

TULSIRAMJI GAIKWAD-PATIL College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

An Autonomous Institute





DEPARTMENTOFELECTRICALENGINEERING

B. Tech. Electrical Engineering

Teaching Scheme

Considering

National Education Policy 2020

From

Academic Year 2024-25

Page 1 of 12



Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of Institute

- 1. To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.
- 2. To provide facilities and services to meet the challenges of Industry and Society.
- 3. To facilitate socially responsive research, innovation and entrepreneurship.
- 4. To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To emerge as a learning hub and center of excellence in the domain of Electrical Engineering.

Mission of the Department

- 1. To disseminate knowledge replete with quality education in the field of Electrical Engineering in meticulous and methodical manner.
- 2. To provide platform to address societal issues as well as challenges faced by industries.
- 3. To developer search culture and inculcate innovative and entrepreneurial skills.
- 4. To ensure overall development of students and staff by instilling knowledge and professional ethics as a part of lifelong learning.

Program Outcomes (PO)

- 1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of Complex Problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and software tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
- **8. Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
- 9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

PSO1: Formulate the solutions to Electrical and Electronics Engineering problems using the basic concepts.

PSO2: Develop the process to interpret networks parameters in power system operation and control with their protection and driving mechanisms.

PSO3: Apply project based learning to conduct experiments with Electrical Machines, Power Electronics to develop energy efficient system

Page 4 of 12

Program Education Objectives (PEO)

- 1. Demonstrate and analyze the fundamental knowledge with respect to the various domains of Electrical Engineering.
- 2. Investigate and apply modern tools to develop innovativeness in different applications of Electrical Engineering domain.
- 3. Integrate new emerging trends and concepts in Electrical Engineering profession for sustainable development.
- 4. Develop professionals having managerial and administrative Qualities for Electrical Engineering related industries.
- 5. Promote lifelong learning, to prepare for the next challenges in the field of Electrical Engineering.

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)
SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering (NBA Accredited)

Scheme of Instructions: Third Year B.Tech. in Electrical Engineering (As Per NEP 2020)

Semester-VI

SN	Sem	Туре	BoS/	Sub Code	是是"中国"的"	T/P	Cont	act H	ours	C1'4-	% Weightage		age	ESE	Total
	STATE:	THE RELEASE	Dept	Sub Code	Subject	1/P	L	P	Hrs	Credits	CT/IA	CA	ESE	Duration	Marks
1	VI	PCC	EE	BEE33601	Power System Analysis	T	3	-	3	3	30	10	60	3 Hrs	100
2	VI	PCC	EE	BEE33602	Switchgear &Protection	Т	3	-	3	3	30	10	60	3 Hrs	100
3	VI	VSEC	EE	BEE33603	I.ETAP 2.PV SYST	P	-	4	4	2	-	25	25	2 Hrs	50
4	VI	PEC	EE	BEE33604- 06	Program Elective-II	Т	4	-	4	4	30	10	60	3 Hrs	100
5	VI	PEC	EE	BEE33607- 09	Program Elective-III	Т	4	-	4	4	30	10	60	3 Hrs	100
6	VI	PCC	EE	BEE33610	Power System Analysis Lab	P	-	2	2	1	-	25	25	2 Hrs	50
7	VI	PCC	EE	BEE336011	Switchgear & Protection Lab	P	-	2	2	1	-	25	25	2 Hrs	50
8	VI	MDM	ME	BME33612	Introduction to Industry 4.0	Т	2	-	2	2	15	5	30	2 Hrs	50
	Total				16	8	24	20	135	120	345	20 Hrs	600		

Course Category	BSC/ESC(Basic Science Course/ Engineering Science Course.)	rcc	PEC (Programme Elective courses)	Multidisciplinary courses	SEC(Skill Course)	Humanities Social Science &Management	Experiential Learning Courses	CC (Liberal Learning Courses
Credits		08	08	02	02			
Cumulative Sum	16/13	39	12	18	08	14	02	04

PROGRESSIVE TOTAL CREDITS: 106+20 = 126

		<u> </u>				
fruthe.	pro-			June, 2024	1.00	Applicable for AY 2024-25
Chairperson	Dean Academics	Vice Principal	Principal	Date of Release	Version	Onwards



Wardha Road, Nagpur-441108



NAAC Accredited (A+ Grade) & NBA Accredited
An Autonomous Institute affiliated to RTMNU Nagpur

	•	An Autonomous Institute athliated to KTMINU Nagpur							
		Third Year	(Semester-VI) B. Tech. Electrical Engineering						
		BE	EE33601: Power System Analysis						
	Teach	ing Scheme	Examination Schem	e					
	Lectures	3 Hrs./week	CT 30Ma	ırks					
	Tutorial	0 Hrs./week		Marks Marks					
To	otal Cree	dit 3							
			Total 100M						
			Duration of ESE:03 Hrs.0	0Min.					
Cou	rse Obje								
1		the impact of faults on schemes according	(short circuits, open circuits, etc.) on the power system and des	sign ———					
2	Assess	the system's ability t	to maintain steady operation following disturbances such as fau						
3	Evaluate	e system performance u	under different operating conditions and ensure it meets reliability sta	ındards.					
			Course Contents	Hours					
			anning and operational, components Representation Single						
	Unit I	line diagram per uni	it quantities p.u. impedance diagram p.u. reactance diagram	(9)					
		Network graph, Bu	is incidence matrix, Primitive parameters, Bus admittance						
			ive parameters Representation of off nominal transformer						
		Formation of bus ad	mittance matrix of large power network.						

