Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road,Nagpur-441108
NAAC Accredited (A+ Grade)&NBA Accredited
An Autonomous Institute affiliated to RTMNU Nagpur

Third Year (Semester-V) B. Tech. Electrical Engineering

BEE33501:AC Machines

Teaching Scheme	
Lectures	3Hrs./week
Tutorial	0Hrs./week
Total Credit	3

Examination Scheme	
CT	30Marks
CA	10Marks
ESE	60Marks
Total	100Marks
Duration of ESE: 03 Hrs.00Min.	

Course Objective:

1	Understand the working principle of a three-phase induction motor.
2	Analyze the need for different starters and their applications.
3	Explain the Double Field Revolving Theory and its significance.

Course Contents		Hours
Unit I	**Three Phase Induction Motor**: Working Principle, Production of rotating magnetic field, synchronous speed, rotor speed and slip. Construction detail of 3 phase squirrel cage induction motor and slip ring induction motor. Rotor Quantities: Frequency, Induced EMF, power factor at starting and running condition. Characteristics of torque verses slip (speed), Torque: starting, full load and maximum with relation among them. Losses and efficiency.	(9)
Unit II	**Starting and Controlling of Induction Motor**: Starting of 3-phase IM (No numerical) 1) Direct On-Line starter 2) Stator resistance starter 3) Star-Delta starter 4) Auto transformer starter 5) Rotor resistance starter Speed control of three phase induction motor by a) Pole changing method b) Frequency control method c) By stator voltage control d) Rotor resistance control e) V/F methods. Applications of three phase induction Motor.	(9)
Unit III	**Single Phase Induction Motor**: - Principle and Operation, Double Field Revolving Theory. Principle and Working of Shaded Pole Induction Motor, Split Phase Induction Motor and Capacitor Start Capacitor Run Motor, Applications.	(9)
Unit IV	**Three Phase Synchronous Generator**-Introduction, Constructional features of Salient Pole and Cylindrical Pole Rotor Machines, Introduction to Armature Winding and Field Winding, Winding Factors and EMF Equation, Armature Reaction, Phasor Diagram Under Load Condition, Regulation and Synchronous Impedance Method to Find Voltage Regulation. **Three Phase Synchronous Motor**: - Construction and Principle, Starting of Synchronous, Motor, Motor on Load, Effect of Changing Field Excitation at Constant, Load, V and Inverted-V Curves. Applications.	(9)

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Unit V	**Fractional Horse Power motor (FHP)-** Construction and Working: Synchronous reluctance motor, Switched reluctance motor, BLDC, permanent magnet synchronous motor, stepper motor, AC and DC Servomotors. Application.	(9)

Text Books	
1	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2	P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3	B L Theraja, AK Theraja, "A Textbook of Electrical Technology In Si Units" Volume-II, 25th Edition (2024)
Reference Books	
1	I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5th Edition 2017.
2	P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2nd Edition 2010
3	J.B. Gupta, "Theory & Performance of Electrical Machines". 2013
Useful Links	
https://nptel.ac.in/courses/108102146	
https://archive.nptel.ac.in/courses/108/105/108105155/	

BEE33501	**Course Outcomes**	**CL**
BEE33501.1	**Distinguish** the various components of a three-phase induction motor.	**3**
BEE33501.2	**Analyze** methods for starting and controlling the speed of three-phase induction motors.	**4**
BEE33501.3	**Apply** the working principles of single-phase induction motors to industrial and domestic applications.	**3**
BEE33501.4	**Examine** the construction and operational principle of synchronous machines.	**4**
BEE33501.5	**Identify** appropriate fractional horsepower motors based on the requirements of specific applications.	**3**

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Third Year(Semester-V) B. Tech. Electrical Engineering

BEE33502: Control System Engineering

Teaching Scheme	
Lectures	3Hrs./week
Tutorial	0Hrs./week
Total Credit	3

Examination Scheme	
CT	30Marks
CA	10Marks
ESE	60Marks
Total	100Marks
Duration of ESE:03 Hrs.00Min.	

