

# 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			Examin	ation Scheme
Lectures	3Hrs./week		CT 30Marks	
	0Hrs./week		CA	10Marks
Total Credit	3	it senious l'emigate distrit v	ESE	60Marks
			Total	100Marks
energia de la participa de la companya del companya del companya de la companya d	Ader as convey as	deanesid see of the continuity of	Duration of I	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 Cont	ents APRIL 130 (1801) 2011 APRIL 1 (1886) formation in	Hours
	Three Phase Induction Motor: Working Principle, Production of rotating magnetic field, synchronous speed, rotor speed and slip. Construction detail of 3	(9)
TI:4 T	phase squirrel cage induction motor and slip ring induction motor. Rotor	
Unit I	Quantities: Frequency, Induced EMF, power factor at starting and running condition. Characteristics of torque verses slip (speed), Torque: starting, full load	hikadi
	and maximum with relation among them. Losses and efficiency.	te an or entre of pro-
¥ 7.	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	(9)
Unit II	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	() 神艺机造作。
1	c) By stator voltage control d) Rotor resistance control e) V/F methods. Applications of three phase induction Motor.	JALLIUM
£ 14 1031	Single Phase Induction Motor: - Principle and Operation, Double Field	Water town
Unit III	Revolving Theory. Principle and Working of Shaded Pole Induction Motor, Split Phase Induction Motor and Capacitor Start Capacitor Run Motor. Applications	(9)
	Three Phase Synchronous Generator-Introduction, Constructional features of Salient Pole and Cylindrical Pole Rotor Machines, Introduction to Armsture	(9)
	Winding and Field Winding, Winding Factors and EMF Equation, Armature	
Unit IV	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.	



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Nagour

Unit	V Fractional Horse Power motor (FHP)- Co Synchronous reluctance motor, Switched reluctance magnet synchronous motor, stepper motor, AC and D	ce motor, BLDC, permanent (9)
Text Book	KS	
1 A	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", Mo	leGraw Hill Education, 2013.
2 P.	. S. Bimbhra, "Electrical Machinery", Khanna Publishers,	, 2011.
	L Theraja, AK Theraja, "A Textbook of Electrical Techn 2024)	nology In Si Units" Volume-II, 25th Edit
Reference	Books	part of participation of the state of
1 I.	J. Nagrath and D. P. Kothari, "Electric Machines", McGi	raw Hill Education, 5th Edition 2017.
	C. C. Sen, "Principles of Electric Machines and Power Elec	ectronics", John Wiley & Sons, 2 <sup>nd</sup> Edition
3 J.	B. Gupta, "Theory & Performance of Electrical Machines	es". 2013
Useful Lin	iks - znestronoran i de le vice	hase more than one boom , it can be it it

https://nptel.ac.in/courses/108102146

https://archive.nptel.ac.in/courses/108/105/108105155/

BEE33501	Course Outcomes (1) 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