Unit I	Need for system planning and operational, components Representation Single line diagram per unit quantities p.u. impedance diagram p.u. reactance diagram Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters Representation of off nominal transformer Formation of bus admittance matrix of large power network. Voltage regulation of transmission lines, Voltage regulation using per-unit quantities, effect of load power factor on voltage regulation UNIT II POWER FLOW ANALYSIS Bus classification Formulation of Power Flow problem in polar coordinates	(9)	
Unit II	Power flow solution using Gauss Seidel method Handling of Voltage controlled buses Power Flow Solution by Newton Raphson method.	(2)	
Unit III	UNIT III SYMMETRICAL FAULT ANALYSIS Assumptions in short circuit analysis Symmetrical short circuit analysis using Thevenin's theorem Bus Impedance matrix building algorithm (without mutual coupling) Symmetrical fault analysis through bus impedance matrix Post fault bus voltages Fault level Current limiting reactors.	(9) ! ጠላታ 2 (2) ! 2 (1) 2 (2)	& A 160 (a)
Unit IV	UNIT IV UNSYMMETRICAL FAULT ANALYSIS Symmetrical components Sequence impedances Sequence networks Analysis of unsymmetrical faults at generator terminals. LG, LL and LLG unsymmetrical fault occurring at any point in a power system computation of post fault currents in symmetrical component and phasor domains.	(9)	
Unit V	UNIT V STABILITY ANALYSIS Classification of power system stability Rotor angle stability Swing equation Swing curve Power-Angle equation Equal area criterion Critical clearing angle and time Classical step-by-step solution of the swing equation modified Euler method.	(9)	
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Text	Books						
1	"Power System Stability and Control", Prabha Kundur McGraw Hill Education1st Edition, 1994						
2	"Modern Power System Analysis", D. P. Kothari, I. J. Nagrath, R. K. Saket, McGraw Hill Education, 5th Edition, 2022						
3	"Power System Analysis", J.B. Gupta, S.K. Kataria and Sons, Reprint 2013 Edition						
Reference Books							
1	"Power System Analysis and Design", J. Duncan Glover, Thomas Overbye, Mulukutla S. Sarma, Cengage Learning, 6th Edition, 2017						
2	"Power System Operation and Control", A. Chakrabarti, S. Halder, PHI Learning3rd Edition, 2010						

BEE33601	Course Outcomes	CL
BEE33601.1	Formulate bus admittance matrices, including off-nominal transformer representation, for large power networks.	4
BEE33601.2	Apply Gauss-Seidel and Newton-Raphson methods for solving power flow equations, including handling voltage-controlled buses.	3
BEE33601.3	Compute post-fault bus voltages, fault currents, and fault levels, considering current limiting reactors.	3
BEE33601.4	Classify power system stability and evaluate rotor angle stability using the swing equation, power-angle equation, and swing curve.	3
BEE33601.5	Compute post-fault currents for LG, LL, and LLG faults at generator terminals and any system location using symmetrical components and phasor domain methods	4

Assistant Professor
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TGPCET Mohazon, Nagpur

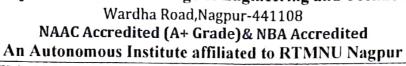
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Department Of Electrical Engineering
Tulsiramji Gaikwad - Patil College
Of Engineering And Technology
Nagpur



Text Books

Tulsiramji Gaikwad-Patil College of Engineering and Technology





			Third Year	r (Semester-VI) B. Tech. El	ectrical Engine	ering			
				EE33602: Switchgear & pro					
	Teach	ning S	cheme		Examina	tion Schem	ie		
	Lecture	es	3 Hrs./week		CT	arks			
	Tutoria		0 Hrs./week		CA	10 M	arks		
Te	otal Cre	dit	3		ESE	60 M	arks		
					Total	100 N			
			,		Duration of ES	SE: 03 Hrs.0	00Min.		
	,			Course Objective:					
1				necessity and basic terminology	of protective relayi	ng, causes,	types of		
-				in power system protection.	1 4 4				
2	system			nderstand different types of relays	and protective sch	emes usea 11	n power		
3				itchgear, arc interruption theory ar	nd working of diffe	rent types o	f circuit		
	brakers								
		,		Course Contents			Hours		
			•	hy of protection: Necessity of Pr			(9)		
	Unit I	1	causes of faults, fundamental requirements of a good protection scheme, Primary						
		and Back up protection, Protective zones Rewirable & HRC fuse, MCB, ELCB and their comparison. Classification of relays. Comparison of Electro-							
		1	_		. Comparison of	Electro-			
				and Numerical relays.					
١,		Over-Current Protection:							
'	Unit II	Introduction to Over current Protection, over current relay co-ordination. Over current protection schemes for medium voltage lines, Time-Current							
		1	•	urrent setting, Time setting, dire	_				
				lel feeders and ring mains.	cononar-over carr	cite rolay,			
		1 -	-	C/IEEE/IS codes)					
		1		ion.: Distance Protection of Hi	gh Voltage lines,	working			
_		princ	ciple and char	racteristic of Impedance relay, M	lho relay, Reactan	ce Relay,	(0)		
U	Init III	three	step distance	e protection scheme with contact	diagrams, effect	of power	(9)		
				nce, line length and source impe			i.		
		dista	nce relays, Ca	rries aided distance protection sch	nemes with contact	diagram,	12 %.		
	,		er current prote			(2%)	1.7		
				ction Schemes:			1		
U	nit IV			n, Bus Bar arrangement schemes,			(9)		
."	(10年 10年 My)		4 h	fferential relaying and other relay			1		
(5	₹£ ⊕°%5°,			differential protection, protection	of Induction moto	or against			
	14010			ort circuits, Buchholz relay.					
	7		chgear :	witcheser Arging Phanamara -	rinainlas af a '				
τ	Jnit V			witchgear, Arcing Phenomena, pa			(9)		
14	4			iking voltages, RRRV, Breaking					
		curre	nis. Different	types of circuit breakers (Air Bla	asi, and vacui	ım cırcuit	-		

breaker) their constructional features, Selection of circuit breakers

1	Sunil S. Rao, "Switchgear and Protection", Khanna Publication, 1992, New Delhi.								
2	B. Ravi	B. Ravindranath, M. Chander, "Power System Protection and Switchgear", New age International.							
3	B. Ram	, "Power System Protection and Switchgear", Tata McGraw Hill							
4	Y.G. Pa Second	Y.G. Paithankar, S.R. Bhide, "Fundamentals of Power System Protection", Prentice Hall, India Second Edition, 2010							
Refe	rence Bo	oks							
1	C. Rus	C. Russell Mason, "The art & Science of Protective Relaying", Willey, 1956.							
2	Warrin	igton, "Protective Relaying Vol. I & II", Springer	31						
3		Lythall, "Switchgear Handbook", J & P Newness Butterworth, London							
4		A.T John & S.K. Salman, "Digital Protection for power Systm",2004.							
Usefu	ıl Links								
https	://online	courses.nptel.ac.in/noc24_ee64/preview							
https	://online	courses.nptel.ac.in/noc23_ee59/preview							
BEE	E33602	Course Outcomes	CL						
BEE	33602.1	Understand basic terminology of Protective relaying, different types of faults & components used in power system protection.	2						
BEE	33602.2	Apply over current protection schemes for medium voltage lines.	3						
BEE	33602.3	2.3 Apply distance protection schemes for high voltage lines.							
BEE	33602.4	Analyze protection schemes and 6							
BEE	33602.5	Comprehend switching phenomenon and working of circuit breakers.	4						