Course Objective:

1	To study modeling and transfer function of linear and time-invariant control system
2	To study Stability, Time domain and Frequency domain Specifications
3	Introduction to state space approach and understand theory of state transition matrix

Course Contents		Hours
Unit I	**Introduction to need for automation and automatic control:** Need of Control System Open loop, Closed Loop Control system. Mathematical modeling (Electrical & Electromechanical) differential Equation, Transfer functions, Block diagram, Signal flow graph.	(9)
Unit II	**Time Response Analysis:** Time response of system, standard inputs, first order and second order system, concept of gain and time constant. Steady state error, type of control system, approximate methods for higher order system, PD, PI, PID controllers	(9)
Unit III	**Stability of Control System:** Stability of control systems, condition of stability, characteristics equation, Routh Hurwitz criterion, special cases for determining relative stability. Root location and its effect on time response, elementary idea of root locus, effect of addition of pole and zero on proximity of imaginary axis.	(9)
Unit IV	**Frequency Response Analysis:** Frequency response method of analyzing linear system, Bode plot, stability and accuracy analysis from frequency response, open loop and close loop frequency response, effect of variation of gain and addition of pole and zero on response plot, stability margin in frequency response.	(9)
Unit V	**State Space Analysis:** State variable methods of analysis, characteristics of system state. Choice of state variables, representation of vector matrix differential equation, standard form, relation between transfer function and state variables	(9)

Text Books

1	Modern Control System Engineering by K Ogatta, Publisher Prentice Hall, India. 5th edition, 2010
2	Control System Analysis by Nargrath / Gopal, Publisher New Age International, 6th edition, 2017
3	Control System Engineering by S K Bhattacharya Publisher, Pearson, 3th edition, 2013

Reference Books

1	Control System Principle and Design by M Gopal Publisher, TMH (Tata McGraw Hill), 4th edition, 2012

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2	Control System Engineering by Samarjit Ghosh Publisher, Pearson, 2nd edition, 2012
3	Linear System Design by D Azzouand Houpis, Publisher, Pearson, 5th edition, 2003

Useful Links

https://archive.nptel.ac.in/courses/107/106/107106081/

https://archive.nptel.ac.in/courses/108/106/108106098/

https://www.youtube.com/playlist?list=PLxn52v8fxX5l5tGzU1NAxRDkgqxK0k5UZ

BEE33502	Course Outcomes	CL
BEE33502.1	**Compute** the Feedback in control system Block diagram representation of closed loop control system.	3
BEE33502.2	**Examine** the system response and stability in time-domain specifications	3
BEE33502.3	**Analyze** the techniques like Root locus, Routh Hurwitz criterion and check the stability of the systems.	4
BEE33502.4	**Differentiate** the Polar, Nyquist & Bode Plots in frequency response analysis of control system.	4
BEE33502.5	**Obtain** models of dynamic systems in transfer function and state space forms.	3

Ghuttke..
Ratik Ghuttke

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Third Year (Semester-V) B. Tech. Electrical Engineering

BEE33503: Power Electronics and Drives

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT	30 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Objectives:

1	To introduce students the basic theory of power semiconductor devices andtheir practical application in power electronics.
2	To familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications.
3	To provide the basis for further studyof power electronics Drives.

Course Contents		Hours
Unit I	**Power Semi-Conductor Devices:** Study of SCR, TRIAC, GTO, BJT, MOSFET and IGBT. Static characteristics: SCR, MOSFET and IGBT, Triggering and commutation circuit for SCR	(9)
Unit II	**Phase Controlled Rectifiers:** Phase controlled techniques: introduction to phase angle control, Single phase half wave-controlled rectifiers. Single phase half controlled and full controlled bridge rectifiers. **Chopper** : Buck, Boost, Buck- Boost regulator, Cuk Converter.	(9)
Unit III	**Inverters:** Single phase Voltage Source Inverter (VSI) and Current Source Inverter (CSI), three phase VSI and CSI – 120^0 and 180^0 modes of operation. **AC voltage controllers:** Single phase and three phase voltage regulators R and RL load – range of control, Single phase cyclo-converters, its types and operating principle.	(9)
Unit IV	**DC Drives:** Phase controlled DC-Drives: Operation with continuous and discontinuous modes, Supply Harmonics, Power Factor and Ripple in motor current; Chopper Controlled DC Drives, Sources current harmonics in chopper, Converter Ratings and closed loop control scheme.	(9)
Unit V	**AC DRIVES**: Induction Motor Drives: Speed control techniques: Stator voltage control, Variable frequency control, Open loop V/f control, Static rotor resistance control and Slip power recovery control schemes, Slip compensation technique.	(9)

Text Books

1	Mohammad H Rashid, "Power Electronics: Circuits Devices and Applications" Pearson 4th edition 2017
2	P.S. Bimbhra, "Power Electronics", Khanna Publishers, 7th Edition, 2022
3	Ned Mohan "Power Electronics: Converters, and Applications Design, Wiley 3rdedition 2014

