



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY.
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS

B.Tech. (Honours) in
ELECTRICAL AND ELECTRONICS ENGINEERING
2024 SCHEME
Semester VII



SEMESTER S7

OPERATION AND CONTROL OF GENERATORS

Course Code	24SJHNEET709	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Synchronous and Induction Machines, Power Systems II	Course Type	Honour

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Electric Generators: Types of electric generators- Synchronous generators- Permanent magnet synchronous generators, Homopolar synchronous generator. Induction generator, Wound rotor doubly fed Induction generator. Parametric Generators- flux reversal generators, Transverse flux reversal generators and linear motion alternators (Basic principle of working and construction). Generator applications- High power wind generators. Prime movers- Hydraulic turbines- Basics, ideal model, speed governors. Steam turbines- modelling and speed governors of steam turbine. Wind and gas turbines (basics only).	9
2	Excitation system- Brushless Excitation, Exciters- DC, AC and static exciters. Modelling of Exciters: - DC exciter, AC exciter and static exciter. Compensation of excitation systems- Instability problem of exciter, solution to the instability of exciter, need of the power system stabilizer (PSS). SG operation at Power Grid- Power/angle characteristics, V-curves, reactive power capability curves, Defining static and dynamic stability of SGs. SG: Modeling for Transients- d-q model, equivalent circuits. Mechanical transients- response to shaft torque input, forced oscillation. Small disturbance electro mechanical transients (basics only).	9
3	Control of Synchronous Generators: General control system, Speed Governing basics- SG with its own load, Isochronous speed governor, The primitive speed - droop governor, load sharing between two SGs with speed- droop speed governor with load reference control. Time response of speed governors. Automatic generation control- AGC control of one SG in a two SGs isolated power system, AGC as a multilevel control system	9

4	Reactive power and voltage control- Production and absorption of reactive power. Methods of voltage control: shunt reactors, shunt capacitors, series capacitors, synchronous condensers, static var systems. Automatic voltage regulation concept. Self-excited induction generators: cage rotor induction machine principle. Self-excitation - Steady state performance of three phase SEIGs, Unbalanced operation of three phase SEIGs	9
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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	Identify different types of electric generators and prime movers.	K2
CO2	Develop the model of synchronous generator and excitation system.	K3
CO3	Explain the basics of speed governor and AGC	K2
CO4	Analyse about Reactive power and voltage control.	K3

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
CO1	3	2	2	1							
CO2	3	3	2	1							
CO3	3	3	2	1							
CO4	3	3	2	1							
CO5	3	3	2	1							

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	Power System Stability and Control	P. Kundur, O.P. Malik	McGraw-Hill	2 nd Edition, 2025
2	Synchronous Generators	Ion Boldea	CRC Press	2 nd Edition, 2016
3	Variable Speed Generators	Ion Boldea	CRC Press	2 nd Edition, 2016
4	Generalized Theory of Electrical Machines	P. S. Bimbhra	Khanna Publishers	5 th Edition, 2002
5	Power System Analysis	Hadi Saadat	McGraw-Hill	3 rd Edition, 2010

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Synchronous Machines	C. Concordia	John Wiley & Sons	Reprint Edition
2	Elements of Power System Analysis	W. D. Stevenson Jr.	McGraw-Hill	4 th Edition, 1995
3	Electric Machinery	A. E. Fitzgerald, Charles Kingsley Jr., and Stephen D. Umans	McGraw-Hill	7 th Edition, 2013
4	Power System Stability, Volume III: Synchronous Machines	Edward Wilson Kimbark	Dover Publications / IEEE Press	Reprint Edition, 1995