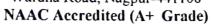
Department of Electrical Engg TGPCET Mohnagri, Nagpur

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

	BEE33603:1. ETAP2. PV SY						
	aching Scheme	Examination	Scheme				
Lectur		IA	-				
Practi		CA	25				
Total Cı	redit 2	ESE	25 50				
		Total Ouration of ESE	2 Hrs.				
DEF22602		Juration of ESE					
BEE33603	Course Outcomes	A 7777 A 70	CL				
	Understand the basic interface, toolbars, and featur system analysis.		2				
BEE33603.2	Develop and execute ETAP programs for cable requirements	sizing based on load	3				
BEE33603.3	Analyze and optimize relay settings using ETAP for co		44				
BEE33603.4	Evaluate PV system performance under different temperatures using PVsyst.	ilt angles and ambient	5				
BEE33603.5	Evaluate the impact of battery State of Charge (S system performance.	OC) on standalone PV	5				
Sr. No.	Course Contents	3					
1	Introduction to ETAP: Overview of ETAP interface, to	olbars, and features.	CO1				
2	To study various ETAP commands: To understand and execute various ETAP commands for power system analysis,						
3	Simulation, and automation using the ETAP interface and scripting						
4	Write a ETAP Program calculate cable sizing based on load requirements.						
5	To perform arc flash analysis using ETAP software in order to calculate incident energy levels						
6	Write a ETAP Program to adjust relay settings and run		CO3				
7	Write a ETAP Program to obtain Automating fault sim types.	ulations for different fault	CO3				
8	Introduction to PVsyst.		CO4				
9	Introduction to PVsyst: Learn basic interface and tools sections Project Design, Database, Tools.		CO4				
10	Learn basic interface and tools in PVsyst, different section I Database, Tools.		CO4				
11	Simulate energy yield for different tilt angles (0° to 45°		CO4				
12	Simulate system performance and check battery state of		CO5				
13	Simulate soiling losses by adjusting dirt accumulation	actors,	CO5				
14	Run the simulations for different ambient temperatures Performance.		CO5				
15	To design and analyze a hybrid photovoltaic (PV) system with battery storage using PVsyst, by evaluating energy generation, battery charging—discharging behavior						

2	"Photovoltaic Systems" by James P. Dunlop - Covers PV system design, including grid-connected configurations.	
2	"Solar Photovoltaic Basics" by Sean White - Discusses fundamentals of solar PV system modeling and software	

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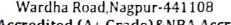


HOD Department Of Electrical Engineering Tulsiramji Gaikwad - Patil College Of Engineering And Technology Nagpur





Wardha Road, Nagpur-441108





Hours

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Third Year	(Semester-VI)	B. Tech.	Electrical	Engineering
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Program Elective-II BEE33604:	Wind Energy Utilization
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Teaching	Scheme	Exami	nation Scheme
Lectures	4 Hrs./week	СТ	30 Marks
Tutorial	0 Hrs./week	CA	10 Marks
Total Credit	4	ESE	60 Marks
		Total	100 Marks
		Duration of	ESE:03 Hrs.00Min.

Course Objective:

- Understanding the principles of wind energy conversion, including the history and characteristics
- Study of different wind turbine technologies, including fixed and variable speed turbines.

Course Contents

Exploring the challenges and opportunities in the wind energy industry, such as cost reduction and grid integration.

	Wind Energy Fundamentals - Introduction, Application and Historical background,	
Unit I	Merits and Limitations, Nature and Origin of Wind, Wind Energy Quantum, Variables in	(9)
	Wind Energy Conversion Systems, Wind Power Density, Power in a Wind Stream, Wind	
	Turbine Efficiency, Power of a Wind Turbine, Forces on the Blade of a Propeller, Wind	
	Velocities and Height from Ground, Mean Wind Velocity, Energy Pattern Factor.	
	Wind Turbine- Generator Units: Introduction, Types of Wind Turbine Generator (WTG)	
Unit II	Units, Planning of a Wind Farm, Horizontal Axis Propeller type Wind Turbine Generator,	(9)
02.00	Horizontal Axis Wind Turbine (HAWT), Practical PV Characteristics, Power Coefficients	
	Versus Tip Speed Ratio, Operation and Control of a HAWT.	
	Wind Energy Farm and Energy Conversion System: Wind to Electric Energy	
	Conversion System, Power versus Velocity of WTG, Power Duration Curves Types of	
Unit III	Wind Energy System, Wind to Electrical Energy Conversion Alternatives, Grid	(9)
	Connection, Energy Storage Requirements with Wind Energy System, Hybrid wind energy	
	systems.* Dr. 4 gr s. r. r. r.	,
	Cost Estimation of WES -Economics of wind Energy, fundamental of economics,	
Unit IV	Initial cost of wind energy project-cost of turbine installation-transportation-grid	(9)
Church	connection-legal and other cost, Operating cost running cost-maintenance cost,	(2)
	Comparison with other energy sources, Cost per unit-case study.	
	Offshore Wind Energy power- Introduction, offshore wind energy technology, future	
Unit V	technological development, scenario for the future offshore development of wind power,	(9)
Chit	new offshore concepts, National Offshore Wind Energy Policy of India-development in	(2)
	India, essential components for development of offshore wind energy.	

Text Books

- Joshua Earnest, Sthuthi Rachel, Wind Energy Technology, PHI Publications, 2019
- G. D. Rai, Non-Conventional Energy Resources, Khanna Publications, 2006 2
- Siraj Ahmed, Wind Energy -Theory and Practice, PHI Publications, 2016

Reference Books

Siegfried Heier, Grid integration of wind energy conversion systems, John Willy and Sons Ltd., 2006.