1, 1			BEE33502: Control System Enginee	ring	1 % Jun
	Teachin	g Scheme	e etter tij skrivet byt. F	Examination Schen	ne
I	ectures	3Hrs./week	ज्याप्ता अवसी द्वारी र परदाद का वा , जान	CT 30Ma	
7	Tutorial	0Hrs./week		<b>CA</b> 10M	larks
To	tal Credi	3 7 11	ayeng a <b>m</b> il mi yahili saka saka ya sahi		larks
		Notice and seasons	visit pe da taña tañ eve		<b>Marks</b>
			ett.	Duration of ESE:03 Hrs.	00Min.
	No. 1. A	nga jaya sajiba sanas	Course Objective:	y a mangripper of his file of the	9 2 4 7
1	To study	modeling and tra	nsfer function of linear and time-invar	iant control system	
2	To study	Stability, Time d	omain and Frequency domain Specific	cations and plants a stack	1 424
3	Introduc	tion to state space	approach and understand theory of sta	ate transition matrix	.1
			Course Contents		Hours
Ţ	Jnit I S	ystem Open loop,	eed for automation and automatic Closed Loop Control system. Mathemeal) differential Equation, Transfer f	atical modeling (Electrical	(9)
U	nit II s	Time Response Arecond order system	nalysis: Time response of system, standard, concept of gain and time constant. opproximate methods for higher ord	Steady state error, type of	(9)
		tability of Contr	ol System: Stability of control system		
Un	ıit III 🗼	haracteristics equelative stability. R	ation, Routh Hurwitz criterion, spec oot location and its effect on time res addition of pole and zero on proximit	ponse, elementary idea of	(9)
	nit III r r I nit IV s	haracteristics equelative stability. Root locus, effect of requency Responsible members, Bode plot, pop and close loop		ponse, elementary idea of y of imaginary axis. ethod of analyzing linear frequency response, open on of gain and addition of	
Ur	nit III r	haracteristics equelative stability. Root locus, effect of requency Responsible of the state of the state Space Analytate. Choice of state	oot location and its effect on time restaddition of pole and zero on proximitates. Frequency response mustability and accuracy analysis from frequency response, effect of variations.	sponse, elementary idea of y of imaginary axis. sethod of analyzing linear frequency response, open on of gain and addition of an expression of system atrix differential equation,	
Ur	nit III r	haracteristics equivalent elative stability. Root locus, effect of requency Responsible end close loop and close loop ole and zero on restate Space Analytate. Choice of statandard form, related	oot location and its effect on time rest addition of pole and zero on proximitates. Frequency response mustability and accuracy analysis from a frequency response, effect of variations polypoonse plot, stability margin in frequencies. State variable methods of analysis e variables, representation of vector maion between transfer function and state	sponse, elementary idea of y of imaginary axis. The sethod of analyzing linear frequency response, open on of gain and addition of the next response.  In the sethod of analyzing linear frequency response, open on of gain and addition of the next response.  In the sethod of the seth	(9)
Ur	nit III r	haracteristics equelative stability. Root locus, effect of requency Responsivem, Bode plot, pop and close loop ole and zero on restate Space Analytate. Choice of state andard form, relate Control System E	oot location and its effect on time rest addition of pole and zero on proximit use Analysis: Frequency response mustability and accuracy analysis from a frequency response, effect of variations polytonia frequency response, effect of variations polytonia frequency response plot, stability margin in frequency response plot, stability m	sponse, elementary idea of sy of imaginary axis. sethod of analyzing linear frequency response, open on of gain and addition of ney response.  s, characteristics of system patrix differential equation, e variables  entice Hall, India. 5th edition	(9) (9) n, 2010
Ur U ext B	nit III r	haracteristics equelative stability. Root locus, effect of requency Responsivem, Bode plot, pop and close loop ole and zero on restate Space Analytate. Choice of state andard form, relate Control System E	oot location and its effect on time rest addition of pole and zero on proximitates. Frequency response mustability and accuracy analysis from a frequency response, effect of variations polypoonse plot, stability margin in frequencies. State variable methods of analysis e variables, representation of vector maion between transfer function and state	sponse, elementary idea of sy of imaginary axis. sethod of analyzing linear frequency response, open on of gain and addition of ney response.  s, characteristics of system patrix differential equation, e variables  entice Hall, India. 5th edition	(9) (9) n, 2010
Ur U ext B	nit III r	haracteristics equivalent elative stability. Root locus, effect of requency Responsivem, Bode plot, cop and close loop ole and zero on restate Space Analytate. Choice of state and ard form, relate System Analysis of System Analysis of the state of the system Analysis of the system Analysis of the state of the system Analysis of the state of the system Analysis of	oot location and its effect on time rest addition of pole and zero on proximitates. Frequency response me stability and accuracy analysis from a frequency response, effect of variations poles, stability margin in frequency response plot, stability margin in frequency representation of vector me ion between transfer function and state angineering by K Ogatta, Publisher Proposition of Vector Proposition of Vector Margrath / Gopal, Publisher New Argument of Proposition of Vector Proposition of Vector Margrath / Gopal, Publisher New Argument / Gopal, Publisher / Gopa	sponse, elementary idea of sy of imaginary axis. The sethod of analyzing linear frequency response, open on of gain and addition of ancy response.  In the set of system patrix differential equation, the variables  The entice Hall, India. 5th edition age International, 6th edition age International, 6th edition	(9) (9) n, 2010
Ur  U  ext B  1  2  3	nit III r	haracteristics equivalent elative stability. Root locus, effect of requency Responsivem, Bode plot, cop and close loop ole and zero on restate Space Analytate. Choice of state and ard form, relate System Analysis System Engineeric	oot location and its effect on time rest addition of pole and zero on proximit use Analysis: Frequency response mustability and accuracy analysis from a frequency response, effect of variations polytonia frequency response, effect of variations polytonia frequency response plot, stability margin in frequency response plot, stability m	sponse, elementary idea of sy of imaginary axis. The sethod of analyzing linear frequency response, open on of gain and addition of ancy response.  In the set of system patrix differential equation, the variables  The entice Hall, India. 5th edition age International, 6th edition age International, 6th edition	(9) (9) n, 2010



2 Cont	ol System Engineering by Samarjit Ghosh Publisher, Pearson, 2nd edition, 2012	
3 Linea	r 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.yo	utube.com/playlist?list=PLxn52v8fxX515tGzU1NAxRDkgqxK0k5UZ	
BEE33502	Course Outcomes	CL
BEE3350	Compute the Feedback in control system Block diagram representation of closed loop control system.	3
BEE3350	and statement in time-domain specifications	3
BEE3350	Analyze the techniques like Root locus, Routh Hurwitz criterion and check the stability of the systems.	4
BEE3350	Differentiate the Polar, Nyquist & Bode Plots in frequency response analysis of control system.	. 4
BEE3350	Obtain models of dynamic systems in transfer function and state space forms.	3

