REGULATION 2017

COURSE STRUCTURE

SYLLABUS

DEPARTMENT OF ELECTRICAL & ELECTRONICSENGINEERING

GIET (AUTONOMOUS), GUNUPUR – 765022

(Affiliated to Biju Patnaik University of Technology, Rourkela)

Accredited by NAAC with 'A' Grade with a CGPA of 3.28/4.00
Accredited by NBA

4 Year B.Tech Degree Programme

Regulation 2017

Syllabus Structure [R-17 EEE]

FIRST YEAR

I SEMESTER [11-39]									
Sl. No.	Course Category	Course Code	Course Title	Hours per week			Credits	ISA	ESA
				L	T	P			
			THEORY						
1	BS	BBSBS1010	Engineering Mathematics-I	3	1	0	4	50	100
2	BS	BBSBS1021	Engineering Physics	3	0	0	3	50	100
		BBSBS1022	Engineering Chemistry						
3	ES	BBSES1031	Basics of Mechanics	3	0	0	3	50	100
		BBSES1032	Basics of Thermodynamics						
4	ES	BBSES1041	Basics of Electronics	3	0	0	3	50	100
		BBSES1042	Basics of Electrical Engineering						
5	ES	BBSES1050	Programming in 'C'	3	0	0	3	50	100
6	HS	BBSHS1060	Communicative English-I	2	0	0	2	50	100
			PRACTICAL / SESSIONAL						
7	BS	BBSBS1121	Engineering Physics Lab	0	0	2	1	50	-
		BBSBS1122	Engineering Chemistry Lab						
8	ES	BBSES1141	Basics of Electronics Lab	0	0	2	1	50	-
		BBSES1142	Basics of Electrical Engineering Lab						
9	ES	BBSES1150	Programming in 'C' Lab	0	0	2	1	50	-
10	HS	BBSHS1160	Communicative English-I Lab	0	0	2	1	50	-
11	ES	BBSES1171	Engineering Drawing	0	0	2	1	50	-
		BBSES1172	Engineering Workshop						
12	MC	BBSHS1180	NSS / NCC	0	0	2	1	50	-
		TOTAL:		**17**	**1**	**12**	**24**	**600**	**600**
			SEMESTER MARKS: 1200	**SEMESTER CREDITS: 24**					
			CUMULATIVE MARKS: 1200	**CUMULATIVE CREDITS: 24**					

[R-17 EEE] II SEMESTER [40-48]									
Sl. No.	**Course Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**ISA**	**ESA**
				L	**T**	**P**			
			THEORY						
1	BS	BBSBS2010	Engineering Mathematics-II	3	1	0	4	50	100
2	BS	BBSBS1021	Engineering Physics	3	0	0	3	50	100
		BBSBS1022	Engineering Chemistry						
3	ES	BBSES1031	Basics of Mechanics	3	0	0	3	50	100
		BBSES1032	Basics of Thermodynamics						
4	ES	BBSES1041	Basics of Electronics	3	0	0	3	50	100
		BBSES1042	Basics of Electrical Engineering						
5	ES	BBSES2050	Data Structure	3	0	0	3	50	100
6	HS	BBSHS2060	Communicative English-II	2	0	0	2	50	100
			PRACTICAL / SESSIONAL						
7	BS	BBSBS1121	Engineering Physics Lab	0	0	2	1	50	-
		BBSBS1122	Engineering Chemistry Lab						
8	ES	BBSES1141	Basics of Electronics Lab	0	0	2	1	50	-
		BBSES1142	Basics of Electrical Engineering Lab						
9	ES	BBSES2150	Data Structures using 'C++' Lab	0	0	2	1	50	-
10	HS	BBSHS2160	Communicative English-II Lab	0	0	2	1	50	-
11	ES	BBSES1171	Engineering Drawing	0	0	2	1	50	-
		BBSES1172	Engineering Workshop						
12	MC	BBSHS2180	YOGA / Project Work	0	0	2	1	50	-
		TOTAL:		**17**	**1**	**12**	**24**	**600**	**600**
			SEMESTER MARKS: 1200	**SEMESTER CREDITS: 24**					
			CUMULATIVE MARKS: 2400	**CUMULATIVE CREDITS: 48**					

SECOND YEAR

[R-17 EEE] III **SEMESTER [49-67]**									
S. N.	**Course Category**	**Subject Code**	**Subjects**	**L**	**T**	**P**	**C**	**ISA**	**ESA**
1	PC	BEEPC3010	Electrical Machines-I	3	1	0	4	50	100
2	PC	BEEPC3020	Network Theory	3	0	0	3	50	100
3	PC	BEEPC3030	Analog & Digital Circuits	3	0	0	3	50	100
4	BS	BBSBS3040	Engineering Mathematics-III	3	1	0	4	50	100
5	ES	BCSES3051	OOPSthrough JAVA	3	0	0	3	50	100
		BCSES3052	Database Management Systems						
6	BS/HS	BBSBS3061	Environmental Engineering & Safety	3	0	0	3	50	100
		BMSHS3062	Engineering Economics and Costing						
PRACTICAL / SESSIONAL									
7	PC	BEEPC3110	Electrical Machines-1 Lab	0	0	2	1	50	-
8	PC	BEEPC3120	Network theory Lab	0	0	2	1	50	-
9	PC	BEEPC3130	Analog & Digital Circuits Lab	0	0	2	1	50	-
10	ES	BCSES3151	JAVA Programming Lab	0	0	2	1	50	-
		BCSES3152	Database Management Systems Lab						
			Total	**18**	**2**	**8**	**24**	**500**	**600**
Semester Marks: 1100				**Semester Credits:24**					
Cumulative Marks: 3500				**Cumulative Credits: 72**					

[R-17 EEE] IV SEMESTER [68-79]									
S. N.	**Course Category**	**Subject Code**	**Subjects**	**Hours per Week**			C	**ISA**	**ESA**
				L	T	P			
1	PC	BEEPC4010	Electrical Machines -II	3	1	0	4	50	100
2	PC	BEEPC4020	Control Systems - I	3	0	0	3	50	100
3	PC	BEEPC4030	Electrical & Electronic Instrumentation	3	0	0	3	50	100
4	PC	BEEPC4040	Electromagnetic Fields	3	1	0	4	50	100
5	ES	BCSES3051	OOPSthrough JAVA	3	0	0	3	50	100
		BCSES3052	Database Management Systems	3	1	0	4	50	100
6	BS/ HS	BBSBS3061	Environmental Engineering & Safety	3	0	0	3	50	100
		BMSHS3062	Engineering Economics and Costing						
PRACTICAL / SESSIONAL									
7	PC	BEEPC4110	Electrical Machines-II Lab	0	0	2	1	50	-
8	PC	BEEPC4120	Control Systems Lab	0	0	2	1	50	-
9	PC	BEEPC4130	Electrical & Electronic Instrumentation Lab	0	0	2	1	50	-
10	ES	BCSES3151	JAVA Programming Laboratory	0	0	2	1	50	-
		BCSES3152	Database Management Systems Laboratory	0	0	2	1	50	
			Total	**18**	**2**	**8**	**24**	**500**	**600**
			Semester Marks: 1100	**Semester Credits: 24**					
			Cumulative Marks: 4600	**Cumulative Credits: 96**					

[R-17 EEE] V SEMESTER [100-101]									
S.N.	Course	Subject Code	Course Title	Hours per week			C	ISA	ESA
				L	T	P			
THEORY									
1	PC	BEEPC5010	Power Electronics	3	1	0	4	50	100
2	PC	BEEPC5020	Micro Processors & Micro Controllers	3	0	0	3	50	100
3	PC	BEEPC5030	Electrical Power Transmission & Distribution	3	0	0	3	50	100
Professional Elective – I (Any One)									
4	PE	BEEPE5041	Control Systems - II	3	0	0	3	50	100
		BEEPE5042	Computer aided design of Electrical Machines						
		BEEPE5043	Power plant economics and tariff regulations						
		BEEPE5044	Photovoltaic, Wind & Hybrid Energy Systems						
5	OE	B**OE50**	**Open Elective**	3	0	0	3	50	100
6	BS/HS	BBSBS5061	Optimization in Engineering	3	0	0	3	50	100
		BMSHS5062	Organizational Behavior						
Laboratories									
7	PC	BEEPC5110	Power Electronics Lab	0	0	2	1	50	-
8	PC	BEEPC5120	Micro Processors & Micro Controllers Lab	0	0	2	1	50	-
9	PC	BEEPC5130	Electric Power generation, Transmission & Distribution Lab	0	0	2	1	50	-
10	PC	BEEPC5140	*Skill development project & hands on training	0	0	2	1	50	-
11	PC	BEEPC5150	^Summer Internship	0	0	-	1	50	-
Total				**18**	**1**	**8**	**24**	**550**	**600**
Semester Marks: 1150				**Semester Credits: 24**					
Cumulative Marks: 5750				**Cumulative Credits: 120**					

*College should conduct at least one NSDC program under this category.

^ Four (4) weeks duration summer internship either in industry or in an R&D organization, including educational institutes with excellent research culture. The student is expected to submit a formal report at the end of the programme.

[R-17 EEE] VI SEMESTER [102-117]									
S.N.	**Course Category**	**Subject Code**	**Subject**	**Hours per week**			**C**	**ISA**	**ESA**
				L	**T**	**P**			
1	PC	BEEPC6010	Switch gear & Protection	3	1	0	4	50	100
2	PC	BEEPC6020	Electric drives	3	0	0	3	50	100
3	PC	BEEPC6030	Communication Engineering	3	0	0	3	50	100
Professional Elective – II (Any One)									
4	PE	BEEPE6041	Smart Grid	3	0	0	3	50	100
		BEEPE6042	Traction						
		BEEPE6043	Advanced Power Electronics						
		BEEPE6044	Electrical power quality						
5	OE	B**OE60**	**Open Elective**	3	0	0	3	50	100
6	BS/HS	BBSBS5061	Optimization in Engineering	3	0	0	3	50	100
		BMSHS5062	Organizational Behavior						
Laboratories									
7	PC	BEEPC6110	Energy management & Auditing lab	0	0	2	1	50	-
8	PC	BEEPC6120	Electric drives	0	0	2	1	50	-
9	PC	BEEPC6130	Photovoltaic & Wind Energy Systems Lab	0	0	2	1	50	
10	PC	BEEPC6140	Advanced Lab 1 – IOT Lab	0	0	2	1	50	-
11	HS	BTPHS6160	# Soft skills & Employability skills	0	0	2	1	50	-
Total				**18**	**1**	**8**	**24**	**550**	**600**
Semester Marks: 1150				**Semester Credits: 24**					
Cumulative Marks: 6900				**Cumulative Credits: 144**					