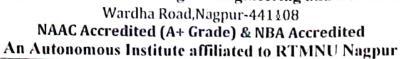
2 Win 2006	d Energy: Fundamentals, Resource analysis and Economics, Mathew Sathyajith,	Springer,		
3 Thor	Thomas Ackermann, Wind power in Power Systems, John Willy and Sons Ltd., 2005.			
Useful Lin	ks			
https://npt	el.ac.in/courses/101104546			
https://np	el.ac.in/courses/1 <u>1</u> 2106622			
https://ww	w.youtube.com/watch?v=QmQ12gSz5CY			
BEE3240	1 Course Outcomes	CL		
BEE3240	system	3		
BEE3240	Compare different types of Wind Generator Systems and their	4		
BEE3240	1.3 Analyze different types of wind energy conversion systems.	4		
BEE3240	sources.	4		
BEE3240	1.5 Examine the offshore wind technology and its essential components.	4		

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Department Of Electrical Engineering Tulsiramji Gaikwad - Patil College Of Engineering And Technology Nagpiir







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

Teaching Scheme Lectures 4 Hrs./week Tutorial 0 Hrs./week Total Credit 4 Total Credit 4 Examination Scheme CT 30 Marks CA 10 Marks ESE 60 Marks Total 100 Marks				
Lectures 4 Hrs./week CT 30 Marks Tutorial 0 Hrs./week CA 10 Marks Total Credit 4 ESE 60 Marks				
Tutorial 0 Hrs./week Total Credit 4 CA 10 Marks ESE 60 Marks	-			
Total Credit 4 ESE 60 Marks				
Total 100 Marks				
I Otal Too Marks				
Duration of ESE: 03 Hrs. 00 Min.				
Course Objective:				
1 To familiarize students with the fundamental concepts of electrical power generation, including various type				
of power plants (e.g., thermal, hydro, nuclear, renewable). 2 To understand the principles of converting mechanical energy into electrical energy through generators and	-			
turbines.				
3 To introduce students to the integration of renewable energy sources (solar, wind, etc.) into the electrical grid				
and power plants. Course Contents Hour	s			
Sources of Electrical Energy: Coal, oil and natural gas, water power, nuclear fission and				
fusion, their scope and potentialities for energy conversion. Electrical Load & Curves: Different (9)				
factors connected with a generating station, connected load, maximum demand, demand factor,				
load factor, diversity factor, plant capacity and utilization factor, load curve, load duration curve,				
load survey, base load and peak load station, advantages o€ interconnection.	_			
Thermal Station: General layout, major equipment, essential and non- essential auxiliaries,				
Unit II electric supply to auxiliaries, cost of generation, effect of different factor on costs. (9) Water Treatment process, Advantages and disadvantages.				
water Treatment process, Advantages and disadvantages.	-			
Hydro station: Hydrology, stream flow, flow duration curve, power duration curve, mass				
Unit III curve and reservoir capacity, type of hydro plants and their field of use, pumped storages plants and their utility, surge tanks, governing characteristics of turbine and hydro generators.				
Advantages and disadvantage.				
Nuclear station: Principle of Nuclear energy, materials, types of nuclear reactors, breeder	-			
reactors, location, material for moderator and control rods, cost economics. Voltage control	- 1			
Unit IV of A.C. generators: Methods of stabilizing exciter voltage, Automatic Voltage regulator	7			
action. Captive & Cogeneration.				
Renewable Energy Sources: Introduction to solar energy, Solar energy collectors, solar energy				
storage, electrical power generation and other Miscellaneous applications of solar energy (9)				
Introduction to wind energy Basic principles of wind energy conversion, site selection, basic				
Unit V component of wind energy conversion system, wind turbines and their analysis, wind Electrical				
generation, stand-alone and grid connected wind electrical power systems, Basic principle of Tidal power, site selection, storage and plant layout for Tidal power plant.				
Text Books	-			
Dr. B.R. Gupta, "Generation of Electrical Energy", S. Chand publisher, 2017.	-			
2 P. K. Nag, "Power Plant Engineering", TMH publisher, 4th Edition, 2017.	-			
E Proposition of the Proposition of April 1				
3 G.D. Rai, "An Introduction to Power Plant Technology", Khanna Publishers 1987				
 G.D. Rai, "An Introduction to Power Plant Technology", Khanna Publishers, 1987. P.C. Sharma, "Power Plant Engineering", Kataria, S.K. & Sons publisher, 2004. 	-			

- M.V. Deshpande, Elements of Power Station Design:, edition: Reprint, publisher: PHI Learning Pvt. Ltd.,
 - Chakraborty, Sony, Power System Engineering, Dhanpatrai & Sons publications 15 th edition 2002. 2
 - Elanchezhian,"Power plant Engineering", I.K. International Publications, 2010 3

Useful Links

https://onlinecourses.nptel.ac.in/noc22 me73/preview

https://archive.nptel.ac.in/courses/112/107/112107291/

https://www.youtube.com/playlist?list=PLMtBdv6WGV5-zDap4AWZE7IdIFNb70KzC

BEE33605	Course Outcomes	CL
BEE33605.1	Illustrate the electrical energy sources as well as factors involved with power plant operation.	3
BEE33605.2	Analyze the working and layout of Thermal power plants and different System comprising the plant.	4
BEE33605.3	Illustrate the working principle and basic components of the Hydro Station .	3
BEE33605.4	Describe the working principle and basic components of the nuclear power plant, voltage control, captive & Cogeneration.	2
BEE33605.5	Investigate the role of renewable Energy sources.	4

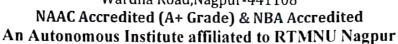
Assistant Professor Department of Flectrical Engg , sapur TGPCET M

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Third Van (Samester VI) D. Tach Flortrical Engineering