Reference Books	
1	M Singh, K Khanchandani "Power Electronics"|2nd Edition, 2017
2	Bimal K. Bose, "Power Electronics and Motor Drives: Advances and Trends" 2nd Edition, 2020
3	Bogdan M. Wilamowski, J. David Irwin "Power Electronics and Motor Drives" 1st Edition, 2017
Useful Links	
1	https://nptel.ac.in/courses/117/106/117106034/
2	https://nptel.ac.in/courses/108108076/
3	https://nptel.ac.in/courses/108105062/

BEE33503	Course Outcomes	CL
BEE33503.1	**Analyze** the static characteristics of SCR, MOSFET, and IGBT to evaluate their suitability in triggering and commutation circuits.	**4**
BEE33503.2	**Apply** phase control techniques to analyze the operation of single-phase half-wave, half-controlled, and fully controlled rectifiers.	**3**
BEE33503.3	**Distinguish** the operation of AC-to-AC single phase and three phase Cyclo-converters.	**4**
BEE33503.4	**Classify** the DC motors drives based on control technique.	**4**
BEE33503.5	**Choose** control techniques for Speed control of AC drives.	**3**

Kunal Sawalakhe

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Third Year (Semester-V) B. Tech. Electrical Engineering

Open Electives –III BEE33504: Energy Audit

Teaching Scheme	
Lectures	2 Hrs/week
Tutorial	0 Hrs/week
Total Credit	2

Examination Scheme	
CT	15
CA	5
ESE	30
Total	50
Duration of ESE: 02 Hrs 00 Min.	

Course Objectives:

1	To give students principles and practices of energy audit and management in various industrial, Commercial, and residential settings.
2	To enable students, learn techniques for assessing energy consumption, identifying in efficiencies, and developing strategies for optimizing energy usage.
3	To gain the knowledge and skills necessary to conduct comprehensive energy audits and implement effective energy management plans.

Course Contents		Hours
Unit I	Basics of Energy Management and Conservation: - Global and Indian energy scenario. Global environmental concerns, Climate Change, Concept of energy management, energy demand and supply, economic analysis; Carbon Trading & Carbon foot prints. Energy Conservation: Basic concepts, Energy conservation in household, transportation, agricultural, service and industrial sectors; Lighting & HVAC systems in buildings.	(9)
Unit II	Energy Audit:- Definition, need, and types of energy audit; Energy management (audit) approach: Understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements; Fuel & energy substitution; Energy audit instruments; Energy Conservation Act; Duties and responsibilities of energy managers and auditors	(9)
Unit III	Energy Action Planning, Monitoring and Targeting: -Energy Action Planning: Key elements; Force field analysis; Energy policy purpose, perspective, contents, formulation, ratification; Organizing the management: location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability; Motivation of employees: Information system-designing barriers, strategies; Marketing and communicating: Training and planning. Monitoring and Targeting : Defining monitoring & targeting; Elements of monitoring & targeting; Data and information analysis; Techniques: energy consumption, production, cumulative sum of differences (CUSUM).	(9)

Text Books

1	Handbook on Energy Audits and Management Amit Kumar Tyagi TERI
2	Energy Management Handbook Wayne C. Turner Wiley Inter Science Publication

Reference Books	
1	Principles of Energy Conservation Archie, W Culp McGraw Hill, 1991
2	Energy Management P. O'Callaghan McGraw - Hill Book Company, 1993
3	Handbook of Energy Engineering Thuman A and Mehta D Paul The Fairmount Press
4	Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I to IV
5	Handbook of Energy Audit and Environment Management Y.P. Abbi, Shashank Jain TERI

BEE33504	Course Outcomes	CL
BEE33504.1	**Summarize** the present energy scenario and the need of energy conservation.	2
BEE33504.2	**Describe** the instruments required for performing energy audit and demonstrate targeted energy audits.	2
BEE33504.3	**Generalize** the concepts on energy monitoring and targeting, measure the savings using the CUSUM Technique	2

Radharam
(Dr. Radharaman Shahe)

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Third Year(Semester-V) B. Tech. Electrical Engineering

Program Electives I: BEE33505: Solar Energy Utilization

Teaching Scheme	
Lectures	4 Hrs./week
Tutorial	0 Hrs./week
Total Credit	4

Examination Scheme	
CT	60Marks
CA	40Marks
ESE	60Marks
Total	100Marks
Duration of ESE: 03 Hrs.00Min.	

Course Objective:

1	To gain the fundamental concepts of solar cells and technologies for its utilization.
2	To enable students, learn techniques for solar PV system design.
3	To gain the knowledge and skills necessary for installations of Grid Connected Solar PV System.

