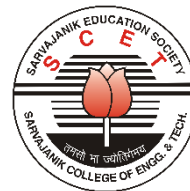




**SARVAJANIK UNIVERSITY**  
**Sarvajani College of Engineering and Technology**  
**Bachelor of Technology**



**B.Tech. Semester V**

**Subject Name: Electrical Machines**

**Subject Code: BTEL15501**

**Type of course: OEC**

**Prerequisite: Basic Electrical Eng.**

**Rationale:** Electrical machines are the prime movers of the industry. All the multi-disciplinary projects require the use of electrical motors at some or the other level. This course aims at providing the basic knowledge of electrical machines, types and their applications.

**Teaching and Examination Scheme:**

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	3	60	25	15	30	20	

**CA1:** Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

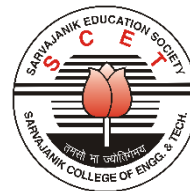
**Content:**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	<p><b>DIRECT CURRENT MACHINES</b>            Working principle, construction, Armature Winding:            Introduction of simplex lap and wave windings.  <b>DC generators:</b> EMF equation, methods of excitation- separately and self-excited – shunt, series, compound - armature reaction, effects of armature reaction - demagnetizing &amp; cross magnetizing ampere-turns, compensating windings, inter poles, commutation, methods to improve commutation - voltage build-up, no load characteristics, load characteristics, losses and efficiency, power flow diagram, parallel operation, applications of DC generators.  <b>D.C. Motors:</b> Principle of operation, back EMF, classification, torque equation, losses and efficiency, power flow diagram, performance characteristics of shunt, series and compound motors, starting of DC motors, necessity and types of starters, design of starters, speed control – methods of speed control, application of DC motor.</p>	12	26%
2.	<p><b>TRANSFORMERS:</b>  <b>Single Phase Transformer:</b></p>	10	23%

**OEC: Open Elective Course**



**SARVAJANIK UNIVERSITY**  
**Sarvajanic College of Engineering and Technology**  
**Bachelor of Technology**



	Working principle, Construction, types, EMF equation, Transformer losses, effect of load, magnetic and resistive leakage, equivalent circuit, regulation of transformer, transformer efficiency, Auto transformer. <b>Three Phase Transformer:</b> Construction, 3-phase transformer connections, Parallel operation of single phase and three phase transformers. Instrument transformers, Current transformers, Potential transformers		
3.	<b>INDUCTION MACHINES:</b> Construction, Types of motor, Working principle, Rotating magnetic field. Operating parameters at different load, No-load & blocked rotor test, Equivalent circuit, Phasor diagram, Torque production; Slip; Speed control of Polyphase induction motors, Starting methods for polyphase induction motors; Induction generator, Cogging and crawling;	9	20%
4.	<b>SYNCHRONOUS MACHINES:</b> Constructional features of synchronous machines; Elementary synchronous machine; Equivalent circuit of a synchronous machine, Voltage regulation; Power – angle and other performance characteristics; Effect of Saliency; <b>synchronous generators;</b> Steady – state stability; Excitation systems; Hunting and damper winding; Applications	8	18%
5.	<b>SPECIAL MACHINES:</b> Construction and working principle of Stepper Motor, Universal Motor, shaded-pole Motor, Repulsion motor, Permanent magnet brushless DC motor.	6	13 %

**Suggested Specification table with Marks (Theory/Practical):**

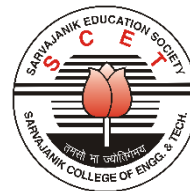
% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	30	20	10	10	00

**Legends:** R: Remembrance, U: Understanding; A: Application, N: Analyze, E: Evaluate C: Create and above Levels (**Revised Bloom’s Taxonomy**)

**Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



**SARVAJANIK UNIVERSITY**  
**Sarvajani College of Engineering and Technology**  
**Bachelor of Technology**



**Reference Text Books:**

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Electric Machines	I J Nagrath and Kothari	McGraw Hill Education	2010	
2	Theory and Performance of Electrical Machines	J B Gupta	Katson Publication	2009	
3	Electrical Technology – Part II	B L Theraja	S Chand Publications	2011	
4	Electrical Machinery	P. S. Bimbhra	Khanna Publishers	2011	
5	Performance and design of AC machines	M. G. Say	CBS Publishers	2002	
6	Electric Machinery	E. Fitzgerald and C. Kingsley	New York, McGraw Hill Education	2013	
7	Performance and design of DC machines	A E Clayton and N. N. Hancock	CBS Publishers	2004	

**Course Outcome:**

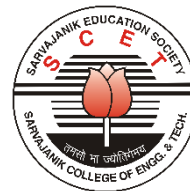
Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Describe working principle, performance, control and applications of DC Machines, Transformer, Induction Machine and Synchronous machine.	30
CO-2	Demonstrate, analyze and conduct various tests on DC Machines, Transformer and Induction Machine.	20
CO-3	Identify, formulate, analyze and solve DC Machines, Transformer, Induction Machine and Synchronous machine related problems.	20
CO-4	Describe working principle, performance and applications of Special Machines.	15
CO-5	Identify applications of various DC Machines, Transformer, Induction Machine and Synchronous machine.	15

**Mapping with Pos:**

**OEC: Open Elective Course**



**SARVAJANIK UNIVERSITY**  
**Sarvajani College of Engineering and Technology**  
**Bachelor of Technology**



	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	2	2	1	2	1	1	1	1	1	3	3	2			1
CO-2	3	2	1	3	1	1	1	1	3	3	3	2			1
CO-3	1	3	2	2	1	1	1	1	2	1	1	2	1	2	1
CO-4	1	1	1	1	1	1	1		1	1	1	1	1	1	1
CO-5	1	2	1	1	1	1	1	1	2	1	1	2		1	1

**LIST OF PRACTICALS:** (Minimum 10 to be performed)

1. To obtain Magnetizing Characteristics, Internal & External Characteristic of Self Excited DC Shunt Generator. Also obtain the critical field resistance of the machine from magnetizing Characteristics.
2. To obtain Speed-Torque characteristics of DC Series Motor and DC Shunt Motor.
3. To perform direct load test on a D.C. shunt motor and plot variation of (a) Input current (b) Speed(c) Torque (d) Efficiency versus output power.
4. Speed control of DC Shunt Motor using a) Armature control and b) field control methods. Also perform Swinburne's test on DC Shunt Motor.
5. To conduct open circuit and short circuit test on a single phase transformer and determine the equivalent circuit parameters.
6. To operate two single phase transformers of different KVA ratings in parallel and plot the variation of currents shared by each transformer versus load current.
7. Equivalent circuit and circle diagram of 3 – ph. Induction motor.
8. Speed control of 3-phase induction motor.
9. Zero power factor method.
10. Synchronous impedance method.
11. Measurement of  $x_d$  and  $x_q$ .
12. To study about the starters of 3-phase induction motor.

**Major Equipment:**

Ammeters, Voltmeters, Wattmeters, Multi-meters, DC Shunt Machines, DC Series Machines Single-phase and Three-Phase Transformers, 3- Phase Induction Charts for earthing and safety precautions

**List of Open Source/learning website:**

- Courses available through NPTEL. - Website: nptel.ac.in
- <http://www.scilab.org/>
- <http://www.gnu.org/software/octave/>
- <http://www.vlab.co.in>
- <http://www.femm.inf>

**OEC: Open Elective Course**



**SARVAJANIK UNIVERSITY**  
**Sarvajnik College of Engineering and Technology**  
**Bachelor of Technology**