		Third Year	ır (Semester-VI) B. Tech. E	lectrical Engin	eering	
Progr	ram Elec	tive –II BE	EE33606: Flexible AC Tran	smission Syster	n	
Te	eaching Sc	heme		Examin	ation Scheme	
Lectures 4 Hrs./week		4 Hrs./week		CT	30 Mai	rks
Tutorial 0 Hrs./week		0 Hrs./week		CA	10 Ma	rks
Total Credit 4		4		ESE	60 Mai	rks
				Total	100 Ma	ırks
				Duration of E	SE: 03 Hrs. 00	Min.
			Course Objective:			
1 Und	erstand the	concepts of fle	exible AC transmission systems (FAC	CTS) and their role in	n modern power	system
oper	ration.					
		model advance	ed FACTS devices such as UPFC an	d IPFC for power flo	ow and phase an	igle
-	lation					11 1 11.
			controllers to improve transmission li	ne performance, stat	oility, and contro	ollability
ın re	al-world po	ower systems.	Course Contents			Hours
	EACTS (Concept and (General System Consideration: Tra	nemission Interconn	ection Flow of	
Power in an AC System, factors affecting the Loading Capability, Power Flow and Dynamic Stability Consideration of Transmission interconnection, relative importance of controllable,				(2)		
Unit I Stability Consideration of Transmission interconnection, relative importance of controllable, Types of FACTS Controllers, Benefits from FACTS Technology.						
	1		Current. Sourced Converters: Conc		ced Converters,	
			Bridge Converter Operation, Three-			(9)
			ections for 12-Pulse Operation, 24- P			
Unit II			nverter, Generalized Technique of l			
CIIIC LI	Control, Basic pulse width modulation converter, Concept of Current Source Converters, and					
	comparison of current source converters with Source converters.					
	Static Sh	unts Comper	nsators: SVC AND STATCOM : 0	Objectives of Shunt	Compensation,	
	Midpoint	Voltage Regu	lation for Line Segmentation, End of	of Line Voltage Sup	port to Prevent	100
Unit III	Voltage I	nstability, Imp	provement of Transient Stability, co	mparison between S	TATCOM and	(9)
707	CVC	fin 4	C18509U	V	,	16.64

	Single-Phase Full-Wave Bridge Converter Operation, Three-Phase Full-Wave Bridge Converter, and Transformer Connections for 12-Pulse Operation, 24- Pulse and 48-Pulse operation. Three level voltage source converter, Generalized Technique of Harmonic Elimination and Voltage	(9)
Unit II	Control, Basic pulse width modulation converter, Concept of Current Source Converters, and comparison of current source converters with Source converters.	
	Static Shunts Compensators: SVC AND STATCOM: Objectives of Shunt Compensation,	
1	Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability, comparison between STATCOM and SVC.	
Unit IV	Static Series Compensators: GCSC, TSSC, TCSC and SSSC: Objectives of Series Compensation, Voltage Stability, Improvement of Transient Stability, Power Oscillation Damping, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators (only SSSC), External (System) Control for Series Reactive Compensator Applications of SSSC in load flow and transient stability studies.	(9)
Unit V	Static Voltage and Phase Angle Regulators; TCVR, TCPAR' UPFC and IPFC: Objectives of Voltage and Phase Angle regulators, Approaches to Thyristor-Controlled Voltage and Phase Angle Regulators (TCVR and TCPARs), Introduction and operating principle of Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC).	(9)

Text Books

- Narain G. Hingorani and Laszlo Gyigyi, "Understanding FACTS Concepts and Technology of Flexible AC Transmission system A John W & Sons Inc Publicati 2000
- K. R. Padiyar, "FACTS: Controllers in Power Transmission & Distribution", New age International, 1st Edition, 2007.
- Yang Hua Song and Johns, "Flexible AC Transmission System (FACTS)", IEEE Publisher, 2006.

Refe	rence Books
1	V.K.Sood, "HVDC and FACTS controllers - Applications of Static Converters in Power System", New Age international (P) Limited, Publisher, New Delhi
2	R. Mohan Mathur, Rajiv K Verma, "Thyristor Based FACTS Controllers for Electrical, Transmission system," wiley, 2002
Usefu	ul Links
https	:://nptel.ac.in/courses

BEE33606	Course Outcomes	CL
BEE33606.1	Understand the problem and constraints related with Stability and large interconnected system.	2
BEE33606.2	Describe voltage-Sourced, current. Sourced converters and harmonic elimination techniques.	2
BEE33606.3	Illustrate the use of Static shunts compensators for improvement in Power Quality	3
BEE33606.4	Discriminate the use of Static Series Compensators for voltage stability	2
BEE33606.5	Explain the operating principal Voltage as well as phase Angle regulators and power flow controller	2

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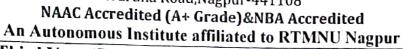
https://onlinecourses.nptel.ac.in/noc23 ee58/preview

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

Program Electives-III BEE33607: Biomass Energy and its

Tutorial 0 Hrs./week Total Credit 4 ESE 60 M Total 100 N Duration of ESE:03 Hrs.0 Course Objective: To give students the basic knowledge of biomass energy utilization To enable students to the process of design of biomass systems To facilitate the regulatory framework of bio-energy in India	larks larks larks Jarks			
Tutorial 0 Hrs./week Total Credit 4 CA 10 M ESE 60 M Total 100 M Duration of ESE:03 Hrs.0 Course Objective: To give students the basic knowledge of biomass energy utilization To enable students to the process of design of biomass systems To facilitate the regulatory framework of bio-energy in India	larks larks Jarks			
Total Credit 4 ESE 60 M Total 100 M Duration of ESE:03 Hrs.0 Course Objective: To give students the basic knowledge of biomass energy utilization To enable students to the process of design of biomass systems To facilitate the regulatory framework of bio-energy in India	larks Iarks			
Total 100 N Duration of ESE:03 Hrs.0 Course Objective: To give students the basic knowledge of biomass energy utilization To enable students to the process of design of biomass systems To facilitate the regulatory framework of bio-energy in India	1arks			
Course Objective: To give students the basic knowledge of biomass energy utilization To enable students to the process of design of biomass systems To facilitate the regulatory framework of bio-energy in India				
Course Objective: 1 To give students the basic knowledge of biomass energy utilization 2 To enable students to the process of design of biomass systems 3 To facilitate the regulatory framework of bio-energy in India	00Min.			
To give students the basic knowledge of biomass energy utilization To enable students to the process of design of biomass systems To facilitate the regulatory framework of bio-energy in India				
To enable students to the process of design of biomass systems To facilitate the regulatory framework of bio-energy in India				
To facilitate the regulatory framework of bio-energy in India				
To facilitate the regulatory framework of bio-energy in India				
Course Contents	Hours			
Unit I Biomass types and Characterization: Biomass basics, dedicated crops, oil crop and microalgae, broad classification and compositional analysis, characteristics and properties of biomass, properties and structural components of biomass.				
Unit II Biomass Conversion Mechanisms: Utilization of biomass through biochemical and thermo chemical routes, conversion mechanism of biomass to biogas and its properties, classification of biogas plants. Thermo-chemical conversion of biomass to solid, liquid and gaseous fuels, gasification numerical.				
Unit III Biomass Waste to Energy: Energy production from biomass wastes through incineration, energy production through gasification of wastes, briquetting obiomass. Success stories through case studies of community biogas plants	(9)			
Hydrogen, Methane and Methanol: Unit IV Bio-hydrogen production, meta bolics, microorganisms, biogas technology fermenter design, biogas purification, methanol production and utilization.	, (9)			
Unit V Bio - Energy Development in India - Financial Analysis of Biomass Energy projects, Government initiatives, project financing for Biomass and Energy projects, case study on biomass energy implementation.	(9)			
Text Books				
S. Rao, Dr. B.B. Parulekar "Energy Technology", Khanna Publishers, 5th Edition				
2 G.D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, 4th Edition				
N.S. Rathore, N.L. Panwar "Biomass Production And Efficient Utilization For Energy Generation Press, 1st Edition	n, CRC			
Reference Books				
John Twidell, "Renewable Energy Sources", Routledge, Fourth Edition				
2 Muhammad Rashed Al Mamun, "Utilization of Biomass for supply of renewable energy in rural Springer 1st Edition				
Dan Bahadur Pal, Pardeep Singh, "Utilization of Waste Biomass in Energy, Environment and Ca CRC Press, 1st Edition	talysis",			

