SEMESTER S3

DC MACHINES & TRANSFORMERS

Course Code	PCEET303	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Describe the constructional details, working and analyse the performance of DC machines and transformers under various load conditions.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Constructional details of dc machines - armature winding - lap and wave – simplex, progressive only – winding diagrams of simplex, lap wound, double layer, 12-slot, 4-pole, dc armature with 12 commutator segments – winding diagram of simplex wave wound, double layer, 16-slot, 6-pole, dc armature with 12 commutator segments (winding diagram not for evaluation) DC generator - principle of operation of DC generator – emf equation – numerical problems Classification DC generators – steady-state equations – numerical problems DC shunt generator - no-load characteristics – critical field resistance, critical speed, voltage build-up - load characteristics – numerical problems Armature reaction - cross magnetising & demagnetising effect (computation of ampere-turns not required) – compensating winding – interpoles – commutation (concept only) – numerical problems Power flow diagram – losses and efficiency – maximum efficiency - numerical problems Parallel operation of DC shunt generators – load sharing – numerical problems	12

2	DC motor – back emf – torque equation – numerical problems Classification of DC motors – steady-state equations – numerical problems Characteristics of DC motors – numerical problems Starting of DC motors – 3-point starter Braking – regenerative braking, dynamic braking and plugging (concepts only) Speed control of DC shunt and series motors – field control and armature control – numerical problems Power flow diagram – losses and efficiency – numerical problems Testing - Swinburne's test – Hopkinson's test – retardation test - separation of rotational losses - numerical problems	**12**
3	Single phase transformers – constructional details - principle of operation - EMF equation - ideal and practical transformer – numerical problems Operation on no load and on load - phasor diagram at different load conditions - equivalent circuit - voltage regulation – numerical problems Losses and efficiency - condition for maximum efficiency – numerical problems Testing of transformers - polarity test - OC test, SC test - Sumpner's test – separation of losses – numerical problems	**11**
4	Autotransformer – saving of copper – numerical problems 3- phase transformer – construction - different connections of 3-phase transformers - Y-Y, Δ-Δ, Y-Δ, Δ-Y – numerical problems Difference between power transformer and distribution transformer – all-day efficiency – numerical problems Scott connection for 3-phase to 2-phase conversion Vector groupings – Yy0, Dd0, Yd1, Yd11, Dy1, Dy11 Parallel operation of 1-phase and 3-phase transformers - essential and desirable conditions On load and off-load tap-changers	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe the constructional details of DC machines	**K2**
CO2	Analyse the performance DC generator under various load conditions	**K3**
CO3	Analyse the performance DC motor under various load conditions	**K3**
CO4	Analyse the performance of 1-phase transformer and auto-transformer under various load conditions.	**K3**
CO5	Describe the constructional details and operation of 3-phase transformers.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										3
CO2	3	3										3
CO3	3	3										3
CO4	3	3										3
CO5	3	2										3

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Electrical Machinery	P.S. Bimbhra	Khanna Publishers	7th edition 2021
2	Electric Machines	D P Kothari & I J Nagrath	Tata McGraw Hill	5th edition 2017
3	DC Machines & Transformers	K Murugesh Kumar	Vikas Publishing House	2nd edition 2004
4	Theory & Performance of Electrical Machines	J.B. Gupta	S K Kataria	15th edition 2022

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	NPTEL https://archive.nptel.ac.in/courses/108/105/108105155/