Course Contents		Hours
Unit I	**Solar Radiation:** Irradiance, Irradiance and Peak Sun Hours, Solar Radiation Data, Sun-path Diagram, Defining the position of the sun, solar altitude, geometric effects, tilting solar modules, magnetic north and true north	(10)
Unit II	**PV Cells:** Introduction, Characteristic of a Solar Cell, Power Characteristic of a solar cell, Fill Factor and Equivalent Solar Cell Circuit, STC and NOCT, Factors which affect the performance of solar cells, manufacture of solar cells, commercial modules, electrical protection, module reliability	(10)
Unit III	**Inverters:** Purpose of inverters, grid connected inverters vs. stand-alone inverters, types of grids connected inverters, PV to inverter interface, Inverter protection systems, Power Quality, Monitoring, Inverter Efficiency, matching PV array to voltage specifications, current ratings and power ratings of inverter. Calculations for matching array and inverter.	(10)
Unit IV	**Balance of System, Cable Sizing and Losses in Grid Connected PV System:** Determining Cable Size of the AC and DC Cables, Array String Protection and Disconnect Switches, Lightning Protection, Array Junction Box, PV Main Disconnection Devices, Metering, Losses in a Grid Connected PV System.	(10)
Unit V	**System Yield and Performance & Economics of Grid Connected Systems:** Energy Yield of a System, Calculating the Energy Yield for a PV grid Connected System, Specific Yield, Performance Ratio, Simple Payback, Determining Costs Associated with the Whole PV System, Valuing a PV System, Calculations of Levelized Tariff from a Solar PV System.	(10)

Text Books

1	Grid Connected PV Systems Design and Installation, Global Sustainable Energy Solutions Pty. Ltd, GSES India Sustainable Energy Private Ltd, First Edition 2018.
2	Solar Photovoltaics - Fundamentals, Technologies and Applications, Chetan Singh Solanki, PHI Publishers, 3rd, Edition 2015
3	Solar Energy, S.P. Sukhatme, 4th Edition, Tata McGraw Hill, 2017
4	Solar Energy Utilization, G.D. Rai, 5nd Edition, Khanna Publishers, 2025

Reference Books	
1	Solar Farms: The Earthscan Expert Guide to Design and Construction of Utility-scale Photovoltaic Systems, Christopher Martell, Routledge Publishers. 2017
2	Solar Photovoltaic Power Optimization: Enhancing System Performance through Operations, Measurement, and Verification, Michael Ginsberg, Routledge. 2019
3	Solar Photovoltaic Power Systems: Principle, Design and Optimization, Dr. Sundaravadivelu, Tata Mc Graw hill, Second Edition. 2017

BEE33505	Course Outcomes	CL
BEE33505.1	**Analyze** Solar Radiation data and measurements using solar radiation geometry.	4
BEE33505.2	**Classify** the PV Module Technology on the basis of electrical parameters.	4
BEE33505.3	**Determine** the optimized array output matching with inverter voltage, current and power rating specifications.	5
BEE33505.4	**Analyze** the sizing and selection of AC and DC cables, protection devices, and balance of system components to minimize losses and ensure safety in grid-connected photovoltaic systems.	4
BEE33505.5	**Calculate** the energy yield of the Grid Connected Solar PV System and performance ratio, economics of the system.	3

Dr. P. V. Thakre

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Third Year (Semester-V) B. Tech. Electrical Engineering

Program Electives I : BEE33506: Utilization of Electrical Energy

Teaching Scheme	
Lectures	4 Hrs./week
Tutorial	0 Hrs./week
Total Credit	4

Examination Scheme	
CT	60Marks
CA	40Marks
ESE	60Marks
Total	100Marks
Duration of ESE: 03 Hrs.00Min.	

Course Objective:

1	To impart fundamental knowledge about various electrical heating, welding, and illumination systems used in industrial, commercial, and domestic applications.
2	To enable students to analyze and design effective lighting schemes for various environments, ensuring optimal illumination and energy efficiency.
3	To develop an understanding of different electric traction systems, including their operation, control, and performance characteristics.