 # To be conducted by Training & Placement department of the college

[R-17 EEE] VII SEMESTER [118-139]									
S.N.	**Course Category**	**Subject Code**	**Subject**	**Hours per Week**			**C**	**ISA**	**ESA**
				L	**T**	**P**			
1	PC	BEEPC7010	Power System Operation & Control	3	0	0	3	50	100
2		BEEPC7020	FACTS	3	0	0	3	50	100
		Professional Elective – III *(Any one)*							
3	PE	BEEPE7031	Introduction to Robotics	3	0	0	3	50	100
		BEEPE7032	Advanced Power Systems						
		BEEPE7033	Digital Signal Processing						
		BEEPE7034	Neural Networks & Fuzzy Logic						
		Professional Elective – IV *(Any one)*							
4	PE	BEEPE7041	Generalized Theory of Electric Machines	3	0	0	3	50	100
		BEEPE7042	Principles of Entrepreneurship						
		BEEPE7043	Fundamentals of Cloud Computing						
		BEEPE7044	Big Data analytics						
5	OE	B**OE70**	**Open Elective**	3	0	0	3	50	100
Practical/ Sessional									
6	PC	BEEPC7110	Power System Operation & Control lab	0	0	2	1	50	-
7	PC	BEEPC7140	Advanced lab-II: Simulation	0	0	2	1	50	-
8	PC	BEEPC7150	Mini Project / Projects on Internet of Things	0	0	6	3	150	-
9	PC	BEEPE7160	## Massive Open Online Course (MOOC)	0	0	4	2	100	-
10	PC	BEEPC7170	^Summer Internship - II	0	0	2	1	50	-
Total				**15**		**12**	**23**	**650**	**500**
Semester Marks: 1150				**Semester Credits: 23**					
Cumulative Marks: 8050				**Cumulative Credits: 167**					

##Meeting with the global requirements, to inculcate the habit of self-learning and in compliance with ^UGC guidelines, Massive Open Online Course (MOOC) have been introduced as electives and it can be selected with the latest industrial requirement.

[R-17 EEE] VIII SEMESTER

S. No.	Course Category	Subject Code	Course Title	Hours per week			C	ISA	ESA
				L	T	P			
		Theory							
		Professional Elective-V *(Any One)*							
1	PE	BEEPE8011	Illumination Engineering	3	0	0	3	50	100
		BEEPE8012	Computer Networks						
		BEEPE8013	Industrial safety & Hazard management						
		BEEPE8014	Satellite Communication						
		Professional Elective - VI *(Any One)*							
2	PE	BEEPE8021	Fundamentals of Global Positioning system	3	0	0	3	50	100
		BEEPE8022	Biomedical Instrumentation						
		BEEPE8023	Green Buildings Technology						
		BEEPE8024	Hybrid Electric Vehicles						
3	OE	B**OE80**	**Open Elective**	3	-	-	3	50	100
		PRACTICAL/SESSIONAL							
4	PC	BEEPC8150	Major project/ Industrial project /Startup training cum project	0	0	12	6	300	-
5	PC	BEEPC8180	Seminar and Technical Writing	0	0	4	2	100	-
6	PC	BEEPC8190	Comprehensive VIVA	0	0	4	2	100	-
				9	**0**	**20**	**19**	**650**	**300**
Semester Marks: 950				**Semester Credits: 19**					
Cumulative Marks: 9000				**Cumulative Credits: 186**					

CREDIT REPRESENTATION

Lectures (hrs/wk/Sem.)	Tutorials (hrs/wk/Sem.)	Practical Work (hrs/wk/Sem.)	Credits (L: T: P)	Total Credits
3	0	0	3:0:0	3
3	1	0	3:1:0	4
0	0	2	0:0:2	1
0	0	4	0:0:4	2
0	0	6	0:0:6	3
0	0	12	0:0:12	6

SCHEME OF INSTRUCTION SUMMARY

SL. NO.	COURSE WORK - SUBJECTS AREA	CREDITS / SEMESTER								TOTAL CREDITS	%
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities, Social & Management Study (HS)	3	3	-	3	-	4	-	-	13	7
2	Basic Sciences (BS)	8	8	7	-	3	-	-	-	26	14
3	Engineering Sciences (ES) / Basic Engineering (BE)	12	12	4	4	-	-	-	-	32	17
4	Professional Core (PC)	-	-	13	17	13	14	5	-	62	33
5	Professional Electives (PE)	-	-	-	-	3	3	11	6	23	12
6	Open Electives (OE)	-	-	-	-	3	3	3	3	12	7
7	Project Work, Seminar and/or Internship in Industry or elsewhere	-	-	-	-	2	-	4	10	16	9
8	Mandatory Courses (MC)	1	1	-	-	-	-	-	-	2	1
	TOTAL	**24**	**24**	**24**	**24**	**24**	**24**	**23**	**19**	**186**	**100**

DISTRIBUTION OF CREDITS AND MARKS

Year	Semester	THEORY				PRACTICAL / SESSIONAL			Total	
		No. of Subjects	Credits	ISA	ESA	No. of Labs	Credits	ISA	Credits	Marks
I Year	I Sem	6	18	300	600	6	6	300	24	1200
	II Sem	6	18	300	600	6	6	300	24	1200
II Year	III Sem	6	20	300	600	4	4	200	24	1100
	IV Sem	6	20	300	600	4	4	200	24	1100
III Year	V Sem	6	19	300	600	5	5	250	24	1150
	VI Sem	6	19	300	600	5	5	250	24	1150
IV Year	VII Sem	5	15	250	500	5	8	400	23	1150
	VIII Sem	3	9	150	300	3	10	500	19	950
TOTAL		44	138	2200	4400	38	46	2400	186	9000

SECOND YEAR

III SEMESTER									
S. N.	**Course Category**	**Subject Code**	**Subjects**	**L**	**T**	**P**	**C**	**ISA**	**ESA**
1	PC	BEEPC3010	Electrical Machines-I	3	1	0	4	50	100
2	PC	BEEPC3020	Network Theory	3	0	0	3	50	100
3	PC	BEEPC3030	Analog & Digital Circuits	3	0	0	3	50	100
4	BS	BBSBS3040	Engineering Mathematics-III	3	1	0	4	50	100
5	ES	BCSES3051	OOPSthrough JAVA	3	0	0	3	50	100
		BCSES3052	Database Management Systems						
6	BS/HS	BBSBS3061	Environmental Engineering & Safety	3	0	0	3	50	100
		BMSHS3062	Engineering Economics and Costing						
PRACTICAL / SESSIONAL									
7	PC	BEEPC3110	Electrical Machines-1 Lab	0	0	2	1	50	-
8	PC	BEEPC3120	Network theory Lab	0	0	2	1	50	-
9	PC	BEEPC3130	Analog & Digital Circuits Lab	0	0	2	1	50	-
10	ES	BCSES3151	JAVA Programming Lab	0	0	2	1	50	-
		BCSES3152	Database Management Systems Lab						
			Total	**18**	**2**	**8**	**24**	**500**	**600**
Semester Marks: 1100				**Semester Credits:24**					
Cumulative Marks: 3500				**Cumulative Credits: 72**					

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC3010	**Electrical Machines-I**	3	1	0	4	A

Course Educational Objectives

CEO1	To know basic construction of DC generators, motors and transformers
CEO2	To analyze the working principle the DC generators, motors and transformers.
CEO3	Draw the different characteristic curves of DC generators and motors.
CEO4	To conduct various types test on DC generators, motors and transformers.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Analyze the constructional features and operation of DC machines
CO2	Investigate the characteristics of DC generators and motors
CO3	Analyze the differences in operation of different DC machine configurations.
CO4	Understand the concepts of single phase and three phase transformers
CO5	Conduct different tests on DC generators, motors and transformers.
CO6	Understand the concepts of 3-phase transformers and various configuration of connections

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1											1		
CO2	1	1											2		
CO3	2	1											1		
CO4	1	2													
CO5	2	2													
CO6	2	2											2		
Avg.	1.67	1.5											1.5		

SYLLABUS

UNIT:1 **(10 Hours)**

Basic construction and operation of a DC machine, induced EMF in an armature coil. Armature winding– Elementary armature coil and commutator, lap and wave windings, construction features of commutator, linear commutation, Derivation of back EMF equation, armature, armature reaction, air gap flux density distribution with armature reaction

UNIT:2 **(12 Hours)**

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series

motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

UNIT:3 **(14 Hours)**

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

UNIT:4 **(14 Hours)**

Three phase transformers: Constructional features, As a single unit and as a bank of three single phase transformers. Three-Phase Transformer connections, The per unit system for Three Phase Transformer, Transformer Ratings and Related problems, Two Single-Phase Transformers connected in Open Delta (V-Connection) and their rating. T-Connection (Scott Connection) of Two Single-Phase Transformers. Transformer Three phase Connections: Various Phase Displacements (0o, 180o, +30o and -30o), Connection Diagrams and Phasor Diagrams of various Vector Groups (Yy0, Dd0, Dz0, Yy6, Dd6, Dz6, Yd1, Dy1, Yz1, Yd11, Dy11, and Yz11)

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books/References:

1. *A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.*
2. *A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.*
3. *M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.*
4. *P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.*
5. *I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC3020	**Network Theory**	3	0	0	3	A

Course Educational Objectives

CEO1	Prepare the students to have a basic knowledge in the analysis of Electric Networks.
CEO2	Solve the given circuit with various theorems and methods.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Solve complex networks by using various Network Theorems
CO2	Analyzing Laplace transformation and two port networks with steady state and transient analysis
CO3	Identifying the significance of Poles and Zeros in Network functions
CO4	Solving Fourier series analysis and designing the Filter circuits
CO5	Evaluating the electrical networks with Network synthesis

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2											1		
CO2	3	3											1		
CO3	2	2											2		
CO4	3	3											1		
CO5	2	2											1		
Avg.	2.4	2.4											1		

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Unit – I **[11Hrs]**

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's Theorem, Reciprocity Theorem, Maximum Power transfer theorem, Tellegen's theorem, Millman's theorem, Compensation theorem.

Coupled Circuits: Coupled Circuits, Dot Convention for representing coupled circuits, Coefficient of coupling.

Resonance: Band Width and Q-factor for series and parallel resonant circuits.

Unit - II **[12Hrs]**

Laplace Transform & its Application: Introduction to Laplace Transform, Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform, Application of Laplace transform: Circuit Analysis (Steady State and Transient).

Two Port Network Functions& Responses: z, y, ABCD and h-parameters, Reciprocity and Symmetry, Interrelation of two-port parameters, Interconnection of two-port networks.

Network Functions: Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots.