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

	BEI	33503: Power Electronics	and Drives	e ja Granda	
Teaching So	cheme	ay sayan an at the said of the best.	Examination	Scheme	
Lectures	3 Hrs/week		CT	30 Marks	N 19
Tutorial	0 Hrs/week		CA	10 Marks	
Total Credi	t 3		ESE	60 Marks	
4 7	u u e		Total	100 Mark	
		914112	Duration of E	SE: 03 Hrs 00	Min.
Course Obj					
1	application in pow	ents the basic theory of power server electronics.			
2	To familiarize the their applications.	operation principle of AC-DC, D	C-DC, DC-AC c	onversion circ	uits and
3	To provide the ba	sis for further studyof power elect	tronics Drives.	ik, projes	1.4.1
Course Cont	ents	Haham Charles in remother with	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	for '	Hours
Unit I	Power Semi-Con and IGBT. Static commutation circ	ductor Devices: Study of SCR, To characteristics: SCR, MOSFET uit for SCR	TRIAC, GTO, BJ	T, MOSFET iggering and	(9)
£.	Phasa Controller	Rectifiers: Phase controlled tecl		4:41	1
Unit II	angle control, Sin controlled and ful	gle phase half wave-controlled red l controlled bridge rectifiers. Boost, Buck- Boost regulator, Cu	ctifiers. Single ph		(9)
Unit II Unit III	angle control, Sin controlled and ful Chopper: Buck, Inverters: Single Inverter (CSI), th AC voltage control	gle phase half wave-controlled red I controlled bridge rectifiers.	k Converter.  r (VSI) and Curund 180° modes of	rrent Source of operation.	(9)
	angle control, Sin controlled and ful Chopper: Buck,  Inverters: Single Inverter (CSI), th AC voltage controlled and principle.  DC Drives: Phadiscontinuous mocurrent; Chopper	gle phase half wave-controlled red I controlled bridge rectifiers. Boost, Buck- Boost regulator, Cu e phase Voltage Source Inverte ree phase VSI and CSI – 120° a rollers: Single phase and three pl	k Converter.  r (VSI) and Curund 180 <sup>0</sup> modes of hase voltage regularities, its types a reation with confirmation and Ripp	rrent Source of operation. llators R and and operating attinuous and ple in motor	
Unit III	angle control, Sin controlled and ful Chopper: Buck,  Inverters: Single Inverter (CSI), th AC voltage controlled.  DC Drives: Phadiscontinuous modurrent; Chopper Converter Ratings  AC DRIVES: Incontrol, Variable in the control of t	gle phase half wave-controlled red I controlled bridge rectifiers. Boost, Buck- Boost regulator, Cue phase Voltage Source Inverte ree phase VSI and CSI – 120° a rollers: Single phase and three place f control, Single phase cyclo-converse controlled DC-Drives: Opendes, Supply Harmonics, Power Controlled DC Drives, Sources of	k Converter.  r (VSI) and Curand 180° modes of hase voltage regularities, its types a cration with confector and Rippeurrent harmonication techniques: Scontrol, Static ro	rrent Source of operation. llators R and and operating attinuous and ple in motor in chopper,	(9)
Unit III Unit IV	angle control, Sin controlled and ful Chopper: Buck, Inverters: Single Inverter (CSI), the AC voltage control RL load – range of principle.  DC Drives: Phadiscontinuous modurrent; Chopper Converter Ratings  AC DRIVES: Incontrol, Variable is control, Variable is control and Slip p	gle phase half wave-controlled red I controlled bridge rectifiers. Boost, Buck- Boost regulator, Cure phase Voltage Source Inverte ree phase VSI and CSI – 120° a rollers: Single phase and three plants of control, Single phase cyclo-converse controlled DC-Drives: Opendes, Supply Harmonics, Power Controlled DC Drives, Sources of and closed loop control scheme.  Supply Harmonics, Power Controlled DC Drives, Sources of and closed loop control scheme.	k Converter.  r (VSI) and Curand 180° modes of hase voltage regularities, its types a cration with confector and Rippeurrent harmonication techniques: Scontrol, Static ro	rrent Source of operation. llators R and and operating attinuous and ple in motor in chopper,	(9)
Unit III Unit IV Unit V	angle control, Sin controlled and ful Chopper: Buck,  Inverters: Single Inverter (CSI), th AC voltage control RL load – range oprinciple.  DC Drives: Phadiscontinuous mocurrent; Chopper Converter Ratings  AC DRIVES: Incontrol, Variable is control and Slip p	gle phase half wave-controlled red I controlled bridge rectifiers. Boost, Buck- Boost regulator, Cure phase Voltage Source Inverte ree phase VSI and CSI – 120° a rollers: Single phase and three plants of control, Single phase cyclo-converse controlled DC-Drives: Opendes, Supply Harmonics, Power Controlled DC Drives, Sources of and closed loop control scheme.  Supply Harmonics, Power Controlled DC Drives, Sources of and closed loop control scheme.	k Converter.  r (VSI) and Curand 180° modes of hase voltage regularities, its types a cration with confector and Rippeurrent harmonication techniques: Scontrol, Static rollip compensation	rrent Source of operation. llators R and and operating attinuous and ple in motors in chopper, stator voltage tor resistance in technique.	(9) (9)
Unit III Unit IV Unit V Text Books	angle control, Sin controlled and ful Chopper: Buck, Inverters: Single Inverter (CSI), th AC voltage control RL load – range of principle.  DC Drives: Phadiscontinuous modurrent; Chopper Converter Ratings  AC DRIVES: Incontrol, Variable to control and Slip polymers.  Mohammad H Ras 4th edition 2017	gle phase half wave-controlled red l controlled bridge rectifiers. Boost, Buck- Boost regulator, Cure phase Voltage Source Inverte ree phase VSI and CSI – 120° a rollers: Single phase and three plase control, Single phase cyclo-converse controlled DC-Drives: Opendes, Supply Harmonics, Power Controlled DC Drives, Sources of and closed loop control scheme. Succeeding the control of the control o	k Converter.  r (VSI) and Curand 180° modes of hase voltage regularities, its types a cration with confector and Rippeurrent harmonical trol techniques: Scontrol, Static rossilip compensation	rrent Source of operation. llators R and and operating attinuous and ple in motors in chopper, stator voltage tor resistance in technique.	(9) (9)