	Course Contents	Hours
Unit I	**Electric Heating and Welding:** I) Electric Heating: Types and methods of electrical heating, advantages of electrically produced heat, types & application of electric heating equipment II) Importance, Advantages & Disadvantages of welding, classification of welding processes, Resistance welding, Electric arc welding, Ultrasonic welding, electron beam welding, laser beam welding.	(10)
Unit II	**Illumination and Lighting Systems:** Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, basics of CFL, LED & Plasma, Lux level requirements for various applications, classification of light fittings and luminaries, factors affecting the design of indoor lighting installations, total lumen method of calculation, Lighting design for indoor applications, Outdoor lighting system design for street lighting and flood lighting.	(10)
Unit III	**Refrigeration & Air conditioning**: Terminology, refrigeration cycle, refrigeration systems (Vapor compression, vapor absorption), domestic refrigerator, drinking water cooler, desert air cooler. Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and Central air conditioning.	(10)
Unit IV	**Electric Traction:** Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipment (collector gear for overhead equipments, conductor-rail equipment) Speed-Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve	(10)
Unit V	**Fans & Pumps: Fans and Blowers:** Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportunities. Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance,	(10)

	efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system. Compressors and **DG Sets:** Compressors: Compressor types, Compressor efficiency, Compressed air system components. Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets.	

Text Books	
1	J. B. Gupta, "Utilization of Electric Power & Electric Traction", Kataria & Sons,1st Edition,2013
2	H. Partap, "Art and Science of Utilization of Electrical Energy", Dhanpat Rai & Sons, Delhi, 2014
3	Dr N. V. Suryanarayana, "Utilization of Electrical Power", Wiley Eastern Ltd, New Age International Publisher,2nd Edition, 2017.
Reference Books	
1	E.OpenshawTaylor,"UtilizationofElectricEnergy",TheOrientBlackswan Publisher.
2	Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency.

Useful Links

https://www.youtube.com/watch?v=PW44aMos2YA

NPTEL::Electrical Engineering –Illumination Engineering

https://www.youtube.com/watch?v=cvQ5tss5sfA

BEE33506	**Course Outcomes**	**CL**
BEE33506.1	**Apply** the process of Electric Heating and Welding equipment.	**3**
BEE33506.2	**Calculate** illumination parameters for specific conditions by using illumination methods.	**3**
BEE33506.3	**Classify** the Refrigeration & Air conditioning with applications.	**4**
BEE33506.4	**Analyze** Electric Traction system with its power supply structure.	**4**
BEE33506.5	**Select** proper rating of DG sets, know the operational factor.	**3**

Prof. Prafull Ghadge

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Third Year (Semester-V) B. Tech. Electrical Engineering

Program Electives I : BEE33507: High Voltage Engineering

Teaching Scheme	
Lectures	4 Hrs./week
Tutorial	0 Hrs./week
Total Credit	4

Examination Scheme	
CT	60Marks
CA	40Marks
ESE	60Marks
Total	100Marks
Duration of ESE: 03 Hrs.00Min.	

Course Objective:

1	To impart fundamental knowledge about various electrical heating, welding, and illumination systems used in industrial, commercial, and domestic applications.
2	To enable students to analyze and design effective lighting schemes for various environments, ensuring optimal illumination and energy efficiency.
3	To develop an understanding of different electric traction systems, including their operation, control, and performance characteristics.

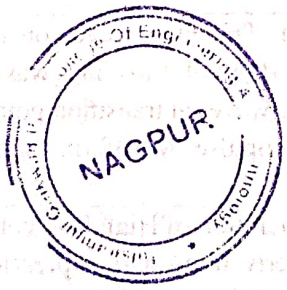
Course Contents		Hours
Unit I	Breakdown mechanism in Di-electric: Ionization process; Townsend's criterion for B.D. Break down in electro-negative gases, Time-lag for B.D.; Streamer theory for B.D in gases, Paschen's law; B.D in non-uniform field. Corona discharges and introduction of corona post B.D. phenomenon and applications, Practical considerations in using gases for insulation purpose; vacuum insulation, Liquid as insulators, conduction and B.D. inpure and commercial liquids. Intrinsic, electromechanical &thermal B.D., B.D. of solid di-electrics in practice; B.D.in composite dielectrics.	(10)
Unit II	Lighting and switching over voltages: Mechanism of lightening, types of strokes, parameter and characteristics of lightening strokes, characteristics of switching surges; power frequency over voltages. Control of O.V. due to switching. Protection of lines by ground wires, protection by lightning Arrester, gap type and sapless L.A., selection of L.A. ratings, surge-absorbers.	(10)
Unit III	Traveling waves and Insulation coordination: Traveling waves on transmission lines, Classification of lines attenuation and distortion of traveling waves, reflection and transmission of waves, behavior of rectangular waves at transition points. Introduction to insulation coordination, associated terms, impulse waveform. introduction to BIL Reduced BIL and SIL.	(10)
Unit IV	Generation of high voltage and. Currents: Generation of High D.C voltages by rectifiers, voltage doubler and multiplier, circuits (Derivations and expression 'not required), electrostatic machines, Generation of high AC voltages by Cascade transformers, Resonant transformers, generation high frequency AC high voltage. Generation of impulse voltages: Standard impulse wave shapes, analyses of model and commercial impulse generation circuits, wave shape control Marx circuit, tripping and control of impulse generation, generation of switching surges generation of impulse current.	(10)
Unit V	Measurement of high voltage and current: Measurement of high AC and DC voltage by micro ammeter, generating voltmeter resistance and capacitance potential divider, series impedance voltmeter CVT, Magnetic type potential transformers, electrostatic voltmeter. Peak reading AC voltmeter. Sphere gap arrangement. Measurement of impulse voltage	(10)