Unit – III [12 Hrs]

Fourier Series& its Application: Fourier series, Fourier analysis and evaluation of coefficients, Steady state response of network to periodic signals, Fourier transform and convergence, Fourier transform of some functions.
Passive Filter: Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response

Unit – IV **[12 Hrs.]**

Network Synthesis: Realizability concept, Hurwitz property,
positive realness, properties of positive real functions, Synthesis of R-L, R-C and L-C driving point functions in Foster and Cauer forms.
Network Topology: Graph of a network, Concept of tree, Incidence matrix, Tie-set matrix, Cut-set matrix, Formulation and solution of network equilibrium equations on loop and node basis

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. *Fundamentals of Electric Circuits – Alexander &Sadiku– Tata McGraw Hil,5th Editionl.*
2. *Circuits & Networks: Analysis, Design and Synthesis- Sukhija&Nagsarkar- Oxford*

Reference Book:

1. *Network Analysis – M E Van Valkenburg – Pearson Education, 3rd Edition.*
2. *Network Synthesis – M E Van Valkenburg – Pearson Education.*
3. *Network Analysis and Synthesis – Franklin F. Kuo – Wiley Student Edition.*
4. *Linear Circuits Analysis and Synthesis – A Ramakalyan – Oxford University Press.*
5. *Problems & Solutions in Electric Circuit Analysis – Sivananda&Deepa – Jaico Book.*
6. *Theory and problem of electrical circuits, Schaum's Outline Series, TMH – Joseph A. Edminister, MahmoodMaqvi.*
7. *Electric Circuits – David A.Bell – Oxford, 7th Edition, 2015.*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC3030	**Analog & Digital Circuits**	3	0	0	3	A

Course Educational Objectives

CEO1	To provide concepts that underpins the disciplines of Analog circuits, digital electronics and Microprocessor systems.
CEO2	To provide basic knowledge of designing Analog and digital circuits
CEO3	To provide the concept of various components

Course Outcomes

CO1	Knowledge and Awareness of various components.
CO2	Design of stable Analog circuits and Circuit simulation.
CO3	Binary and hexadecimal calculations and conversions.
CO4	Design of combinational and sequential circuits

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2												
CO2	1	1	2												
CO3	1	1	2												
CO4	1	1	2												
Avg.	1	1.25	2												

SYLLABUS

Unit – I **[11Hrs]**

Voltage Regulator and components: Zener diode. Series and ShuntRegulator. Regulator ICs 78XX, IC 79XX.Light Emitting diode(LED),Schottky diode, Varactor diode, power diode, Photodiodes, LiquidcrystalDisplays, Solar cells, Thermistor

Biasing of BJT: DC operating point, BJT characteristics & parameters, all biasing circuits, analysis of above circuits and their design, variation of operation point and its stability. Differential Amplifier, constant current source, current mirror. Introduction to FET and comparison with BJT

Unit - II **[12Hrs]**

Operational Amplifiers and linear applications: Block diagram representation, Ideal Op-amp, Equivalent circuit, Open-loop configuration, Transfer characteristics. Op-amp with negative feedback, Frequency response. Op-amp IC 741 specifications. Basic op-amp applications: Adder, Scalar, Subtractor, Difference amplifier, I-V converter, V-I converters, Integrator, Differentiator, Instrumentation amplifier using 2 and 3 op-amp stages. IC 555 Timer, Astable, and MonostableMultivibrator.

Unit – III [12 Hrs]

Number Systems and Codes: Binary, Octal, Decimal and Hexadecimal number Systems and their

conversion, Binary Addition and Subtraction ,Gray Code, BCD Code, Excess-3 code, ASCII Code. Boolean Algebra and Logic Gates: Theorems and Properties of Boolean Algebra, Standard SOP and POS form, Reduction of Boolean functions using Algebric method, K -map method (2,3,4 Variable). Basic Digital Circuits: NOT,AND,OR,NAND,NOR,EX-OR,EX-NOR Gates. Combinational Logic Design: Introduction, Half and Full Adder, Half and Full Subtractor, Four Bit Binary Adder, One digit BCD Adder, code conversion, Multiplexers and Demultiplexers, Decoders, 4-bit Magnitude Comparator IC 7485 and ALU IC74181.

Unit – IV **[12 Hrs]**

Sequential Logic Design: Flip Flops: SR, D, JK, JK Master Slave and T Flip Flop, Truth Tables and Excitation Tables, Flip-flop conversion. Counters: Design of Asynchronous and Synchronous Counters, Modulo Counters, UP- DOWN counter .IC 74193 Shift Registers: Shift Register IC 7496, SISO, SIPO,PIPO,PISO, Bidirectional Shift Register , Universal Shift Register, Ring and Johnson Counter.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:

1. *Robert L. Boylestad, Louis Nashelsky, "Electronic devices and circuit Theory", PHI*
2. *Ramakant A. Gaikwad, "Op-amp and linear Integrated circuits", PHI*
3. *R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill.*
4. *M. Morris Mano, "Digital Logic and computer Design", PHI.*
5. *J. Bhasker." VHDL Primer", Pearson Education*

Reference Book:

1. *Martin s. Roden, Gordon L. Carpenter, William R. Wieserman "Electronic Design-From Concept to Reality", Shroff Publishers and Distributors.*
2. *D.royChoudhury,shailB.jain, "Linear integrated Circuits", New age International Publisher.*
3. *SubrataGhosal, "Digital Electronics", Cengage Learning.*
4. *Anil K. Maini, "Digital Electronics Principles and Integrated Circuits", Wiley India*
5. *Donald p Leach, Albert Paul Malvino, "Digital principles and Applications", Tata McGraw Hill.*

Subject Code	Name of the Subject	L	T	P	C	QP
BBSBS3040	**ENGINEERING MATHEMATICS - III**	3	1	0	4	A

Course Educational Objectives

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	To know Analytic function and their properties.
CO2	To Evaluate Real Integrals by using residue integration method.
CO3	To apply numerical methods in Engineering Mathematical Problems
CO4	To investigate Probability distribution problems andleast square method to fit a curve and to evaluate the correlation coefficient and regression lines for the data.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2													
CO2	1	3													
CO3	1	3													
CO4	2	3													
Avg.	1.5	2.75													

SYLLABUS

Unit – I **[11Hrs]**

Complex Analysis:

Analytic function, Cauchy-Riemann equations, Harmonic Function, Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula.

Unit - II [12Hrs]

Taylor's series, Laurent's series, Singularities and zeros, Residues, Cauchy Residue theorem, Evaluation of real integrals.

Unit – III [12 Hrs]

Numerical methods:

Errors, Solving of algebraic and transcendental equations by using fixed point iteration and Newton-Raphson's method. : Newton divided difference interpolation,Lagrange interpolation ,Newton's forward and backward interpolation.Numerical Differentiation,Numerical integration:The trapezoidal rule, The simpson's rules, Ordinary differential equation: Modified Euler's method, Runge-kutta methods.

Unit – IV **[12 Hrs]**

PROBABILITY:

Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson and uniform distributions, Normal distribution, Random sampling, Estimation of Parameters (maximum likely hood method),Confidence intervals, Testing of hypothesis ,Acceptance sampling ,Regression and correlation analysis, fitting of straight line by least square method.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. Advanced Engineering Mathematics by E. Kreyszig, Tenth Edition, Willey

2. Numerical Methods by jain and Iyengar.

Reference Books:

1. Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.
2. Higher Engineering Mathematics by B.V.Ramana, McGraw Hills Education
3. Numerical Methods by Dutta and jena.

Subject Code	Name of the Subject	L	T	P	C	QP
BCSES3051	**OOPS through JAVA**	3	0	0	3	A

Course Educational Objectives

CEO1	Programming in the Java programming language
CEO2	Knowledge of object-oriented paradigm in the Java programming language, the use of Java in a variety of technologies and on different platforms.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Knowledge of the structure and model of the Java programming language, (knowledge)
CO2	Use the Java programming language for various programming technologies (understanding)
CO3	Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)
CO4	Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (evaluation)

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2		2										
CO2			2		2										
CO3			2		2										
CO4			2		2										
Avg.			2		2										

SYLLABUS

Unit – I **[11Hrs]**

An introduction Object Oriented Programming, Features of Object Oriented Programming Introduction to Java. Difference between C/C++ and Java, Features of Java, First Java Program, Writing the java program, Compiling the program, JVM and its significance in executing a program?, Architecture of JVM. Understanding, Java Tokens, Datatypes, Operators, Control Structures and Arrays, Conditional Statements, Loops/ Iterators, Jumping Statements, Java Arrays, Multidimensional Arrays, Taking Input from keyboard, Command Line Arguments, Using Scanner Class, Using Buffered Reader class.

Unit - II **[12Hrs]**

Introduction to Classes and Objects. Constructors, static Keyword, this Keyword, Array of Objects, Access Modifiers (Public, Private, Protected, Default). Inheritance, Types of Inheritance and Java

supported Inheritance, super, Polymorphism, Method Overloading, Constructor Overloading, Method Overriding, Dynamic Method Dispatching. String Manipulations. Wrapper classes, Auto boxing and unboxing. Abstract classes, Interfaces, Multiple Inheritance Using Interfaces, Java API Packages, User-Defined Packages, Accessing Packages, Error and Exception Handling, Types of exceptions Hierarchy of Exception classes, try, catch, finally, throw, throws, Commonly used Exceptions and their details ,User defined exception classes.

Unit – III [12 Hrs]

Multithreading , Thread in Java, Thread execution prevention methods. (yield(), join(), sleep()), Concept of Synchronization, Inter Thread Communication, Basics of Deadlock, Demon Thread, Improvement in Multithreading, Inner Classes, Introduction, Member inner class, Static inner class, Local inner class, Anonymous inner class. IO Streams (java.io package) ,Byte Stream and Character Stream, Files and Random Access Files, Serialization, Collection Frame Work (java.util), Util Package interfaces, List, Set, Map.