1	M Singh, K Khanchandani "Power Electronics"  2nd Edition	on, 2017
2	Bimal K. Bose, "Power Electronics and Motor Drives: Ad	Ivances and Trends" 2nd Edition, 2020
3	Bogdan M. Wilamowski, J. David Irwin "Power Electron	nics and Motor Drives" 1st Edition, 2017
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1	https://nptel.ac.in/courses/117/106/117106034/	A Property of the first transfer
2	https://nptel.ac.in/courses/108108076/	Align Plant

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BEE33503	Course Outcomes of the the base of the course of the cours	CL <sup>1</sup>
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	<b>Distinguish</b> 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

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

	Third Year (So	emester-V) B. Tech. Electric	cal Engineering		
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Teaching S	Scheme	Total Mark the Company of the Compan	Examination Sch	ieme	4.5 188
Lectures	2 Hrs/week	berg a location of a same and	CT	1	5
Tutorial	0 Hrs/week		CA	5	5
Total Cred	lit 2	er e, gje og grefting til de kritisk og digte. Er en en en er er er	ESE	3	0
	1973 155	_adminassaultan_esesc_es_es_des	Total	5	0
		outgrapes and the larger state.	Duration of ESE:	02 Hrs 00	Min.
Course Ol	bjectives:				and the second second second second
1	industrial, Comme	principles and practices of energercial, and residential settings.			
2	efficiencies, and d	ts, learn techniques for assessing eveloping strategies for optimizing	g energy usage.		
3		edge and skills necessary to conduve energy management plans.	ict comprehensive en	nergy audi	its and
Course Con	tents	·	***************************************		Hour s
Unit I	scenario. Global of management, ener Carbon foot prints	Management and Conservation: environmental concerns, Climate rgy demand and supply, economic Energy Conservation: Basic concertation, agricultural, service and in buildings.	Change, Concept o analysis; Carbon Treepts, Energy conser	f energy rading & vation in	(9)
Unit II	(audit) approach performance, ma efficiencies, opti- substitution; Ener	efinition, need, and types of energy: Understanding energy costs, atching energy use to require mizing the input energy require gy audit instruments; Energy Coenergy managers and auditors	bench marking, ment, maximizing irements; Fuel &	energy system energy	(9)
Unit III	Key elements; For formulation, ratif management, top responsibilities of Information system Training and plantargeting; Element Techniques: energy (CUSUM).	anning, Monitoring and Targeting ce field analysis; Energy policy purication; Organizing the manage of management support, accountability nodesigning barriers, strategies; Manning. Monitoring and Targeting ts of monitoring & targeting; Day consumption, production, cun	arpose, perspective, ement: location of gerial function, ro; Motivation of emarketing and community in and information	contents, f energy oles and apployees: micating: toring & analysis:	(9)
Text Books					
1		gy Audits and Management Amit			
2	Energy Manageme	ent Handbook Wayne C. Turner W	ilev Inter Science P	ublication	

Reference	re 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

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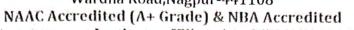
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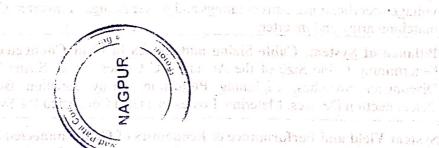
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### Third Year(Semester-V) B. Tech. Electrical Engineering

