GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA

ELECTRICAL ENGINEERING DEPARTMENT

Ref. No. EE/440 Dated 09/6/2022

Dean Academic

With the ref. to your letter number Ref. No. AS/79/1178 Dated 8.6.2022, the required information regarding scheme and syllabus for Minor Degree is as follows:

S. No	Course CODE	Course Name	Hours Per week			Internal Marks	External marks	Total	Credits
			L	T	P				
1	MnPCEE-101	Electrical Machines	2	0	0	40	60	100	2
2	MnPEEE-101	Renewable Energy Systems	3	0	0	40	60	100	3
3	MnLPCEE 101	Electrical Machines Laboratory	0	0	2	30	20	50	1

HOD (EE)

Exam Co-ordinator

NOTE: The above scheme is for 4th/6th/8th Semester.

Subject Code: MnPCEE-101
Subject Name: Electrical Machines

Programme: B.Tech (EE)	**L: 2 T: 0 P: 0**
Semester: even	**Teaching Hours:** 24
Theory/Practical: Theory	**Credits:** 2
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:60%**
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Basics of Electrical Engineering
Additional Material allowed in ESE: Scientific Calculator
On Completion ofthe course, the student will have the ability to:

CO #	Course Outcomes (CO)
1.	Understand construction and working principle of Transformers
2.	Understand construction and working principle of DC machines
3.	Understand construction and working principle of Three-phase Induction Motors
4.	Understand construction and working principle of Synchronous Machines
5.	Develop conditions for maximizing the performance of AC and DC machines
6.	Apply various methods for determining voltage regulation of synchronous generator

DETAILED CONTENTS

PART-A

TRANSFORMERS *(06 Hours)*

Working principle, Construction, types, EMF equation, Transformer on no load and on load, exact and approximate equivalent circuit, O.C & S.C.test on transformer, regulation of transformer, losses & efficiency, condition for maximum efficiency, All day efficiency, Efficiency curve, Sumpner's test, Auto transformer, Parallel operation and its conditions.

DC MACHINES *(06 Hours)*

DC Generator: Construction features, emf equation of dc generator, methods of excitation, losses condition for maximum efficiency.

DC Motor: Working principle, voltage equation, condition for maximum power, torque developed, starting and speed control.

PART-B

Three-Phase induction motor *(06 Hours)*

Construction, types, rotating magnetic field, principle of operation, slip, frequency of rotor current, rotor emf, rotor current, expression for torque, conditions for maximum torque, torque slip characteristics, starting torque, effect of change in supply voltage on torque, slip and speed, relation between full load torque and maximum torque, starting methods.

Synchronous Machines *(06 Hours)*

Alternator: Basic principle, construction, pitch factor, distribution factor, emf equation, alternator on load, voltage regulation, synchronous impedance method, mmf method, ZPF method, parallel operation, synchronization of alternator. Synchronous motor: Basic principle, methods of starting, application.

Text / References:

1. A. E. Fitzgerald and C. Kingsley, *"Electric Machinery"*, McGraw Hill Education, 2013.
2. M. G. Say, *"Performance and design of AC machines"*, CBS Publishers, 2002.
3. P. S. Bimbhra, *"Electrical Machinery"*, Khanna Publishers, 2011.

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4. I. J. Nagrath and D. P. Kothari, *"Electric Machines"*, McGraw Hill Education, 2010.
5. A. S. Langsdorf, *"Alternating current machines"*, McGraw Hill Education, 1984.

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Subject Code: MnPEEE-101
Subject Name: RENEWABLE ENERGY SYSTEMS

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 0
Semester: Even	**Teaching Hours:** 36L
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 20%
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hours
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

Additional Material Allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Analyze the global and national energy scenario as regards to energy crisis
2.	Analyze the available solar potential in India
3.	Understand the basic physics of wind power generation
4.	Evaluate the application of fuel cell in diverse fields
5.	Evaluate the application of bio mass energy system in future development
6.	Evaluate the energy harnessing from biomass, wind, geothermal, tidal and other non conventional sources of energy

Detailed Contents

Part-A

INTRODUCTION **(04L)**

Global and National energy scenarios, Limitation of conventional energy sources, need and growth of alternative energy source, Energy-Environment interaction, basic scheme and application of direct energy

SOLAR ENERGY **(06L)**

Solar energy in India, Solar radiation spectra, solar geometry, Earth Sun angles and observer Sun angles, solar day length, solar collectors, estimation of solar energy availability, Applications of solar energy, solar furnace, Diode equivalent circuit of PV cell , Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency.

WIND ENERGY **(08L)**

Wind systems in India, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions, Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Wind Energy Conversion systems.

Part-B

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FUEL CELL **(06L)**

Principle of Operation of Fuel Cell, Gibb's free energy, general description of fuel cells types, construction, operational characteristics and applications.

BIO MASS ENERGY **(06L)**

Availability of bio-mass and its Conversion Theory, Harvesting of biomass (coppicing, pollarding, lopping, pruning, thinning), Biomass conversion technologies (thermochemical, biochemical and agrochemical) technology, briquetting, biomass gasification technology.

MISCELLANEOUS SOURCES **(06L)**

Geothermal system, hydro-electric plants, Tidal energy, Biodiesel, Thermo-electric and MHD generator

Text /References Books:

1. B. R. Gupta, Generation of Electrical Energy, S. Chand.
2. G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, 2005.
3. S. Rao, and B.B. Parulekar, Energy Technology: Non-Conventional, Renewable and Conventional, Khanna Publishers, 2005.
4. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
5. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
6. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
7. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.
8. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
9. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.

Online Course:

https://nptel.ac.in/courses/121/106/121106014/ - 21 August 2020

https://nptel.ac.in/courses/108/108/108108078/ - 21 August 2020

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Subject Code: MnLPCEE-101
Subject Name: *Electrical Machines Laboratory*

Programme: B.Tech (EE)	**L: 0 T: 0 P: 2**
Semester: even	**Teaching Hours**: 24
Theory/Practical: Theory	**Credits:**1
Internal marks: 30	**Percentage of Numerical/Design/ Programming Problems:** 100%
External Marks:20	**Duration of End Semester exam (ESE):** 1.5hr
Total marks:50	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

On Completion of the course, the student will have the ability to:

CO #	Course Outcomes (CO)
1.	Construct equivalent circuits for single phase transformer by performing open and short circuit tests
2.	Comprehend the requirement of starting and speed control methods of induction motors in the various applications of industry
3.	Determine voltage regulation of synchronous generator
4.	Construct equivalent circuits for induction motor by performing no-load and block rotor tests
5.	Construct characteristic curves of DC machines
6.	Perform parallel operation of single-phase transformers

Sr. No.	Name of Practical
1	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.
2	To perform Open Circuit and Short circuit Test on a transformer and find its efficient and regulation.
3	Speed control of DC Shunt Motor using a) Armature control and b) field control methods.
4	To obtain Magnetizing Characteristics, Internal & External Characteristic of Self Excited DC Shunt Generator. Also obtain the critical filed resistance of the machine from magnetizing Characteristics.
5	To obtain Speed-Torque characteristics of DC Series Motor.
6	To obtain Speed-Torque characteristics of DC Shunt Motor.
7	To study different starters of D. C. motor.
8	To study different starters of three phase induction motor.
9	To perform No load and Block rotor test on induction motor and plot equivalent circuit.
10	To Study the effect of Inserting resistance on rotor of Slip ring induction motor.
11	To draw the V curves for synchronous machine.
12	To find the voltage regulation of synchronous machine.
13	To study capacitor start and capacitor run induction motor.

Reference Material
Manual Available in lab

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