Unit – IV [12 Hrs]

Applet Introduction, Life Cycle of an Applet, GUI with an Applet, Abstract Window Toolkit (AWT), Introduction to GUI, Description of Components and Containers, Component/Container hierarchy, Understanding different Components/Container classes and their constructors, Event Handling, Different mechanisms of Event Handling, Listener Interfaces, Adapter classes.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. Programming in Java. Second Edition. Oxford higher education. (Sachin Malhotra/ SauravChoudhary)
2. Core Java for beginners. (RashmiKanta Das), Vikas Publication

Reference Book:

1. *JAVA Complete Reference (9th Edition) HerbaltSchelidt.*

Subject Code	Name of the Subject	L	T	P	C	QP
BCSES3052	**Data Base Management Systems**	3	0	0	3	A

Course Educational Objectives

CEO1	To understand the different issues involved in the design and implementation of a database system
CEO2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
CEO3	To understand and use data manipulation language to query, update, and manage a database
CEO4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Interpreting the Database Management concepts, different Data models and architectures with ER to Relational mapping
CO2	Applying and executing the SQL, relational algebra and calculus commands to create and manipulate Database
CO3	Differentiate normal forms for normalization process to construct the consistent Database.
CO4	Design the Database by inspecting concurrency and recovery strategies to make complete DB without confliction and consistent DB in concurrent environment

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1		2										
CO2			1		2										
CO3			1		2										
CO4			2		2										
Avg.			1.25		2										

SYLLABUS

UNIT:1 **(15 Hours)**

Introduction to database Systems, advantages of database system over traditional file system, Basic concepts & Definitions, Database users, Database Language, Database System Architecture, Schemas, Sub Schemas, & Instances, database constraints, 3-level database architecture, Data Abstraction, Data Independence, Mappings, Structure, Components & functions of DBMS, Data models

UNIT:2 **(13 Hours)**

Entity relationship model, Components of ER model, Mapping E-R model to Relational schema, Relational Algebra, Tuple & Domain Relational Calculus, Relational Query Languages: SQL and QBE. Database Design :- Database development life cycle (DDLC), Automated design tools, Functional dependency and Decomposition, Join strategies, Dependency Preservation & lossless Design, Normalization, Normal forms:1NF, 2NF,3NF, and BCNF, Multi-valued Dependencies, 4NF & 5NF. Query processing and optimization: Evaluation of Relational Algebra Expressions, Query optimization, Query cost estimation.

UNIT:3 **(10 Hours)**

Network and Object Oriented Data models, Storage Strategies: Detailed Storage Architecture, Storing Data,

Magnetic Disk, RAID, Other Disks, Magnetic Tape, Storage Access, File & Record Organization, File Organizations & Indexes, Order Indices, B+ Tree Index Files, Hashing Data Dictionary.

UNIT:4 **(12 Hours)**

Transaction processing and concurrency control: Transaction concepts, properties of transaction, concurrency control, locking and Timestamp methods for concurrency control schemes. Database Recovery System, Types of Data Base failure & Types of Database Recovery, Recovery techniques. Fundamental concepts on Object-Oriented Database, Object relational database, distributed database, Parallel Database, introduction to Data warehousing & Data Mining.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. Sudarshan, Korth: Database System Concepts, 6th edition, McGraw-Hill Education

Reference Books:

1. Elmasari&Navathe: Fundamentals of Database System, Pearson Education.
2. Ramakrishnan: Database Management Systems, McGraw-Hill Education.
3. Andrew S. Tanenbaum: Modern Operating Systems, 3rd Edition, Pearson Education.
4. Terry Dawson, Olaf Kirch: Linux Network Administrator's Guide, 3rd Edition O'Reilly edia

Subject Code	Name of the Subject	L	T	P	C	QP
BBSBS3061	**ENVIRONMENTAL ENGINEERING & SAFETY**	3	0	0	3	A

Course Educational Objectives

CEO1	Understanding the concepts of Ecological Concepts and Biotic components
CEO2	Analysing the concepts of Water Treatment and its standards and parameters

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understanding the concepts of Ecological Concepts and Biotic components
CO2	Analysing the concepts of Water Treatment and its standards and parameters
CO3	Understanding the concept of Solid Waste Management and its practical implementation
CO4	Know the Occupational Safety and Health Acts, Safety procedures, Type of Accidents and its preventive actions

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						1	2								
CO2						2	2								
CO3						1	2								
CO4						2	2								
Avg.						1.5	2								

SYLLABUS

Unit – I **[11Hrs]**

Ecological Concepts: Biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Oxygen cycle, Nitrogen cycle etc., Environmental gradients, Tolerance levels of environment factors, Indian Environmental Law. Chemistry in Environmental Engineering: Atmospheric chemistry, Soil chemistry. Biodiversity and its conservation

Unit - II **[12Hrs]**

Water Treatment: water quality standards and parameters, DO and BOD of water. Water treatment processes: Pre-treatment of water, Conventional process, advanced water treatment process.

Waste Water Treatment: pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production.

Air Pollution: Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change – greenhouse gases, non-criteria pollutants, Air pollution meteorology, Atmospheric dispersion. Industrial Air Emission and Control. Flue gas desulphurization, NOx removal, Fugitive emissions. Noise pollution- Noise standards, measurement and control.

Unit – III [12 Hrs.]

Solid Waste Management: Source, classification and composition of MSW, Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous Waste Management: Hazardous waste and their generation, Treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing

Unit – IV **[12 Hrs.]**

Occupational Safety and Health Acts, Safety procedures, Type of Accidents, Chemical and Heat Burns, Prevention of Accidents involving Hazardous substances, Human error. Hazard Control Measures in steel industry, Petroleum Refinery, Pharmaceutical industry. Fire Prevention -Detection, Extinguishing Fire safety, Handling and Storage of Hazardous Materials. Personal Protective Equipment's.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. Environmental Engineering, Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Environmental Engineering by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack
3. Environmental Engineering and Safety ,Raut&Sen Scientific Publishers.
4. Industrial Safety ,Desmukh

Reference Book:

1. Environmental Engineering by Arcadio P. Sincero&Gergoria A. Sincero PHI Publication
2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGrawHill International Edition, 2004
3. Environmental Science, Curringham&Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters &WendellP. Ela - PHI Publication.
6. Industrial Safety Management and Technology, Colling. D A – Prentice Hall, New Delhi.

Subject Code	Name of the Subject	L	T	P	C	QP
BMSHS3062	**Engineering Economics & Costing**	3	0	0	3	A

Course Educational Objectives

CEO1	Analysing the engineering projects with Engineering economics principles
CEO2	Evaluating the projects with financial analysis and its financial viability

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Analysing nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics
CO2	Understanding Cost and revenue concepts, Basic understanding of different market structures,
CO3	Evaluating time value of money- Interest - Simple and compound, nominal and effective rate of interest,Cash flow diagrams, Principles of economic equivalence
CO4	Understanding the concepts of Depreciation and its implementation approaches

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1											2				
CO2											2				
CO3											2				
CO4											1				
Avg.											1.75				

SYLLABUS

Unit – I **[11Hrs]**

Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economicsand Macro Economics.

Demand- Meaning of demand, Demand function, Law of Demand and its exceptions,Determinants of demand, Elasticity of demand & its measurement (Simple numericalproblems to be solved), Supply-Meaning of supply, Law of supply and its exception,Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simplenumerical problems to be solved).

Production-Production function, Laws of returns: Law of variable proportion, Law of returnsto scale

Unit - II **[12Hrs]**

Cost and revenue concepts, Basic understanding of different market structures, Determinationof equilibrium price under perfect competition (Simple numerical problems to be solved),Break Even Analysis-linear approach (Simple numerical problems to be solved).

Banking -Commercial bank, Functions of commercial bank, Central bank, Functions ofCentral Bank.

Inflation-Meaning of inflation, types, causes, measures to control inflation.National Income-Definition, Concepts of national income, Method of measuring nationalincome.

Unit – III [12 Hrs]

Time value of money- Interest - Simple and compound, nominal and effective rate of interest,

Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects-Present worth method, Future worth method, Annualworth method, Internal rate of return method, Cost benefit analysis for public projects.

Unit – IV **[8 Hrs.]** Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculatingdepreciation (Straight line method, Declining balance method), After tax comparison ofproject.
Teaching Methods: Chalk& Board/ PPT/Video Lectures
Text Book: 1. *Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw HillEducation India* 2. *Principles of Economics, DevigaVengedasalam; KarunagaranMadhavan,Oxford University Press.* 3. *Engineering Economy by William G.Sullivan, Elin M.Wicks, C. PatricKoelling, Pearson* 4. *R.PaneerSeelvan, " Engineering Economics", PHI* 5. *Ahuja,H.L., "Principles of Micro Economics" , S.Chand& Company Ltd* 6. *Jhingan,M.L., "Macro Economic Theory*

LABORATORIES

Subject Code	**Name of the Laboratory**	L	T	P	C	QP
BEEPC3110	**Electrical machines-ILab**	0	0	2	1	

Prerequisites: Calculus, differential equations, and electric and magnetic circuit analysis. Knowledge of KCL and KVL and ability of analyzing Electric Circuits.

Course Educational Objectives

CEO1	To determine efficiency by various types test on DC generators, motorsand transformers.
CEO2	To plot characteristics curve of different machines.
CEO3	To perform different speed control methods of DC motors.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Analyzelosses of different Electrical machines.
CO2	Understand the characteristics curve of different machines
CO3	Analyze the different speed control methods of DC motors.
CO4	Examine the efficiencies of DC generators, motors and transformers
CO5	Observe the connections of Single phase transformers

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2	1												
CO2		1	1												
CO3		2	2												
CO4		2	1												

CO5		1	1												
Avg.		1.6	1.2												

List of Experiments

Select any 8 experiments from the list:

1. Determination of critical resistance & critical speed from no load test of a DC shunt generator.
2. Plotting of external and internal characteristics of a DC shunt generator.
3. Speed control of DC shunt motor by armature voltage control and flux control method.
4. Determination of efficiency of DC machine by Swinburne's Test
5. Determination of efficiency of DC machine by Brake test
6. Determination of efficiency of DC machine by Hopkinson's Test.
7. Determination of Efficiency and Voltage Regulation by Open Circuit and Short Circuit test on single phase transformer.
8. Polarity test and Parallel operation of two single phase transformers.
9. Back-to Back test on two single phase transformers.
10. Load Test on 1-phase transformer
11. Scott Connection of Single phase Transformers

Subject Code	Name of the Laboratory	L	T	P	C	QP
BEEPC3120	**Network Theory Lab**	0	0	2	1	

Course Educational Objectives

CEO1	Verification of Network Theorems.
CEO2	Study of resonance in R-L-C circuits using oscilloscope.
CEO3	Study of input and output of different filters.
CEO4	Study of DC and AC Transients for R-L, R-C & R-L-C circuits.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Design a circuit with various theorems and methods.
CO2	Determine open circuit and short circuit parameters.
CO3	Design different filter circuits.
CO4	Examine transient circuits with various loads
CO5	Design different R-L-C resonance circuits.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	3												
CO2	1	1	1												
CO3	2	1	3												

CO4	1	1	1												
CO5	1	1	3												
Avg.	1.4	1	2.2												

List of Experiments

Select any 8 experiments from the list:

1. Verification of Network Theorems using AC circuits. (Superposition, Thevenin, Norton, Maximum Power Transfer).
2. Study of DC and AC Transients for R-L, R-C & R-L-C circuits using storage oscilloscope.
3. Determination of circuit parameters: Open Circuit and Short Circuit parameters.
4. Determination of circuit parameters: Hybrid and Transmission parameters.
5. Frequency response of Low pass and High Pass Filters.
6. Frequency response of Band pass and Band Elimination Filters.
7. Determination of self-inductance, mutual inductance and coupling coefficient of a single phase two winding transformer representing a coupled circuit.
8. Study of resonance in R-L-C series circuit using oscilloscope.
9. Study of resonance in R-L-C parallel circuit using oscilloscope.
10. Spectral analysis of a non-sinusoidal waveform.