Useful Links	Useful Links					
https://nptel.ac	https://nptel.ac.in/103103207, https://nptel.ac.in/103103206					
Sardar Swaran	Singh National Institute Of Bio-Energy (nibe.res.in)	7 1				
	Course Outcomes	CL				
BEE3607.1	Classify the types of Biomass based on the properties and energy content in the biomass.	3				
BEE3607.2	Explain the conversion mechanism of biomass to biogas through thermo- chemical and gasification process.	2				
BEE3607.3	Assess the energy production from biomass through incineration and gasification methods.	3				
BEE3607.4	Facilitate the fermenter, biogas purification, bio hydrogen production and its utilization.	3				
BEE3607.5	Demonstrate the role of Government of India in the development of bio- energy in India.	4				

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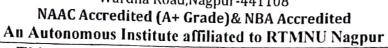


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Third Year (Semester-VI) R Tech Electrical Engineering

		Third Y	ear (Semester-VI) B.Tech.	Electrical Engi	neering	
	Program	n Electives-	III BEE33608: Electrical I	Distribution Syst	em	
T	eaching S	Scheme			ination Sche	me
	tures	4 Hrs./week		CT	30 Marks	
	orial	0 Hrs./week		CA	10 Marks	
Total	Credit	4		ESE	60 1	Marks
				Total 100 Marks		
				Duration o	f ESE:03 Hrs	.00Min.
4 10-2			Course Objective			
			of an electrical distribution syst			
2 The	coretical u	nderstanding o	f how to assess a distribution sys	stem's performance	using its key	performance
ina	icators, su	ch as power lo	sses and voltage dips.			İ
r10	tor and vol	ltage profiles f	e management and compensation or greater value	strategies to enhan	ce the system	's power
		ange promes i	Course Contents			Hours
	Intro	duction to	Distribution Systems: Introd	luction, load mod	deling and	
Uni	t I chara	cteristics, Coin	ncidence factor, contribution fa-	ctor loss factor - R	Relationship	(9)
	betwe	en the load	factor and loss factor. Classif	ication of loads:	Residential,	
	Distri	hution Feeders	ltural and Industrial loads and the & Substations: Design Consider	er characteristics.	- Fandama	
Unit	II Radia	l and doon tv	nes of primary feeders, voltage	e levels feeder loo	ding: bosic	(0)
Unit II Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system. SUBSTATIONS: Rating of					(9)	
	distril	oution substat	ion, service area within prima	arv feeders Renef	its derived	
	throug	gh optimal loca	ation of substations. Layout of th	e Substation.	its derived	
	6	4 79	•			
Unit	Distri	bution System	Analysis: Voltage drop and powe	r-loss calculations:	Derivation	
	for vo	Itage drop and	power and its numerical		102207-	(9)
	W-1	real to interest		Y	73/4	
309	Protec	tive Devices &	Automation: Objectives of d	listribution system	protection,	9.51
Unit	types	of common fa	aults and procedure for fault ca	lculations. Protective	e Devices:	(9)
	Princi	ple of operati	on of Fuses, Circuit Re-closure	es and line section	alizes, and	
	circuit	breakers. A	automation:-Introduction to Di	stribution Automa	tion, Data	
	acquis	ition system	and decentralized control, da	ta acquisition and	protection	
		lerations of con				
T T 1.	Voltag	ge Control &	Power Factor Improvement: E	quipment for volta	ge control,	
Unit	Vertect	or series capa	acitors, line drop Compensation	, effect of AVB/A	VR, Power	(9)
	Canada	control usin	g different types of power	capacitors, shunt	and series	
	Capac	mia Instificati	shunt capacitors (Fixed and S	witched), capacitor	allocation-	1.
Text Boo	le a	mic Justinean	on Procedure to determine the be	est capacitor location	n.	
			System- Kamaraju, Tata McGraw I			
2 Ele	ctric Power	Distribution, D	r.S.Sivanagaraju, Dr.K.Shankar. D	anapathi Rai Publica	tions.	
3 Elec	ctric Power	Distribution A.	S. Pabla Tata Mc Graw-Hill Publi	shing Company.		