	by 'potential dividers and peak reading voltmeters. Measurement of High AC DC current; measurement of high frequency and impulse current by resistive shunt (Bifilar strip shunt only,)	

Text Books	
1	M. S. Naidu &V. Kamaraju, "High Voltage Engineering",TMG,5th edition ,2017.
2	C.L Wadhwa," "High voltage Engineering" New Age international, 3rd Edition,2012.
3	R D Begamudre, "EHV AC Transmission", new age international publisher 4th Edition, 2018.
Reference Books	
1	A Haddat and D. Warne, "Advances in high Voltage Engineering" ", Institution of Engineering &Technology publications,2004.
Useful Links	
https://nptel.ac.in/courses/108104013	
https://archive.nptel.ac.in/courses/108/108/108108099/	

BEE33506	**Course Outcomes**	**CL**
BEE33506.1	**Analyze** Breakdown mechanism in Solid, Liquid & Gases medium.	**3**
BEE33506.2	**Classify** lighting & switching over voltages.	**4**
BEE33506.3	**Analyze** the behavior of traveling waves on transmission lines.	**4**
BEE33506.4	**Distinguish** methods of measurement of High voltages and Currents.	**4**
BEE33506.5	**Apply** appropriate methods and instruments for measuring high AC/DC voltages and currents	**3**

Ashvini Adhaone.



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Third Year (Semester-V) B. Tech. Electrical Engineering

BEE33508:AC Machines Lab

Teaching Scheme	
Lectures	2Hrs./week
Total Credit	1

Examination Scheme	
CA	25 Marks
ESE	25 Marks
Total	50 Marks
Duration of ESE: 02 Hrs.00 Min.	

Sr. No	List of Experiment	CO
1.	Find Efficiency of Induction Motor Using Blocked Rotor Test and Load Test	CO1
2.	Test Different Starting Methods of Induction Motor	CO1
3.	Study Torque and Speed of Single-Phase Induction Motor	CO2
4.	Speed control of 3 phase Slip ring Induction motor by Rotor resistance Control	CO2
5.	Examine the Equivalent circuit of single phase induction motor	CO3
6.	Control Speed of Induction Motor by Adding Rotor Resistance	CO3
7.	Demonstrate synchronization test on two Alternator	CO4
8.	Study Torque and Speed of Single-Phase Induction Motor	CO4
9.	Demonstrate synchronization test on two Alternator	CO5
10.	Synchronization of Alternators and Real-Time Load Sharing Analysis Using Digital Tools	CO5

Text Books

1	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education,2013
2	A. E. Clayton andN. N. Hancock, "Performance and design of DC machines", CBS Publishers, a 2014.
3	M. G. Say, 'Performance and design of AC machines", CBS Publishers, 2012.

Reference Books

1	P. S. Bimbhra, "Electrical Machinery", Khanna Publishers,2011.
2	I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2017

Useful Links

1. https://nptcl.ac. in/courses/ I I 7/ I 06/ I I 7 I 06034/
2. https://nptel.ac. inlcourses/ I 08 I 08076/

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	Course Outcomes	CL
BEE33508.1	**Calculate** the Efficiency of Induction Motor by using blocked test and load test.	3
BEE33508.2	**Analyze** starting methods and speed control methods of AC Machine	4
BEE33508.3	**Measure** Internal Parameters of Single-Phase Induction Motor	5
BEE33508.4	**Utilize** Synchronization test of Alternator and check the performance by using Digital Simulation	3
BEE33508.5	**Conduct** Synchronization of Alternators and Evaluate Load Sharing and Stability Using Real-Time Digital Tools.	3