Subject Code	Name of the Laboratory	L	T	P	C	QP
BEEPC3130	Analog & Digital Circuits Lab	0	0	2	1	

Course Outcomes

CO1	To analyse Analog circuits
CO2	To analyse digital circuits
CO3	To know the performance of Amplifiers
CO4	To design the counters and flip flops

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	2												
CO2	1	2	2												
CO3	1	2	2												
CO4	1	2	2												
Avg.	1	2	2												

List of Analog Experiments: (any 8)

1. Half Wave and Full Wave Rectifiers, Filters, Power supplies
2. Frequency Response of CE, CB, CC and CS amplifiers
3. Darlington Amplifier
4. Differential Amplifiers- Transfer characteristic, CMRR Measurement
5. Cascode / Cascade amplifier

6. Class A and Class B Power Amplifiers
7. Determination of bandwidth of single stage and multistage amplifiers
8. Spice Simulation of Common Emitter and Common Source amplifiers
9. Design and implementation of code converters using logic gates
   (i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa
10. Design and implementation of 4 bit binary Adder/ Sub tractor and BCD adder using IC 7483

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Subject Code	Name of the Laboratory	L	T	P	C	QP
BCSES3151	**JAVA programming Lab**	0	0	2	1	

Prerequisites:

Course Educational Objectives

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the Loop control structures: do, while, for etc.
CO2	Know the Classes and objects.
CO3	Know the Data abstraction & data hiding, inheritance, polymorphism.
CO4	AnalyseThreads, exception handlings and applet programs

CO-PO & PSO Mapping:

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1		2										
CO2			1		2										
CO3			2		2										
CO4			2		2										
Avg.			1.5		2										

List of Experiments

1. Introduction, Compiling & executing a java program.
2. Data types & variables, decision control structures: if, nested if etc.
3. Loop control structures: do, while, for etc.
4. Classes and objects.
5. Data abstraction & data hiding, inheritance, polymorphism.
6. Threads, exception handlings and applet programs
7. Interfaces and inner classes, wrapper classes, generics

Subject Code	Name of the Laboratory	L	T	P	C	QP
BCSES3152	Data Base Management Systems lab	0	0	2	1	

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Know the procedures and functions of SQL
CO2	Understand the ODBC using either VC++
CO3	Write the programs on database triggers
CO4	Understand the lock operations

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2			2										
CO2		2			2										
CO3		2			3										
CO4		2			2										
Avg.		2			2.25										

List of Experiments

1. Use of SQL syntax: insertion, deletion, join, updating using SQL.
2. Programs on join statements and SQL queries including where clause.
3. Programs on procedures and functions.
4. Programs on database triggers.
5. Programs on packages.
6. Programs on data recovery using check point technique.
7. Concurrency control problem using lock operations.
8. Programs on ODBC using either VC++.
9. Programs on JDBC.
10. Programs on embedded SQL using C / C++ as host language.

IV SEMESTER									
S. N.	**Course Category**	**Subject Code**	**Subjects**	**Hours per Week**			C	**ISA**	**ESA**
				L	T	P			
1	PC	BEEPC4010	Electrical Machines -II	3	1	0	4	50	100
2	PC	BEEPC4020	Control Systems - I	3	0	0	3	50	100
3	PC	BEEPC4030	Electrical & Electronic Instrumentation	3	0	0	3	50	100
4	PC	BEEPC4040	Electromagnetic Fields	3	1	4	4	50	100
5	ES	BCSES3051	OOPSthrough JAVA	3	0	0	3	50	100
		BCSES3052	Database Management Systems	3	1	0	4	50	100
6	BS/ HS	BBSBS3061	Environmental Engineering & Safety	3	0	0	3	50	100
		BMSHS3062	Engineering Economics and Costing						
PRACTICAL / SESSIONAL									
7	PC	BEEPC4110	Electrical Machines-II Lab	0	0	2	1	50	-
8	PC	BEEPC4120	Control Systems Lab	0	0	2	1	50	-
9	PC	BEEPC4130	Electrical & Electronic Instrumentation Lab	0	0	2	1	50	-
10	ES	BCSES3151	JAVA Programming Laboratory	0	0	2	1	50	-
		BCSES3152	Database Management Systems Laboratory	0	0	2	1	50	
			Total	**18**	**2**	**8**	**24**	**500**	**600**
			Semester Marks: 1100	**Semester Credits: 24**					
			Cumulative Marks: 4600	**Cumulative Credits: 96**					

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC4010	**Electrical Machines -II**	3	1	0	4	A

Course Educational Objectives

CEO1	To understand the concept of three phase synchronous generator
CEO2	To study about the characteristics and parameters of cylindrical rotor type and salient pole type three phase synchronous generators
CEO3	To get concept of parallel operation of three phase synchronous generator
CEO4	To study about principle and properties of synchronous motor
CEO5	To acquire knowledge about working principle and properties of three phase and single phase induction motors

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Working principle and characteristics of synchronous machines
CO2	Interpreting the concept and difference between cylindrical rotor and salient pole type three phase synchronous generators.
CO3	Understand the concept of parallel operation of alternator and its synchronization with infinite bus bar
CO4	Acquiring knowledge about properties and concept of synchronous motor.
CO5	Differentiate properties and concept between three phase and single phase induction motor.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2											2		
CO2	2	3											1		
CO3	1	1											2		
CO4	1	2											2		
CO5	2	2											2		
Avg.	1.6	2											1.8		

SYLLABUS

Unit – I **[14Hrs]**

Three Phase Synchronous Generators: Synchronous Generator Construction (both Cylindrical Rotor and Salient Pole type), the Speed of Rotation of a Synchronous Generator, Induced voltage in A.C Machines, The Internal Generated Voltage of a Synchronous Generator, The Equivalent Circuit of a Synchronous Generator (Armature Reaction Reactance, Synchronous Reactance and Impedance).

Cylindrical Rotor type Three Phase Synchronous Generators: The Phasor Diagram of a Synchronous Generator, Power and Torque in Synchronous Generators (Power Angle Equation and Power Angle Characteristic), Measuring Synchronous Generator Model Parameters (Open Circuit and Short Circuit Tests and Determination of Synchronous Impedance and Reactance, The Short Circuit Ratio), Voltage Regulation and Speed Regulation. Voltage Regulation by Synchronous Impedance Method

Unit - II **[12Hrs]**

Salient Pole type Three Phase Synchronous Generators: Two Reaction Concept, Development of the Equivalent Circuit of a Salient Pole type Three Phase Synchronous Generator (Direct axis and

Quadrature axis Reactance, Phasor Diagram for various load power factors,), Torque and Power Equations of Salient Pole Synchronous Generator (Power Angle Equation and Power Angle Characteristic with stator resistance neglected). Slip Test for determination of direct axis and Quadrature axis Reactance.

Parallel operation of Three Phase A.C. Synchronous Generators

The Conditions Required for Paralleling, The General Procedure for Paralleling Generators,

Three Phase Synchronous Motors: Basic Principles of Motor operation, Steady State Synchronous Motor operation, Starting Synchronous Motors, Operation of synchronous motors connected to bus and phasor diagrams for normal, under and over excited conditions, V and Λ curves, Synchronous Motor Applications.

Unit – III [14 Hrs.]

Three phase induction machines:

Constructional features and types; 3-phase distributed winding production of rotating magnetic field, Principle of Operation, The Effect of Coil Pitch and distribution factor on A.C. Machines, winding factor, Concept of Slip, Slip Speed; Phasor diagram and Development of equivalent circuit and derivation of torque equation; Typical torque-slip characteristic and influence of different parameters on it, No-Load and Blocked Rotor tests,

Determination of Parameters, power flow diagram, Losses and Efficiency, Methods of starting and speed control. Cogging, Crawling.

Unit – IV **[8 Hrs.]**

Single phase induction machines: Double field revolving theory, Methods of starting using auxiliary winding, development of equivalent circuit. No-Load and Blocked Rotor tests,

Determination of Parameters Speed Control of Single Phase Induction Motors.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Stephen J. Chapman-'Electric Machinery and Fundamentals'- McGraw HillInternational Edition, (Fourth Edition), 2015.*
2. *M.G.Say-'Alternating Current Machines', English Language Book Society(ELBS)/ Longman, 5th Edition, Reprinted 1990.*

Reference Books:

1. *B.S.Guru&H.R.Hiziroglu-'Electric Machinery & Transformers'-3rd Ed-OxfordPress, 2014.*
2. *P.C.Sen-'Principles of Electric Machines and Power Electronics'-2nd Edition, JohnWiley and Sons, Wiley India Reprint, 2014.*
3. *A.E.Fitgerland, Charles Kingslay Jr. & Stephen D. Umans -Electric machinery – 6thEdition McGraw Hill – Reprint 2015.*
4. *D.P. Kothari & I.J. Nagrath - Electric Machines – 4th Edition McGraw Hill – Reprint2015.*
5. *P S Bimbhra– Electrical Machinery –Khanna Publishers.*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC4020	**Control Systems - I**	3	0	0	3	A

Course Educational Objectives

CEO1	To know the performance of different control system through design in state space.
CEO2	To understand the stability of linear and nonlinear systems.
CEO3	To understand the principle of digital control system and to analyse it's stability

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Acquiring knowledge about theoretical concept of control system and its application.
CO2	Analysis the concept of control stability of a system in frequency domain and time domain
CO3	Understand the time response analysis and feedback characteristics of control system.
CO4	Analyze about state variable analysis and PID controller.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2	3												
CO2		3	2												
CO3		3	2												
CO4		1	2												
Avg.		2.25	2.3												

SYLLABUS

Unit – I **[12 Hrs.]**

Introduction to Control Systems: Basic Concepts of Control Systems, Open loop and closedloop systems, Servo Mechanism/Tracking System.

Mathematical Models of Physical Systems: Differential Equations of Physical Systems, Transfer functions, Block Diagram Algebra, Signal flow Graphs.

Feedback characteristics of Control Systems: Feedback and Non-feedback System, Reduction of parameter variation by use of feedback, control over System Dynamics by use of feedback, Control of the Effects of disturbance signals by use of feedback, linearizing effect offeedback, regenerative feedback, Regenerative feedback.