Refere	ence Bo	oks		1 230	
1	1 Electrical Power Distribution System Engineering, TuranGonen, CRC Press.				4
	Electrica			-	
3	Electric	Power Distribution Automation M. K. Khedkar & G. M. Dhole University Science	Press.		
Useful	l Links				
https://a	archive.n	ptel.ac.in/courses/108/107/108107112/			
https://v	www.dig	imat.in/nptel/courses/video/108107112/L01.html			
https://a	archive.n	ptel.ac.in/noc/courses/noc18/SEM2/noc18-ee15/			
BEE	33608	Course Outcomes		CL	
BEE3	33608.1	Understand the general aspects of electrical distribution system.		2	
BEE3	33608.2	Design and analysis of distribution feeders and substations.		4	
BEE3	BEE33608.3 Analyze the need for protection and distribution automation.			3	
BEE.33008.4		Recognize the significance of voltage drop and power loss in the distribution system.		2	
BEE3	33608.5	Implement the need for controlling the PF, Voltage and Power and the equipment used for mitigating them.		4	*-

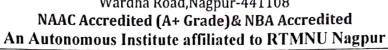
Du. Protek Glassistant Professor Department of Electrical Engs TGPCET, Mongaon, Nagpur



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				ear (Semester-VI) B.Tech.		eering	
				ogram Electives-III BEE33			
	Teach	ing S	cheme			nation Schem	e
	Lecture		4 Hrs./week		CT	30Ma	irks
	Tutoria	l	0 Hrs./week		CA	10Ma	ırks
T	otal Cre	dit	4		ESE	60Ma	
					Total	100M	
					Duration of	ESE:03 Hrs.00	OMin.
_	Course Objective:						
	1 To provide good foundation for learning Hybrid and Electric Vehicle						
2	To und	erstan	d the concepts	of power converters and motors	used in Electric Vel	hicles.	
3	To famil	iarize	the energy stora	ge system and charging infrastructur	·e.		
				Course Contents			Hours
τ	Jnit I	Electr Fuel-(ic Vehicle, Gen Cell Electric V	andamentals: History, Basics of learn Layout of EV, EV classification Vehicles (FCEVs) Comparison was ges & Disadvantages of EV, National	: Battery Electric Ve ith Internal Combu	hicles (BEVs), estion Engine:	(9)
Unit II Storage System - Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its modeling, SOC, Different Types of Batteries, Super Capacitor based energy storage and its analysis, Hybridization of different energy storage devices.				(9)			
U	nit III	yehicl Switch	es, Control of hed Reluctance	Induction Motor Drive, Permane Motor (SRM) Drive, four quadrant of its analysis, dual converter.	nt Magnet (PM) m	otor Drive &	17# (9) 22 A
U	nit IV	HEVs Electri	, Operating Mo ic Vehicles (P.	des, Degree of Hybridization, Comp HEVs) Real Life examples of H ehicles, HEVs and EVs.	parison of HEVs, Pl	ug-in Hybrid	(9)
Unit V Energy Management System and Charging Infrastructure - Introduction to energy management strategies used in electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies, Types of EV charging Infrastructure & Standardized Communication protocols for EV charging.				(9)			
Tex	t Books						
1	Prof. S	Sunil P	'awar, "Electric	Vehicle Technology" Notion Press	Publication, 2 nd editio	n, 2020	
2				drives - Modelling, Analysis & Cor			
3 Refe	lqbal erence Be	Hussa ooks	ain, Electric ar	nd Hybrid Vehicles Design Funda	mentals, 2/e, CRC	Press, 2003.	
1	Vedam	Subra	hmanyam, " Ele	ectric drives concepts and application	ns" McGraw II:II 10	104	
2				"Electric Vehicle Technology", Wi		790	
	-			, wi	10y, 2003.		

C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001

Useful Links		1 1		
https://nptel.ac.in/courses/108106170				
https://onlinecou	urses.nptel.ac.in/noc22_ee53			
https://onlinecou	urses.nptel.ac.in/noc21_ee112			
BEE33609	Course Outcomes	CL		
BEE33609.1	Acquire knowledge on the basic concepts of Electric Vehicle system.	3		
BEE33609.2	Compare different types of batteries and their characteristics.	4		
BEE33609.3	Analyze different types of converter based AC and DC drives.	4		
BEE33609.4	Examine the types of Hybrid Electric Vehicles and their parameters.	4		
BEE33609.5	Illustrate the energy management system and explore the communication protocols of charging system.	3	l l	

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

BEE33610: Power System Analysis Lab

Teaching Scheme		Scheme	•	Examina	tion Scheme	e
	tical	2 Hrs./week		CA	25 Ma	arks
	Credit	1		ESE	25 Ma	arks
	7			Total	50 Ma	ırks
				DurationofES	E:3Hrs.00M	ins
			Course Outcomes			
BEE330	110.1	onditions	transfer and monitor feeder pa			4
BEE330	BEE33610.2 Formulate bus admittance (Y-BUS) and impedance (Z-BUS) matrices using direct inspection methods.					3
BEE33	510.3 M	lodel and ana arameters and s	llyze transmission lines, includ imulation of Ferranti effect using	MATLAB		4
BEE33	510.4 D	esign and simu	late multi-area load frequency con	itrol using SIMUL	INK.	4
BEE33	610.5 Po	erform fault and study fault bel	alysis (LL, LG, LLG, LLLG) on 3 navior and system response	-phase synchronou	is machines	3
Sr. No.			List of Experiment			СО
1	To obtain the original unbalanced phase voltages from symmetrical components using MATLAB				CO1	
2	Simulation of monitoring the feeder parameter from workstation					CO1
3	Formation of Admittance (Y) BUS using direct inspection method.				CO2	
4	To find load flow analysis using Gauss-Seidal method in MATLAB				CO2	
5	Formati	on of Impedan	ce (Z) BUS using direct inspection	n method.		CO2
6			program to model transmission lin			CO3 19.31
7	Determ	ination of Sequ	ence Impedance of Cylindrical Ro	otor Synchronous N	Machine	CO3
8	Design	the MATLAB	program to simulate Ferranti effec	t		CO3
9	Determ	ine ABCD cons	stants and Regulation of a 3-Ф tran	nsmission line mod	lel.	CO4
10	To obta	in symmetrical	components of set of unbalanced	currents		CO4
11			K model for two area load frequence			CO4
12	LLG an	d LLLG fault a	nalysis of 3-Ф synchronous mach	ine.		CO5
13	To perfo	orm power flow	v solution of a 3-Bus system using	MATLAB-PSAT		CO5
14	LG and	LL fault analys	sis of 3-Φ synchronous machine.			CO5
15	To become familiar with various aspects of the transient stability analysis of Single-Machine-Infinite Bus (SMIB) system using MATLAB					CO5
Text Bo	oks					
1	I. J. Nagrath, D. P. Kothari, Modern Power System Analysis, 3rd Edition, Tata McGraw Hill Publishing Co. Ltd., 2003					
2			ion: Transmission and Distributio			
3	A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, "A Text book of Power System Engineering", Dhanpat Rai Publication, 2016					
Referen	ce Books					



1	"Electrical Power Systems", C.L. Wadhwa,, New Age International Publication, 6th Edition, 2010
2	"Computer Techniques in Power System Analysis", M.A. Pai, Tata McGraw-Hill, 2nd Edition, 2006.
3	"Power System Analysis", John J. Grainger & William D. Stevenson, McGraw Hill, 1st Edition, 1994.