-				ctives I: BEE33505: Solar F	THE ST CHARLES	OIX	
	Teach	ing S	Scheme	ing Pagement of Page 18	Examina	tion Scheme	2.16 4-5
	Lecture	3	4 Hrs./week	esta Augusta de La esta	СТ	60Ma	rks
	Tutoria	10.00	0 Hrs./week		CA	40Ma	rks
To	otal Cre	dit	4	or see he away lade no appelant see	ESE	60Ma	rks
				i ang dawaka nijinggi tangga at in.	Total	100Ma	
			Ass. of the sec.	KING TELLES (DE LES GERMEN DE MAN TENNES DE LES	Duration of E	SE: 03 Hrs.00	Min.
		y 1:		Course Objective:	9 87 9 7 7	ration.	
1	To gain	the fu	undamental con	ncepts of solar cells and technolog	gies for its utilizati	on.	
2	To enab	le stu	dents, learn tec	chniques for solar PV system desi	gn.	ranidada e	ri we
3				skills necessary for installations of		Solar PV Sys	stem.
	1			Course Contents			Hours
		Solar	r Radiation: Ir	radiance, Irradiance and Peak Sur	n Hours, Solar Rac	liation Data	
	Unit I	Sun-յ	path Diagram, I	Defining the position of the sun, so	olar altitude, geom	etric effects,	(10)
	¥1	tiltinį	g solar modules	s, magnetic north and true north		,	` ,
		PVC	Cells: Introduct	ion, Characteristic of a Solar Cell,	Power Characteris	stic of a solar	9
1	Unit II	cell,	Fill Factor and	Equivalent Solar Cell Circuit, S	TC and NOCT, Fa	actors which	(10)
		modi	ules electrical	ance of solar cells, manufactur protection, module reliability	e of solar cells,	commercial	
		Inve	rters: Purpose	of inverters, grid connected inve	rters vs. stand-alo	ne inverters.	
· .	Jnit III	types	s of grids com	nected inverters, PV to inverter	interface, Inverte	er protection	
	Juit III	syste	ms, Power Qu	nality, Monitoring, Inverter Efficiency	ciency, matching	PV array to	(10)
		voita	hing array and	ns, current ratings and power ratir	igs of inverter. Cal	culations for	
				, Cable Sizing and Losses in	Crid Connected	DV/ C	
τ	Unit IV	Dete	rmining Cable	Size of the AC and DC Cables	S Array String Pr	otection and	
		Disco	onnect Switch	nes, Lightning Protection, Arra	ay Junction Box	. PV Main	(10)
		Disc	onnection Devi	ices, Metering, Losses in a Grid C	Connected PV Syst	em.	
		Syste	em Yield and 1	Performance & Economics of G	Frid Connected S	vetomes	
	Unit V	Ener	gy Yield of a S	System, Calculating the Energy	Yield for a PV ori	d Connected	
		Syste	em, Specific Y	ield, Performance Ratio, Simple	e Payback, Deterr	nining Costs	(10)
		Asso	ciated with the	e Whole PV System, Valuing a	a PV System, Ca	lculations of	
		Leve	elized Tariff fro	om a Solar PV System.		,	
	t Books						
1	Grid (	Conne	ected PV Syster	ns Design and Installation, Globa	ıl Sustainable Ener	gy Solutions	Pty. Lt
	USES	India	a Sustainable E	nergy Private Ltd, First Edition 2	018.		
2	Publis	Pnote hers,	ovoltaics - Fun 3 <sup>rd</sup> , Edition 20	damentals, Technologies and A	pplications, Cheta	n Singh Sola	nki, Pł
3				me, 4th Edition, Tata McGraw H	ill 2017		
			0, ,	, and Edition, Tutte Moditary II	111, 2017		

Refe	rence B	Books			
1	Solar Farms: The Earthscan Expert Guide to Design and Construction of Utility-scale Photosystems, Christopher Martell, Routledge Publishers. 2017				
2 Solar Photovoltaic Power Optimization: Enhancing System Performance through Optimization, Michael Ginsberg, Routledge. 2019					
3	Solar I	Photovoltaic Power Systems: Principle, Design and Optimization, Dr. Sundaravad aw hill, Second Edition. 2017	ivelu, Tata		
BEE.	33505	Course Outcomes	CL		
BEE3	3505.1	Analyze Solar Radiation data and measurements using solar radiation geometry.	4		
BEE3.	3505.2	Classify the PV Module Technology on the basis of electrical parameters.	4		
BEE3	3505.3	Determine the optimized array output matching with inverter voltage, current and power rating specifications.	5		
	3505.4	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		
BEE3:	3505.5	Calculate the energy yield of the Grid Connected Solar PV System and performance ratio, economics of the system.	3		

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#### 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

Teaching Scheme		in the second of		<b>Examination Scheme</b>	
Lectures	4 Hrs./week			CT	60Marks
Tutorial	0 Hrs./week		-	CA	40Marks
Total Credit	4	a mar illustration of	si Maringa grid	ESE	60Marks
The second section of the second		esim i kuran kiri	est majoriy or	Total 44	100Marks
			,	Duration of FS	SF: 03 Hrs 00Min