Control System and Components: Stepper motor, AC & DC Servomotor, Synchros, AC Tachometer

Unit - II **[12 Hrs.]**

Time response Analysis: Standard Test Signals, Time response of first order systems, Time Response of Second order systems, Steady State Errors and Static Error Constants of different types of systems, Effect of adding a zero to a system, Design specification of second order system, Performance indices.

Concepts of Stability: The concept of stability, Necessary conditions for stability, Hurwitz Stability Criterion, Routh Stability Criterion, Relative Stability Analysis, More on Routh Stability Criterion.

The Root locus Technique: Introduction, Root locus Concepts, Construction of Root locus, Rout Contours, Systems with transportation lag.

Unit – III [12 Hrs.]

Frequency Response Analysis: Correlation between Time and Frequency Response, Polar plots, Bode plots

Stability in Frequency Domain: Mathematical Preliminaries, Nyquist Stability Criterion, Assessment of Relative stability using Nyquist Criterion, Closed loop Frequency Response, Closed loop frequency response: Constant M circles, Constant N-Circles, Nichol's chart

Unit – IV **[8 Hrs.]**

State Variable Analysis: Introduction, Concepts of State, State Variables and State Model, Solution of State Equations, Concepts of Controllability and Observability.

Design Specifications of a control system: Proportional Derivative Error Control (PD Control), Proportional Integral Controller (PI Control), Proportional, Integral and Derivative Controller (PID Control), Derivative Output Control.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. *Control Systems Engg. by I.J. Nagrath and M.Gopal, 5th Edition, New Age International Publishers (2010)*
2. *Modern Control Engineering by K. Ogata, 5th edition PHI.*
3. *Automatic Control Systems by Benjamin C. Kuo, 7th Edition, Prentice-Hall India publication (1995)*

Reference Book:

1. *Design of Feedback Control Systems by R.T. Stefani, B. Shahian, C.J. Savator, G.H. Hostetter, Fourth Edition (2009), Oxford University Press.*
2. *Control Systems (Principles and Design) by M.Gopal 3rd edition (2008), TMH.*
3. *Analysis of Linear Control Systems by R.L. Narasimham, I.K. InternationalPublications*
4. *Control Systems Engineering by S.P. Eugene Xavier and J. Josheph Cyril Babu,1stEdition (2004), S. Chand Co. Ltd.*
5. *Problems and solutions in Control System Engineering by S.N. Sivanandam and S.N. Deepa, Jaico Publishing House.*
6. *Modern Control Systems by Richard C.Dorf and Robert H. Bishop, 11thEd (2009),Pearson.*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC4030	**Electrical and Electronics Instrumentation**	3	0	0	3	A

Course Educational Objectives

CEO1	To introduce students to monitor, analyze and control any physical system.
CEO2	To understand students how different types of meters work and their construction
CEO3	To provide a student a knowledge to design and create novel products and solutions for real life problems.
CEO4	To introduce students a knowledge to use modern tools necessary for electrical projects

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Test and troubleshoot electronic circuits using various measuring instruments.
CO2	Understand the construction and working of different measuring instruments.
CO3	Understand the construction and working of different AC and DC bridges and its applications.
CO4	Analyze different type of interferences, its causes and methods for its reduction.
CO5	Relate and apply the appropriate measuring techniques to real time applications
CO6	Study the storage of digital signal and analyzers for analyzing digital signal to provide with meaning full information

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2													
CO2	1	2													
CO3	2	2													
CO4	1	1													
CO5	2	2													
CO6	1	1													
Avg.	1.5	1.7													

SYLLABUS

Unit – I **[12 Hrs]**

Measurement and Error: Definition, Accuracy and Precision, Significant Figures, Types of Errors, Standards of Measurement: Classification of Standards, Electrical Standards, IEEE Standards

Types of measuring instrument: (Ammeter and Voltmeter: Derivation for Deflecting Torque of; PMMC, MI (attraction and repulsion types), Electro Dynamometer and Induction type Ammeters and Voltmeters. Energy meters and wattmeter, Construction, Theory and Principle of operation of Electro-Dynamometer and Induction type wattmeter, compensation, creep, error, testing, Single Phase and Poly-phase Induction type Watt-hour meters. Frequency Meters: Vibrating reed type, electrical resonance type, Power Factor Meters.

Unit - II **[14 Hrs]**

Measurement of Resistance, Inductance and Capacitance: Resistance: Measurement of Low Resistance by Kelvin's Double Bridge, Measurement of Medium Resistance, Measurement of High Resistance, Measurement of Resistance of Insulating Materials, Portable Resistance Testing set (Meg ohmmeter),

Measurement of Insulation Resistance when Power is ON, Measurement of Resistance of Earth Connections. Inductance: Measurement of Self Inductance by Ammeter and Voltmeter, and AC Bridges(Maxwell's, Hay's, & Anderson Bridge), Measurement of Mutual Inductance by Felici's Method, and as Self Inductance. Capacitance: Measurement of Capacitance by Ammeter and Voltmeter, and AC Bridges (Owen's, Schering & Wien's Bridge), Screening of Bridge Components and WagnorEarthing Device, Transducer: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Peizo-Electric transducers, Optical Transducer, Torque meters, inductive torque transducers, electric tachometers, photo-electric tachometers, Hall Effect Transducer.

Unit – III **[12 Hrs]**

Galvanometer: Construction, Theory and Principle of operation of D'Arsonval, Vibration (Moving Magnet & Moving Coil types), and Ballistic Galvanometer, Influence of Resistance on Damping, Logarithmic decrement, Calibration of Galvanometers, Galvanometer Constants, Measurement of Flux and Magnetic Field by using Galvanometers, Potentiometer: Construction, Theory and Principle of operation of DCPotentiometers (Crompton, Vernier, Constant Resistance, & Deflection Potentiometer),and AC Potentiometers (Drysdale-Tinsley & Gall-Tinsley Potentiometer)

Unit – IV **[12 Hrs]**

Current Transformer and Potential Transformer : Construction, Theory, Characteristics and Testing of CTs and PTs, Electronic Instruments for Measuring Basic Parameters: Amplified DC Meters, AC Voltmeters using Rectifiers, True RMS Voltmeter, Considerations for choosing an Analog Voltmeter, Digital Voltmeters (Block Diagrams only), Q-meter, Oscilloscope: Block Diagrams, Delay Line, Multiple Trace, Oscilloscope Probes, Oscilloscope Techniques, Introduction to Analog and Digital Storage Oscilloscopes, Measurement of Frequency, Phase Angle, and Time Delay using Oscilloscope.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Electrical Measurements and Measuring Instruments – Golding &Widdis – 5th Edition, Reem Publication.*
2. *Modern Electronic Instrumentation and Measurement Techniques – Helfrick& Cooper – Pearson Education.*

Reference Books:

1. *A Course in Electrical and Electronic Measurements and Instrumentation – A K Sawhney – DhanpatRai& Co.*
2. *Electronic Instrumentation – H C Kalsi – 2nd Edition, Tata McGraw Hill.*
3. *Electronic Measurement and Instrumentation – Oliver & Cage – Tata McGraw Hill.*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC4040	**Electromagnetic Fields**	3	1	0	4	A

Course Educational Objectives

CEO1	To study about the concept of Co-ordinate systems & Transformation.
CEO2	To study about Vector Calculus
CEO3	To get theoretical concept of calculation and derivation of electrostatic field.
CEO4	Understand the theoretical derivation of magnetostatics field.
CEO5	To acquire knowledge about electromagnetic field and wave propagation

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Relate the vector calculus with electric and magnetic field in space.
CO2	Employ mathematical tools like integral & differential calculus to study electric and magnetic behaviour through a medium.
CO3	Solve electromagnetic relation using Maxwell formulae and analyze moving charges on magnetic fields.
CO4	Formulate the idea of applying properties of electromagnetic waves in transmission lines and design circuits using conductors as well as dielectrics.
CO5	Measure and decide the nature of a wave to propagate in a particular medium

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2													
CO2	1	2													
CO3	2	1													
CO4	2	2													
CO5	3	2													
Avg.	2	1.8													

SYLLABUS

Unit – I **(12 hours)**

Co-ordinate systems & Transformation: Cartesian co-ordinates, circular cylindrical co-ordinates, spherical co-ordinates.

Vector Calculus: Differential length, Area & volume, Line surface and volume Integrals, Del operator, Gradient of a scalar, Divergence of a vector & divergence theorem, curl of a vector &Stoke's theorem, laplacian of a scalar

Unit - II [12Hrs]

Electrostatic Fields: Coulomb's Law, Electric Field Intensity, Electric Fields due to point, line, surface and volume charge, Electric Flux Density, Gauss's Law – Maxwell's Equation, Applications of Gauss's Law, Electric Potential, Relationship between E and V –Maxwell's Equation An Electric Dipole & Flux Lines, Energy Density in Electrostatic Fields., Electrostatic Boundary – Value Problems: Possion's& Laplace's Equations, Uniqueness theorem, General procedures for solving possion's or Laplace's Equation.

Unit – III **[12 Hrs]**

Magnatostatic Fields: Magnetic Field Intensity, Biot-Savart's Law, Ampere's circuit law-Maxwell Equation, applications of Ampere's law, Magnetic Flux Density-Maxwell's equations. Maxwell's

equation for static fields, Magnetic Scalar and Vector potentials.
Unit – IV **(12 hours)** Electromagnetic Fields and Wave Propagation: Faraday's Law, Transformer & Motional Electromagnetic Forces, Displacement Current, Maxwell's Equation in Final forms, Time Varying Potentials, Time-Harmonic Field. Electromagnetic Wave Propagation: Wave Propagation in loss Dielectrics, Plane Waves in loss less Dielectrics, Power & pointing vector.
Teaching Methods: Chalk& Board/ PPT/Video Lectures
Text Books: *1. Matthew N. O. Sadiku, Principles of Electromagnetics, 4th Ed., Oxford Intl. Student Edition.*
Reference Books: *1. C. R. Paul, K. W. Whites, S. A. Nasor, Introduction to Electromagnetic Fields, 3rd, TMH.* *2. W.H. Hyat, Electromagnetic Field Theory, 7th Ed, TMH.*

Laboratories

Subject Code	Name of the Laboratory	L	T	P	C	QP
BEEPC4110	**Electrical Machines -II Lab**	0	0	2	1	

Course Educational Objectives

CEO1	To study the voltage regulation and characteristics of alternator
CEO2	To acquire knowledge of characteristics of synchronous motor
CEO4	To study working principle of different type of single phase induction motor
CEO4	To understand the concept of synchronization of an alternator with infinite bus bar

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Acquire practical concept of synchronization of an alternator with infinite busbar
CO2	Apply the knowledge of alternator in generation field.
CO3	Implement the characteristics of three and single phase induction motors in different drives
CO4	Understand the concept and application of synchronous motor in various industrial field.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2	2												
CO2		2	2												
CO3		2	2												
CO4		2	2												
Avg.		2	2												

List of Experiments

1. Determination of the voltage regulation of an alternator by synchronous impedance method and zero power factor (zpf) method

2. Study of parallel operation of two alternators
3. Measurement of direct and quadrature axis reactance of a salient pole synchronous machine
4. Determination of the V and inverted V curves of a synchronous motor
5. Determination of parameters of synchronous machine
   a. Positive sequence reactance
   b. Negative sequence reactance
   c. Zero sequence reactance
6. Determination of parameter of a single phase induction motor and study of
   (a) Capacitor start induction motor
   (b) Capacitor start and capacitor run induction motor
   (c) Universal motor
   (d) Shaded pole motor
   (e) Repulsion motor
7. Determination of Efficiency, Plotting of Torque-Slip Characteristics of Three Phase Induction motor by Brake Test.
8. Determination of parameters of three phase induction motor from No load Test and Blocked Rotor Test
9. Speed control of a three phase induction motor using variable frequency drives
10. Performance of grid connected induction generator.

