the station, Testing <b>procedure</b>, Direct testing, Test report, Indirect testing.</p>

Reference Books:

1. Power System Protection and Switchgear by B Ravindranath and M Chander, New Age International.
2. Switchgear and Protection: Sunil S Rao, Khanna Publishers.
3. Power System Protection and Switchgear by Bhuvanesh Oza, Nirmal Nair, Rashesh Mehta and Vijay Makwana, Tata McGraw Hill .
4. High Voltage Circuit Breakers: Design and Applications by Ruben D. Garzon, CRC Press.



## Simulation Lab-I

The simulations/experiments are to be done on a computer to give exposure of available tool/software to students. The teacher should help students to perform as many simulations as possible. The programming exercises preferably should be done using C or C++.

Suggested but not limited to, list of simulations/experiments, is given below:

1. Solution of set of linear equations using one or two suitable numerical methods (like Gaussian Elimination).
2. Solution of ordinary differential equation using Euler's method. The simulation should show the effect of variation in time step on the performance of the methods. The solution of set of ODE should also be done with the same method using matrix notations.
3. Same as above with modified Euler's method. (Some other method like Runge-Kutta or trapezoidal can also be demonstrated).
4. Solution of a single nonlinear equation and a set of non linear algebraic equation using G-S method.
5. Solution of a single nonlinear equation and a set of non linear algebraic equation using N-R method.
6. Computation of leakage inductance of a transformer using FEM analysis.
7. Computation of force on a plunger exerted by electromagnet using FEM analysis.