#### **Course Objective:**

- 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
	Electric Heating and Welding: I) Electric Heating: Types and methods of	
Unit I	electrical heating, advantages of electrically produced heat, types & application	(10)
	of electric heating equipment II) Importance, Advantages & Disadvantages of	
	welding, classification of welding processes, Resistance welding, Electric arc	35.1.1
	welding, Ultrasonic welding, electron beam welding, laser beam welding.	1
*	Illumination and Lighting Systems: Nature of light, terms used in illumination,	
Unit II	solid angle, laws of illumination, polar curves, basics of CFL, LED & Plasma,	F - 10 124
	Lux level requirements for various applications, classification of light fittings and	44.0
	luminaries, factors affecting the design of indoor lighting installations, total lumen	(10)
	method of calculation, Lighting design for indoor applications, Outdoor lighting	
	system design for street lighting and flood lighting.	
	Refrigeration & Air conditioning: Terminology, refrigeration cycle,	
Unit III	refrigeration systems (Vapor compression, vapor absorption) domestic	1.00
Ont in	refrigerator, drinking water cooler, desert air cooler. Air conditioning: Factors	(10)
	involved in air conditioning, comfort air conditioning, industrial air conditioning,	(10)
	effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and Central air conditioning.	
	Electric Traction: Traction system, requirement of an ideal traction system,	
Unit IV	different systems for traction, system of railway electrification, comparison	
Cant I y	between AC and DC systems, power supply for electric traction system, overhead	
	equipment (collector gear for overhead equipments, conductor-rail equipment)	(10)
	Speed-Time curve for train movement, crest speed, average speed and schedule	
,	speed, simplified speed-time curve	
	Fans & Pumps: Fans and Blowers: Fan types, fan performance evaluation &	
Unit V	chicient system operation, Ian design & selection criterio, flow control strategies	2 +
	Tall performance assessment energy caving apportunities. D.	(10)
	system characteristics. Pump curves, factors affecting pump performance,	
	27 parity performance,	

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 J. B. Gupta, "Utilization of Electric Power & Electric Traction", Kataria & Sons,1stEdition,2013 H. Partap, "Art and Science of Utilization of Electrical Energy", Dhanpat Rai & Sons, Delhi, 2014 2 Dr N. V. Suryanarayana, "Utilization of Electrical Power", Wiley Eastern Ltd, New Age International 3 Publisher, 2<sup>nd</sup> Edition, 2017. Reference Books E.OpenshawTaylor, "UtilizationofElectricEnergy", TheOrientBlackswan Publisher. 1 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 CL **Course Outcomes** Apply the process of Electric Heating and Welding equipment. BEE33506.1 3 Calculate illumination parameters for specific conditions by using illumination BEE33506.2 3 methods. BEE33506.3 Classify the Refrigeration & Air conditioning with applications. 4

Prof. Practul Ghadge

BEE33506.4

BEE33506.5



Analyze Electric Traction system with its power supply structure.

Select proper rating of DG sets, know the operational factor.

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

<b>Program Electives</b>	I: BEE33507:	High Voltage	Engineering
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Teaching !	Scheme		Examinat	ion Scheme
Lectures	4 Hrs./week		CT	60Marks
Tutorial	0 Hrs./week		CA	40Marks
Total Credit	4		ESE	60Marks
	8	TWO Leggins of	Total	100Marks
			Duration of ESI	E: 03 Hrs.00Min.

#### Course Objective:

- To impart fundamental knowledge about various electrical heating, welding, and illumination systems used in industrial, commercial, and domestic applications.
- To enable students to analyze and design effective lighting schemes for various environments, ensuring optimal illumination and energy efficiency.
- 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	(10)
	di-electrics in practice; B.D.in composite dielectrics.	
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 currents measurement of high frequency and impulse current by resistive shunt (Bifilar strip signally,)	rent; hunt
Text	Books		
1	M. S. N	laidu &V. Kamaraju, "High Voltage Engineering",TMG,5 <sup>th</sup> edition ,2017.	
2	C.L Wa	dhwa," "High voltage Engineering" New Age international, 3rd Edition,2012.	- 14
3	R D Be	gamudre, "EHV AC Transmission", new age international publisher 4th Edition, 201	8.
Refe	rence Bo	ooks	
1		dat and D. Warne, "Advances in high Voltage Engineering" ", Institution of Engineernology publications, 2004.	ering
Use	ful Link		- 13 11 <b>21</b> 22 3
http	s://nptel	.ac.in/courses/108104013	Later Land
https	://archive	e.nptel.ac.in/courses/108/108/108108099/	
BEI	E33506	Course Outcomes	CL
BEE	33506.1	Analyze Breakdown mechanism in Solid, Liquid & Gases medium.	3
BEE:	33506.2	Classify lighting & switching over voltages.	4
BEE:	33506.3	Analyze the behavior of traveling waves on transmission lines.	4
BEE:	33506.4	Distinguish methods of measurement of High voltages and Currents.	4
BEE:	33506.5	Apply appropriate methods and instruments for measuring high AC/DC voltages	3

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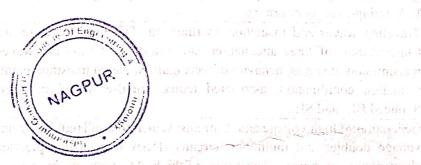
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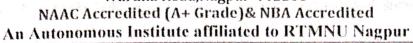
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#### Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441108





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

Teaching	Scheme	Examina	tion Scheme
ectures	2Hrs./week	CA	25 Marks
al Credit		ESE	25 Marks
		Total	50 Martin