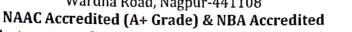
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An Autonomous Institute affiliated to RTMNU Nagpur Third Year(Semester-VI) B. Tech. Electrical Engineering

BEE336011	: Switchgear	& Protection	Lab

BEE336011: Switchgear & Protection Lab							
	Teaching S	Scheme		Exami	nation Sch	eme	
	ectures	2Hrs./week		CA	25	Marks	
Tot	al Credit	1		ESE		Marks	
				Total		Marks	
				Duration of	ESE:02 Hi	rs.00Min.	
1	D-4 :		Course Outcomes (Co	•			
	Determine	Determine time-current characteristics of thermal overload relay, over current relay & earth fault Relay.					
2	Demonstrat	te the character	istics of MCB, HRC fuse, Circuit	Breaker & IDMT ov	er current r	elay.	
3	Determine	characteristics	of transmission line for ABCD par	ameter of PIE & T no	etwork.		
4	Demonstra	te the working	performance of reverse power rela	y & Buchholz relay.			
5	Analyze per	rformance of tra	unsmission line for various faults u	sing MATLAB.	eaning	ins*eiseA	
Sr. No.)	List of Experiment	aprint Sector	for a	CO	
1	Determine t	ime-current cha	tracteristics of thermal overload re	lay.		CO1	
2	Determine t	ime-current cha	tracteristics of over current & earth	ı fault Relay.		CO1	
3	Simulate Overcurrent protection using a simple logic block.				CO1		
4	Determine t	ime-current cha	tracteristics of IDMT over current	relay		CO2	
5		ACB & HRC fo				CO2	
6			stics of MCB & HRC fuse			CO2	
7			aker Opening & Closing Operation			CO2	
			f transmission line for ABCD para		k.	CO3	
,			f transmission line for ABCD para			CO3	
10	Demonstrate	e the working p	erformance of reverse power relay	′,		CO4	
11	Simulation	of Transforme	r Differential Protection using M	ATLAB/Simulink		CO4	
12	Demonstrate	the working p	rinciple of Buchholz relay.			CO4	
13	Analysis of	transmission li	ne for symmetrical faults using MA	ATLAB.		CO5	
14	Analysis of	transmission li	ne for asymmetrical faults using M	IATLAB.		CO5	
15	relay for var		smission line protection by using	the impedance /Over	current	CO5	
Text E	Books					Σ.	
1	Sunil S. Ra	ao, "Switchgea	r and Protection", Khanna Public	cation, 1992, New D	Delhi.		
2	B. Ravindr	anath, M. Cha	nder, "Power System Protection	and Switchgear", N	ew age Int	ernational.	
3	B. Ram, "I	Power System	Protection and Switchgear", Tata	a McGraw Hill			
Refere	ence Books						
1	C. Russell	Mason, "The a	rt & Science of Protective Relay	ing", Willey,1956.			
4 7 1 2							

2	Warrington, "Protective Relaying Vol. I & II", Springer				
3	R. T., Lythall, "Switchgear Handbook", J & P Newness Butterworth, London				
4	A.T John & S.K. Salman, "Digital Protection for power Systm",2004.				
Usefu	l Links				
https://onlinecourses.nptel.ac.in/noc24_ee64/preview					
https://onlinecourses.nptel.ac.in/noc23_ee59/preview					

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

BME33612: Introduction to Industry 4.0

Teaching Scheme		 Exami	nation Scheme
Lectures	2 Hrs./week	CT	15 Marks
Tutorial	0 Hrs./week	CA	05 Marks
Total Credit	2	ESE	30 Marks
		Total	50 Marks
		Duration of	ESE:02 Hrs.00Min.

Course Objective: On successful completion of the course, the students will be able to:

- Know about Industry 4.0 and its scope.
- 2 Explain Design thinking principles and its usage for problem solution
- 3 Apply learned skills to approach problems that exist in real life

	Course Contents	Hours
	Introduction 4.0 Industry: Introduction to Sensing & Actuation, Industry 4.0: Globalization	ООН
	and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and	(8)
	Connected business perspective.	
Unit I	Industry4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform	the property
	and Product Lifecycle Management, Artificial Intelligence, Big Data and Advanced Analysis,	1110.2614
	Introduction to FDM machine, 3D printing demonstration	
	Design Thinking as a Problem-Solving Process: Describe the principles of Design	
	Thinking Describe the Design Thinking process for problem solution.	(8)
Unit II	Basics of Industrial Internet of Things(IIOT):Introduction, Industrial Internet system,	(0)
	Industrial process, Key enablers of HOT, Cyber Security	
	Case Studies:	
Unit III	Real time use cases from different Industries like OIL, Chemical and Pharma and Uses of	(8)
	UAV in industries	(6/

Text Books

- The Concept Industry 4.0:An Empirical Analysis of Technologies and Applications in Production 1 Logistics By Christoph Jan Bartodziej
 - Industry 4.0: Entrepreneurship and Structural Change in the New Digital Land scape, By Springer

Reference Books

- Virtual and Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, By Bartolo, P 1 J, Taylor and Francis
- Rapid Manufacturing: An Industrial Revolution for a Digital Age By Hopkinson, N, Haque, R., and 2 Dickens, P., Wiley
- Make: 3DPrintingByAnnaKaziunasFrance

Useful Links

https://nptelac.in/courses/107101086/

https://nptelac.in/courses/106105195/

https://nptel.ac.in/courses/112104265



BME33612	Course Outcomes	CL
BME33612.1	Know about Industry 4.0 and its scope.	2
BME33612.2	Explain Design thinking principles and its usage for problem solution	2
BME33612.3	Apply learned skills to approach problems that existing real life	2

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Vice-Principal Academics(Core)

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