Subject Code	Subject Code	L	T	P	C	QP
BEEPC4120	**Control Systems Lab**	0	0	2	1	

Course Educational Objectives

CEO1	To study the characteristics of AC servomotor
CEO2	To understand the concept of P,PI,PID controller
CEO3	To acquire knowledge of characteristics of different type of transducers.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Acquire practical concept and application of various transducers in the field of industrial automation and feedback system
CO2	Apply the knowledge of various control system components in automation.
CO3	Implement the characteristics of P , PI , PID controller in advanced control system .
CO4	Understand the concept and application of lag lead compensator.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2	2										
CO2				2	1										
CO3				1	1										

CO4				1	1										
Avg				1.5	1.25										

LIST OF EXPERIMENTS

1. Study of a dc motor driven position control system
2. Study of speed torque characteristics of two phase ac servomotor and determination of its transfer function
3. Obtain the frequency response of a lag and lead compensator
4. To observe the time response of a second order process with P, PI and PID control and apply PID control to servomotor
5. To study and validate the controllers for a temperature control system
6. To study the position control system using Synchros
7. To plot the displacement-voltage characteristics of the given LVDT
8. To study the characteristics of J-type thermocouple and thermistors
9. Use a strain gauge to plot the curve between strain applied to a beam and the output voltage
10. To study on the interface of PLC with PC for data acquisition applications
11. Measurement of speed by using magnetic pick up.

Subject Code	Name of the Laboratory	L	T	P	C	QP
BEEPC4130	**Electrical & Electronic Instrumentation Lab**	0	0	2	1	

Prerequisites:

Course Educational Objectives

CEO1	To study the characteristics of different type of Bridges
CEO2	To understand the concept of galvanometer and potentiometer
CEO3	To acquire knowledge of characteristics of Q meter and CT PT.
CEO4	To study characteristics of energy meter
CEO5	To study the characteristics of different type of Bridges

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Acquire practical concept and application of various bridges in the field of measurement.
CO2	Apply the knowledge of galvanometer and potentiometer for sensitivity and calibration.
CO3	Implement the characteristics of energy meter,, Q meter and CT , PT for measurement of power system .
CO4	Analysis of iron loss of from B-H curve.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	2												
CO2		1	2												
CO3		2	1												

CO4		2	2												
Avg.		2	1.75												

List of Experiments

1. Measurement of Low Resistance by Kelvin's Double Bridge Method.
2. Measurement of Self Inductance and Capacitance using Bridges.
3. Study of Galvanometer and Determination of Sensitivity and Galvanometer Constants.
4. Calibration of Voltmeters and Ammeters using Potentiometers.
5. Testing of Energy meters (Single phase type).
6. Measurement of Iron Loss from B-H Curve by using CRO.
7. Measurement of R, L, and C using Q-meter.
8. Measurement of Power in a single phase circuit by using CTs and PTs.
9. Measurement of Power and Power Factor in a three phase AC circuit by two-wattmeter method.
10. Study of Spectrum Analyzers

V SEMESTER

S.N.	Course	Subject Code	Course Title	Hours per week			C	ISA	ESA
				L	T	P			
THEORY									
1	PC	BEEPC5010	Power Electronics	3	1	0	4	50	100
2	PC	BEEPC5020	Microprocessors & Microcontrollers	3	0	0	3	50	100
3	PC	BEEPC5030	Electric Power Transmission & Distribution	3	0	0	3	50	100
Professional Elective – I (Any One)									
4	PE	BEEPE5041	Control Systems - II	3	0	0	3	50	100
		BEEPE5042	Computer aided design of Electrical Machines						
		BEEPE5043	Power plant economics and tariff regulations						
		BEEPE5044	Photovoltaic, Wind & Hybrid Energy Systems						
5	OE	**Open Elective (Any one)**							
		B**OE**51	Open Elective	3	0	0	3	50	100
6	BS/HS	BBSBS5061	Optimization in Engineering	3	0	0	3	50	100
		BMSHS5062	Organizational Behavior						

Laboratories									
7	PC	BEEPC5110	Power Electronics Lab	0	0	2	1	50	-
8	PC	BEEPC5120	Microprocessors & Microcontrollers Lab	0	0	2	1	50	-
9	PC	BEEPC5130	Electric Power Transmission & Distribution Lab	0	0	2	1	50	-
10	PC	BEEPC5140	*Skill development project & hands on training	0	0	2	1	50	-
11	PC	BEEPC5150	^Summer Internship	0	0	-	1	50	-
Total				**18**	**1**	**8**	**24**	**550**	**600**
Semester Marks: 1150				**Semester Credits: 24**					
Cumulative Marks: 5750				**Cumulative Credits: 120**					

*College should conduct at least one NSDC program under this category.

^ Four (4) weeks duration summer internship either in industry or in an R&D organization, including educational institutes with excellent research culture. The student is expected to submit a formal report at the end of the programme.

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC5010	**POWER ELECTRONICS**	3	1	0	4	A

Course Educational Objectives

CEO1	To get knowledge about various power electronics devices
CEO2	To study about the operation of various converters
CEO3	To analyse the different control circuits

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Understand the basic characteristics of Power Electronic devices
CO2	Analyse the AC to DC and AC to AC converter circuits with various loads
CO3	Evaluate the performance and operation of DC-DC converters with various applications
CO4	Analyse the operation of voltage source inverters.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3											2		
CO2	3	2											1		
CO3	2	1											2		

CO4	1	1											1		
Avg.	2.25	1.75											1.5		

SYLLABUS

Unit – I **[14Hrs]**

Power semiconductor devices:

Switching and V-I characteristic of devices: power diode, Thyristor family: SCR, TRIAC, GTO, Transistor Family: BJT, IGBT, and MOSFET, Series and parallel grouping of SCR.

Triggering Methods:

SCR: (Cosine Firing Scheme), BJT gate drive, IGBT gate drive, TRIAC firing circuit, Isolation of gate and base drive

Protection of Devices:

SCR: Over voltage, Over Current, dv/dt, di/dt, Gate Protection. Transistor: protection of power BJT, IGBT and power MOSFET, dv/dt& di/dt limitation.

Unit - II **[12Hrs]**

AC to DC converter:

Un-controlled Diode rectifier: Single phase half wave and full wave rectifiers with R-L and R -L-E load, 3 phase bridge rectifier with R-L and R-L-E load. Phase Controlled Converter: Principle of phase controlled converter operation, single phase full converter with R-L and R-L-E load,3 phase full converter with R-L and R-L-E load ,single phase semi converter with R-L and R-L-E load, 3 phase semi-converter with R-L and R-L-E load and effect of source inductance.

AC –AC converter:

AC voltage controller: Single phase bi-directional controllers with R and R-L load, single phase cycloconverters.

Unit – III **[14 Hrs.]**

DC to DC converter:

Classification: First quadrant, second quardrant, first and second quardrant, third and fourth quardrant, fourth quardrant converter. Switching mode regulators: Buck regulators, Boost regulators, Buck-Boost regulators, Cuk regulators, Isolated Types: Fly Back Converters, Forward converters, Push Pull Converters, Bridge Converter

Unit – IV **[8 Hrs.]**

DC to AC converter:

Inverters: Single phase Bridge Inverters, 3-Phase Inverters-180^0 mode conduction, 120^0 mode conduction. Voltage control of 3-Phase Inverters by Sinusoidal PWM, Current Source Inverter

Applications:

UPS, SMPS, Battery Chargers, SVC.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Power Electronics: Circuits, Devices and Applications by M H Rashid, 3rd Edition, Pearson*
2. *Power Electronics: By P. C. Sen, Tata McGraw Hill Education, 12th Edition*
3. *Power Electronics, V R Moorthi, Oxford University Press*

Reference Books:

1. *Power Electronics Converters, Applications & Design: by N. Mohan, 2nd Edition, John Wiley & Sons*
2. *Elements Of Power Electronics: Philip T. Krein, Oxford University Press*
3. *Power Converter Circuits: by W Shepherd and L Zhang, CRC, Taylor and Francis, Special Indian Edition*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC5020	**MICROPROCESSORS &MICROCONTROLLERS**	3	0	0	3	A

Course Educational Objectives	
CEO 1	To Develop assembly language programs and basic concepts of the microprocessor and microcontroller
CEO 2	To provide solid foundation on interfacing the external devices to the microprocessor & microcontroller according to the user requirements in order to create novel products and solutions for the real time problems
CEO 3	To Familiar and Design of any type of embedded systems related to industrial and real time applications by knowing the concepts of Microprocessor and Microcontrollers.
CEO 4	To assist the students with an academic environment aware of excellence guidelines and lifelong learning needed for a successful professional carrier in the field embedded systems.
Course Outcomes: : *Upon successful completion of this course, students should be able to:*	
CO1	Explain the basic architecture of 8085 and 8086 microprocessor & list its features
CO2	Develop the assembly language program for 8085, 8086 microprocessor & 8051 microcontroller&indentify the addressing mode of the instructions.

CO3	Analyze the working of different peripheral devices to develop a microprocessor system & analyze the memory interfacing concept.
CO4	Explain the 8051 microcontroller architecture & compare the use of microprocessor & microcontroller in various applications.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-										
CO2	3	2	-	-	3										
CO3	3	-	2	-	-										
CO4	3	-	3	-	-										
Avg	3	1	1.25	-	0.75										

SYLLABUS

UNIT: 1

Introduction to 8 bit-microprocessor. 10 Hours

Introduction to 8085 microprocessor,Architecture,SignalDescriptions,Buses-Address bus,data bus and control Bus ,Instruction format ,Instruction sets ,addressing Modes, Assembly Language Programming,Timingdiagram,stack and sub routine, Data Transfer Schemes, Memory Interfacing and 8085 interrupts.