L	ectures	2Hrs./week		CA	25 Marks
Total Credit		1 1	green and the second	ESE	25 Marks
- Alleran				Total	50 Marks
				Duration of ESE:	02 Hrs.00 Min.
r. No	List of Exp	periment			CO
1.	Find Effici	iency of Induct	tion Motor Using Blocked Rotor	Test and Load Test	CO1
2.	Test Differ	rent Starting M	lethods of Induction Motor	Dig. st.	CO1
3.	Study Toro	que and Speed	of Single-Phase Induction Motor	****	CO2
4.	Speed con	trol of 3 phase	Slip ring Induction motor by Roto	or resistance Control	CO2
5.	Examine t	he Equivalent	circuit of single phase induction m	notor	CO3
6.	Control Sp	peed of Inducti	on Motor by Adding Rotor Resista	ance	CO3
7.	Demonstra	ate synchroniza	ation test on two Alternator		CO4
8.	Study Tor	que and Speed	of Single-Phase Induction Motor	-	CO4
9.	Demonstra	ate synchroniza	ation test on two Alternator		CO5
10.	Synchroni Digital To		rnators and Real-Time Load Sha	ring Analysis Using	CO5
Text ]	Books				
1	A. E. Fitzg	erald and C. Kir	ngsley, "Electric Machinery", New Yo	ork, McGraw Hill Educ	eation,2013
2	A. E. Clayt	ton andN. N. Ha	ncock, "Performance and design of I	OC machines", CBS Put	olishers, a 2014.
3	M. G. Say,	, 'Performance a	nd design of AC machines", CBS Pu	blishers, 2012.	
Refer	ence Books	š			
1	P. S. Bimb	hra, "Electrical I	Machinery", Khanna Publishers,2011		,
2	I. J. Nagrat	h and D. P. Kot	hari, "Electric Machines", McGraw F	Fill Education, 2017	
Usefu	l Links				
1. ht	tps://nptcl.ac	in/courses/ I I	7/ I 06/ I I 7 I 06034/		
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2. https://nptel.ac. inlcourses/ I 08 I 08076/

Department of Electrical Engineering Tulsiramji ( ) wad - Pa 1 ....ge Of Engineering Am Technology

	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
	Measure Internal Parameters of Single-Phase Induction Motor	5
BEE33508.4	Utilize Synchronization test of Alternator and check the performance by using Digital Simulation	and the second s
BEE33508.5	Conduct Synchronization of Alternators and Evaluate Load Sharing and Stability Using Real-Time Digital Tools.	3

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

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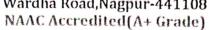
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### An Autonomous Institute affiliated to RTMNU Nagpur

#### Third Year (Semester-V) B. Tech. Electrical Engineering BEE33509: Power Electronics and Drives Lab

eme	g grade in a line of the first	Examina	tion Scheme
Hrs/week	e the first when it is good to tend to	CA	25 Marks

Teaching Scheme			Examination Scheme		e
Practical	2Hrs/week	s the first March of the first of the first	CA		
Total Credit	1		ESE	25 Ma	arks
			Total	50 Ma	arks
4			Duration of E	ESE:3Hrs 00N	Mins
Sr.No.		List of Experimen			CO
1	Determine the c Single Pulse Cor	haracteristics of SCR and study overtr using SCR.	the operation of S	Single Phase	CO1
2	Determine the cl	naracteristics of TRIAC.			C01
3	Construct a single-phase half-controlled Converter and plot its output response			CO2	
4	Analyze and plo	t the wave forms of the Parallel Ir	nverter.		CO3
5	Speed control of separately excited dc motor by varying armature voltage using single phase Fully Controlled Converter			CO4	
6	0 10 10			CO4	
7	Speed control of three-phase induction motor using V/f control			CO5	
	Speed Control of three-phase Slip Ring Induction Motor using Static Rotor Resistance control using Rectifier and Chopper.			CO5	
9	M (- 1.1' 1 ' 1 ' 0 ' 0 ' 1 ' 0 ' 0 ' 1 ' 1 ' 0 ' 0			CO <sub>2</sub>	
10	Modeling and si	mulation of Single Phase H-Bridg	ge inverter using M	IATLAB	CO <sub>3</sub>
<b>Text Books</b>					
1	Mohammad H R Edition,2014	ashid, "Power Electronics: Circuits	Devices and Applica	ations", Pearso	on 4th
2	P. S. Bimbhra, "I	Power Electronics", Khanna Publishe	ers,5thEdition,2012		
3	Ned Mohanetal," 2014	Power Electronics: Converters, App	lications and Design	"Wiley3rd Ed	lition,
Reference B	ooks				-
1	Daniel W Hart	"Power Electronics", McGrawHi	Ill1stEdition, 2011		
2	Joseph Vithayathil, "Power Electronics-Principles and Applications," Mc Graw Hill Inc., New York, 1995.				
3	Vedam Subram Delhi, 1996.	anian, "Power Electronics", New	Age International	(P) Limited,	New

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

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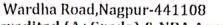
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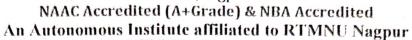
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# Tulsiramji Gaikwad-PatilCollege of Engineering and Technology