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Nagpur

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Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road,Nagpur-441108
NAAC Accredited(A+ Grade)
An Autonomous Institute affiliated to RTMNU Nagpur

Third Year (Semester-V) B. Tech. Electrical Engineering

BEE33509:Power Electronics and Drives Lab

Teaching Scheme	
Practical	2Hrs/week
Total Credit	1

Examination Scheme	
CA	25 Marks
ESE	25 Marks
Total	50 Marks
Duration of ESE:3Hrs 00Mins	

Sr.No.	List of Experiment	CO
1	Determine the characteristics of SCR and study the operation of Single Phase Single Pulse Convertr using SCR.	CO1
2	Determine the characteristics of TRIAC.	CO1
3	Construct a single-phase half-controlled Converter and plot its output response.	CO2
4	Analyze and plot the wave forms of the Parallel Inverter.	CO3
5	Speed control of separately excited dc motor by varying armature voltage using single phase Fully Controlled Converter	CO4
6	Speed Control of separately excited DC motor using Half Controlled Converter.	CO4
7	Speed control of three-phase induction motor using V/f control	CO5
8	Speed Control of three-phase Slip Ring Induction Motor using Static Rotor Resistance control using Rectifier and Chopper.	CO5
9	Modeling and simulation of Buck-Boost converter using MATLAB	CO2
10	Modeling and simulation of Single Phase H-Bridge inverter using MATLAB	CO3

Text Books

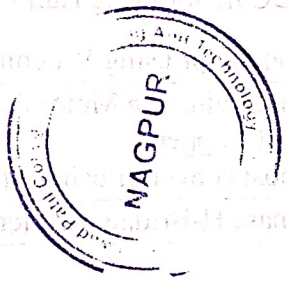
1	Mohammad H Rashid, " Power Electronics: Circuits Devices and Applications", Pearson 4th Edition,2014
2	P. S. Bimbhra, "Power Electronics", Khanna Publishers,5thEdition,2012
3	Ned Mohanetal,"Power Electronics: Converters, Applications and Design"Wiley3rd Edition, 2014

Reference Books

1	Daniel W Hart, "Power Electronics",McGrawHill1stEdition, 2011
2	Joseph Vithayathil, "Power Electronics-Principles and Applications ,"Mc Graw Hill Inc., New York,1995.
3	Vedam Subramanian, "Power Electronics", New Age International(P) Limited, New Delhi, 1996.

EE33509	Course Outcomes:	CL
EE33509.1	**Determine** the characteristics of SCR and demonstrate the triggering circuit.	5
EE33509.2	**Estimate** voltage, current, and power parameters for rectifiers	5
EE33509.3	**Apply** the modulation techniques to pulse width modulated inverters and converter.	3
EE33509.4	**Utilize** Speed control of DC Motor Drive	3
EE33509.5	**Apply** Speed control techniques to AC Motor Drive	3

K.N. Sawalakhe



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Third Year (Semester-V) B. Tech. Electrical Engineering

BEC33510: Digital Electronics and Microcontroller

Teaching Scheme	
Lectures	3Hrs./week
Tutorial	0Hrs./week
Total Credit	3

Examination Scheme	
CT	30Marks
CA	10Marks
ESE	60Marks
Total	100Marks
Duration of ESE:03 Hrs.00Min.	

Course Objective:

1	To understand and analyze the working principles of various combinational circuits and their applications in different digital systems.
2	To analyze and recognize various sequential components utilized in the design of combinational circuits.
3	To develop the skills to design and validate the operation of various combinational and sequential circuits.
4	To provide knowledge on the 8051 microcontrollers, covering its architecture, functionalities, addressing modes, port types, and practical applications.
5	To explore the use of Assembly language programming for the 8051 microcontrollers, emphasizing its timing, control, and counter/timer features in industrial embedded systems.

Course Contents		Hours
Unit I	**Logic Simplification:** Number system, Binary Arithmetic, Boolean algebra and De Morgan's Theorem, Logic Gates, SOP & POS forms, Logic Optimization Technique, Karnaugh maps.	(9)
Unit II	**Combinational logic Design:** Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design.	(9)
Unit III	**Sequential Logic Design**: Latches, Flip flop – S-R, J-K, D, T and Master-Slave JK FF, Counters, Shift registers.	(9)
Unit IV	**Microcontroller Introduction:** Architecture of Microcontroller 8051, Features of 8051, Applications of 8051, Pin diagram and Description of IC-80851, Addressing Mode, Types of Ports,TEMPI,TEMP2, ALU, PROGRAM- COUNTER, PSEN,DPTR,PSW, REGISTER BANK, SFR'S	(9)
Unit V	**Interrupts & Programming:** Interrupt of 8051, Timing and Control Panel, 8051 Counter and Timer, TMOD, TCON, PCON Instruction Set of 8051, Assembly Language Programming, Introduction to Arm-7 (Embedded System)	(9)