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

			(Semester-v) B. Tech. Elec		
		BEC33510	):Digital Electronics and Mi	crocontroller	
	Teaching S	Scheme		Examination Scheme	
Lectures 3Hrs./week			formation One and	CT 30M	arks
	utorial	0Hrs./week		CA 10M	arks
Tot	al Credit	3		ESE 60M	arks
		741 JUNE 841	nga salawaya kuma ay manusur 🗀	Total 100M	larks
				Duration of ESE:03 Hrs.0	0Min.
*5		TEAP 1	Course Objective:	स्तरमञ्जूषा । ज्ञास्तरमञ्जूषा सम्बद्धाः	
			the working principles of vario	us combinational circuits as	nd their
		in different dig		ling die des designs of combin	4: 1
2	circuits.	and recognize v	various sequential components util	lized in the design of combin	national
3	To develop t	he skills to des	ign and validate the operation of v	arious combinational and sec	quential
C	circuits.				
4	i o provide iddressing n	knowleage on lodes port type	the 8051 microcontrollers, coveres, and practical applications.	ing its architecture, function	nalities,
5 7	To explore tl	ne use of Assem	bly language programming for the	8051 microcontrollers, empl	nasizing
i	ts timing, co	ontrol, and cour	nter/timer features in industrial em	bedded systems.	
			Course Contents		Hours
<b>T</b> T •			Number system, Binary Arithmet		
Unit		rs Theorem, Lo gh maps.	ogic Gates, SOP & POS forms, Log	ic Optimization Technique,	(9)
Unit 1			<b>Design:</b> Comparators, Multiplexers hmetic Circuit Design.	, Demultiplexer,	(9)
Unit I		tial Logic Desi unters, Shift reg	ign: Latches, Flip flop – S-R, J-K, sisters.	D, T and Master-Slave JK	(9)
Unit IV  Microcontroller Introduction: Arcl 8051, Applications of 8051, Pin diag Mode, Types of Ports, TEMPI, T PSEN, DPTR, PSW, REGISTER BAN		8051, Pin diagram and Descriptio Ports,TEMPI,TEMP2, ALU, F	n of IC-80851, Addressing	(9)	
Unit	Unit V   Counter and Timer, Th		mming: Interrupt of 8051, Timin TMOD, TCON, PCON Instructions, Introduction to Arm-7 (Embedon)	on Set of 8051, Assembly	(9)
Text B					
1	Fundament	tals of Digital C	Circuits, A. Kumar, Prentice Hall I	ndia, 2016.	
2	Modern Di	gital Electronic	s, R. P. Jain, McGraw Hill Educat	tion, 2019.	
2	7 10	1 - P 1	1 020		, , , , , , , , , , , , , , , , , , ,

Ramesh Gaonkar, Fundamentals of Microcontroller and Applications in Embedded System, Thomson Delmar Learning, 2017

> Department Of Elect Tulsiramj 6 Of Engineering

Refe	rence 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.			
Usefu	nl Links			
https:/	//onlinecourses.nptel.ac.in/noc21_ee10/preview			
-	//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.		
BEC33510.3	Design combinational and sequential circuits and verify functionality.		
BEC33510.4	Analyze Microcontroller 8051, it's Features, real time Applications, Addressing mode & Types of Ports.		
BEC33510.5	<b>Develop</b> 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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# NAAC Accredited (A+ Grade)& NBA Accredited An Autonomous Institute affiliated to RTMNU Nagpur

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

**REE33511:Digital Electronics and Microcontroller Lab** 

	BEE33511:	Digital Electronics and Mic	rocontroller La	b		
Teaching Scheme		en e	Examinat	<b>Examination Schem</b>		
Practical	2Hrs./week	e des series d'Origine Une la	CA CA	25 M		
Total Credit	1		ESE	25 M	arks	
		i san in massif of the rate i	Total		50 Marks	
32			Duration of ES	E:3Hrs.001	Mins	
Sr.No.	Sidal a Parincia	List of Experiment	The I get the	Ž.	CO	
1	Verification of	the truth tables of TTL gates.	o staniel articles in the	1 1271	CO1	
2	Verify the NAN	ND and NOR gates as universal log	gic gates.		CO1	
3		ification of the truth tables of Half		cuits.	CO2	
4		ification of the truth tables of Half			CO2	
5		the truth table of the Multiplexer 7			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)			CO <sub>3</sub>		
10	Write Assembly language program to add two hexadecimal and decimal number			CO4		
111	Write the Asser	mbly language program for square	wave generator by	using	CO4	
12	(Micro vision -5	language program to addition of two		pr	CO5	
13	Write Assembly (Micro vision -5	language program to addition of two	8- bit data using Keil	l software	CO5	
Text Books						
1	Fundamentals of	of Digital Circuits, A. Kumar, Pren	tice Hall India, 201	6.		
2	Modern Digital	Electronics, R. P. Jain, McGraw I	Hill Education, 200	9.		
3	Ramesh Gaonkar, Fundamentals of Microcontroller and Applications in Embedded			ded		
Reference Be	ooks				F	
1	1 Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016.			5.		
2	Digital Electron	nic Principles, By Malvino PHI, 3	Edition. 2014			
3		s: Principles and Applications, Aji		Pvt. Ltd	2011.	
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BEC33511	Course Outcomes:		
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.		
BEC3511.4	Analyze Microcontroller 8051, it's Features, real time Applications, Addressing mode & Types of Ports		
BEC3511.5	<b>Develop</b> 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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