Text Books

1	Fundamentals of Digital Circuits, A. Kumar, Prentice Hall India, 2016.
2	Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2019.
3	Ramesh Gaonkar, Fundamentals of Microcontroller and Applications in Embedded System, Thomson Delmar Learning. 2017

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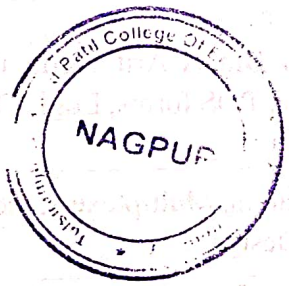
Reference Books	
1	Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016.
2	Digital Electronic Principles, By Malvino PHI, 3 Edition. 2014
3	Microcontrollers: Principles and Applications, Ajit Pal, PHI Learning Pvt. Ltd., 2011.
Useful Links	
https://onlinecourses.nptel.ac.in/noc21_ee10/preview	
https://onlinecourses.nptel.ac.in/noc20_ee42/preview	

BEC33510	Course Outcomes	CL
BEC33510.1	**Compare** the working of combinational circuits for specific applications.	**4**
BEC33510.2	**Identify** the sequential components used in combinational circuits.	**3**
BEC33510.3	**Design** combinational and sequential circuits and verify functionality.	**6**
BEC33510.4	**Analyze** Microcontroller 8051, it's Features, real time Applications, Addressing mode & Types of Ports.	**4**
BEC33510.5	**Develop** Assembly language program for 8051 Microcontroller, Timing and Control Panel of 8051, Counter and Timer panel, & it's Industrial use in embedded system application. (ARM-7)	**6**



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Third Year (Semester-V) B.Tech. Electrical Engineering

BEE33511:Digital Electronics and Microcontroller Lab

Teaching Scheme	
Practical	2Hrs./week
Total Credit	1

Examination Scheme	
CA	25 Marks
ESE	25 Marks
Total	50 Marks
Duration of ESE:3Hrs.00Mins	

Sr.No.	List of Experiment	CO
1	Verification of the truth tables of TTL gates.	CO1
2	Verify the NAND and NOR gates as universal logic gates.	CO1
3	Design and verification of the truth tables of Half and Full adder circuits.	CO2
4	Design and verification of the truth tables of Half and Full sub-tractor circuits.	CO2
5	Verification of the truth table of the Multiplexer 74150	CO2
6	Verification of the truth table of the De-Multiplexer 74154.	CO2
7	Design and test of an S-R flip-flop using NOR/NAND gates.	CO3
8	Verify the truth table of a J-K flip-flop (7476)	CO3
9	Verify the truth table of a D flip-flop (7474)	CO3
10	Write Assembly language program to add two hexadecimal and decimal number	CO4
11	Write the Assembly language program for square wave generator by using 8255	CO4
12	Write Assembly language program to addition of two 8- bit data using Keil software (Micro vision -5	CO5
13	Write Assembly language program to addition of two 8- bit data using Keil software (Micro vision -5	CO5

Text Books

1	Fundamentals of Digital Circuits, A. Kumar, Prentice Hall India, 2016.
2	Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009.
3	Ramesh Gaonkar, Fundamentals of Microcontroller and Applications in Embedded System, Thomson Delmar Learning. 2007

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2	Digital Electronic Principles, By Malvino PHI, 3 Edition. 2014
3	Microcontrollers: Principles and Applications, Ajit Pal, PHI Learning Pvt. Ltd., 2011.

BEC33511	Course Outcomes:	CL
BEC3511.1	**Compare** the working of combinational circuits for specific applications.	4
BEC3511.2	**Identify** the sequential components used in combinational circuits.	3
BEC3511.3	**Design** combinational and sequential circuits and verify functionality.	6
BEC3511.4	**Analyze** Microcontroller 8051, it's Features, real time Applications, Addressing mode & Types of Ports	4
BEC3511.5	**Develop** Assembly language program for 8051 Microcontroller, Timing and Control Panel of 8051, Counter and Timer panel, & it's Industrial use in embedded system application. (ARM-7)	6

Chairman

Dean Academics

Principal
Dr. Premanand Naktode
Principal
TGPCET, Nagpur

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