UNIT:2

Advanced Microprocessor 12 Hours

Introduction to 8086 microprocessor, 8086 Architecture, Register Organization, signal descriptions, Memory Segmentation. Physical memory organization. Addressing Modes, instruction Set .Minimum and Maximum mode operation, Bus Cycle of minimum mode and maximum mode. Interrupts of 8086, Memory interfacing & Assembly Language Program.

UNIT:3

Peripheral Devices 10 Hours

Programmable Peripheral Interface (8255), Programmable Interval Timer (8254) Programmable Interrupt Controller (8259A) - Programmable DMA Controller (8257), Programmable Communication Interface (8251A) – Programmable Keyboard and Display Controller (8279).

UNIT:4

8051 Microcontroller **12 Hours**

Overview of 8051 microcontroller. Architecture. I/O Ports. Memory organization, Addressing modes, data transfer instructions, Logical instructions, Arithmetic instructions, Branching (Jump &Call) instructions, Bit addressable instructions and special instructions, Interrupts and interrupt handler sub routines (Interrupt Service Routines).Assembly language program.

Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books

1. Introduction to Microprocessor for Engineers and scientist ,P K Ghosh,P R Sridhar ,PHI Pvt. Ltd
2. Microprocessor Architecture, Programming and application with 8085,R.S.Gaonkar, PRI

Penram International publishing PVT. Ltd., 5thEdition
3. Advanced Microprocessors and Peripherals - A. K. Ray and K.M. Bhurchandani, TMH, 2nd edition 2006.
4. The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D.M C Kinlay, Pearson Education, Second Edition, 2008.

Reference Books:

1. Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096, Krishna Kant, PHI Publication, 2007.
2. Microprocessors and Interfacing, Programming and Hardware,Douglas V Hall, TMH Publication, 2006.
3. Microprocessors and Interfacing, N. Senthil Kumar, M. Saravanan, S. Jeevananthan and S.K. Shah, Oxford University Press.

	Name of the Subject	L	T	P	C	QP
BEEPC5030	**Electric Power Transmission & Distribution**	3	0	0	3	A

Course Educational Objectives	
CEO1	To train the students about both the transmission and distribution substations.
CEO2	To engage the students in different software designing tools and to engage them to visit the college campus for different overhead lines during their laboratory hours.
CEO3	To provide knowledge about transmission and distribution through workshops and training by industrial experts.
CEO4	To involve the students in maintenance work in college 11kV transformer and also to detect the fault in the distribution station.
Course Outcomes: : *Upon successful completion of this course, students should be able to:*	
CO1	Calculate inductance, capacitance in overhead lines also design overhead conductors for single phase and three phase transmission lines.
CO2	Analyse the performance of different transmission lines and required calculations.
CO3	Configure different types of distribution systems.
CO4	Illustrate the design consideration of underground and overhead lines

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	2											2	
CO2		2	3											3	
CO3		2	3											3	
CO4		3	2											2	
Avg.		2	2.5											2.2	

SYLLABUS

Unit – I **[14Hrs]**

Line Constant Calculations: Introduction to per unit system and calculation for transmission system. Magnetic flux Density, Inductors and Inductance Magnetic field Intensity due to long current carrying conductors, Inductance of two wire transmission line, Flux linkages with one conductor in a group of conductors, Transposition of power lines, Composite Conductors, Inductance of Composite Conductors, Inductance of double circuit three phase line, Concept of GMD, Bundled conductors, Skin and Proximity effect.

Capacitance of Transmission Lines: Electric Field of a Line of charge, Straight Conductor, The Potential Difference between Two Points due to a line Charge, Two infinite lines of charge, Capacitance of a Two Wire Line, Capacitance of a Three Phase Line with Unsymmetrical Spacing, Capacitance of a double circuit line, Inductance of three phase un symmetrically spaced transmission, Effect of Earth on the Capacitance of conductors.

Unit - II **[12Hrs]**

Performance of Lines: Representation of Lines, Short Transmission Lines, The Medium Transmission Lines, The Long Transmission Line: The Long Transmission Line, ABCD constants, Ferranti Effect Hyperbolic Form of The Equations, The Equivalent Circuit of a Long Line, Power Flow Through Transmission Line, Reactive Compensation of Transmission Line. Series and shunt compensation.

Unit – III **[14 Hrs.]**

Overhead Line Insulators: Insulator Materials, Types of Insulators, Voltage Distribution over Insulator String, Methods of Equalizing the potential Mechanical Design of Overhead Transmission Lines: The catenary curve, Sag Tension calculation, supports at different levels, Stringing chart, sag Template, Equivalent span, Stringing of Conductors, Vibration and Vibration Dampers

Distribution: Comparison of various Distribution Systems, AC three-phase four-wire Distribution System, Types of Primary Distribution Systems, Types of Secondary Distribution Systems, Voltage Drop in DC Distributors, Voltage Drop in AC Distributors, Kelvin's Law, Limitations of Kelvin's Law, General Design Considerations

Unit – IV **[8 Hrs.]**

Insulated Cables: The Insulation, Extra High Voltages Cable, Insulation Resistance of Cable, Grading of Cables, Capacitance of Single Core Cables, Heating of cables, Current rating of cables, Overhead lines Vs Underground Cables, Types of cable

Power System Earthing: Soil Resistivity, Earth Resistance, Tolerable Step and Touch Voltage, Actual Touch and Step Voltages, Design of Earthing Grid.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

Power System Analysis- By John J. Grainger & W. D. Stevenson, Jr, Tata Mcgraw-Hill, 2003 Edition, 15th Reprint, 2010**.**

Reference Books:

1. Weedy B.M. and Cory B.J., "Electric Power Systems", 4th Ed., 2008 Wiley India.
2. Electrical Power Systems-C.L.Wadhwa, New Age International Publishers, Sixth Edition.
3. Power System Analysis & Design- By B. R. Gupta, S. Chand Publications, 3rd Edition,Reprint, 2003.

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC5041	**Control Systems -II**	3	0	0	3	A

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Develop mathematical models and understand the mathematical relationships between the sensitivity functions and how they govern the fundamentals in control systems.
CO2	Design and fine tune PID controllers and understand the roles of P, I and D in feedback control
CO3	Design pole-assignment controller and the specific design procedures
CO4	Develop state-space models

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	1		2											
CO3	3	2													
CO4	3	2													
Avg.	3	1.75		2											

SYLLABUS

Unit - I [12Hrs]

State Variable Analysis & Design:

Introduction: Concepts of State, State Variables and State Model (of continuous time systems): State Model of Linear Systems, State Model for Single-Input-Single-Output Linear Systems, Linearization of the State Equation. State Models for Linear Continuous – Time Systems: State-Space Representation Using Physical Variables, State – space Representation Using Phase Variables, Phase variable formulations for transfer function with poles and zeros, State – space Representation using Canonical Variables, Derivation of Transfer Function for State Model. Diagonalization: Eigenvalues and Eigenvectors, Generalized Eigenvectors. Solution of State Equations: Properties of the State Transition Matrix, Computation of State Transition Matrix, Computation by Techniques Based on the Cayley-Hamilton Theorem, Sylvester's Expansion theorm. Concepts of Controllability and Observability: Controllability, Observability, Effect of Pole-zero Cancellation in Transfer Function. Pole Placement by State Feedback, Observer Systems.

Unit – II [14Hrs]

Introduction: Discrete Time Control Systems and Continuous Time Control Systems, Sampling Process. Digital Control Systems: Sample and Hold, Analog to digital conversion, Digital to analog conversion. The Z-transform: Discrete-Time Signals, The Z-transform, Z-transform of Elementary functions, Important

properties and Theorms of the Z-transform. The inverse Z-transform, Z-Transform method for solving Difference Equations.
Z-Plane Analysis of Discrete Time Control Systems: Impulse sampling & Data Hold, Reconstruction of Original signals from sampled signals: Sampling theorm, folding, aliasing. Pulse Transfer function: Starred Laplace Transform of the signal involving Both ordinary and starred Laplace Transforms; General procedures for obtaining pulse Transfer functions, Pulse Transfer function of open loop and closed loop systems. Mapping between the s-plane and the z-plane, Stability analysis of closed loop systems in the z-plane: Stability analysis by use of the Bilinear Transformation and Routh stability critgion, Jury stability Test.

Unit – III **[10 Hrs.]**

Nonlinear Systems :

Introduction :Behaviour of Non linear Systems, Investigation of nonlinear systems.
Common Physical Non Linearities: Saturation, Friction, Backlash, Relay, MultivariableNonlinearity.
The Phase Plane Method: Basic Concepts, Singular Points: Nodal Point, Saddle Point, Focus Point, Centre or Vortex Point, Stability of Non Linear Systems: Limit Cycles, Construction of Phase Trajectories: Construction by Analytical Method, Construction by Graphical Methods.

Unit – IV **[8 Hrs.]**

The Describing Function Method:

Basic Concepts: Derivation of Describing Functions: Dead-zone and Saturation, Relay with Dead-zone and Hysteresis, Backlash. Stability Analysis by Describing Function Method: Relay with Dead Zone, Relay with Hysteresis, Stability Analysis by Gain-phase Plots. Jump Resonance. Liapunov's Stability Analysis: Introduction, Liapunov's Stability Critrion: Basic Stability Theores, Liapunov Functions, Instability. Direct Method of Liapunov& the Linear System: Methods of constructing Liapunov functions for Non linear Systems.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *Discrete-Time Control System, by K.Ogata, 2nd edition (2009), PHI.*
2. *Control Systems Engineering, by I.J. Nagrath and M.Gopal., 5th Edition (2007 / 2009), New Age International (P) Ltd. Publishers.*

Reference Books:

1. *Design of Feedback Control Systems-Stefani,Shahian, Savant,Hostetter, 4th Ed, OxfordPress.*
2. *Modern Control Systems by K.Ogata, 5th Edition (2010), PHI.*
3. *Modern Control Systems by Richard C. Dorf. And Robert, H.Bishop, 11th Edition (2008), Pearson Education Inc. Publication.*
4. *Control Systems (Principles & Design) by M.Gopal, 3rd Edition (2008), Tata Mc.Graw Hill Publishing Company Ltd.*
5. *Control Systems Engineering by Norman S.Nise, 4th Edition (2008), Wiley India (P) Ltd.*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPE5042	**Computer aided design of Electrical Machines**	3	0	0	3	A
Course Educational Objectives						

CEO1	To lay the foundation of efficient design and operation of motors & generators in modern day automotive, domestic and renewable energy systems.
CEO2	To make the students to investigate the principles of structural assessment, electromagnetic analysis, dimensional and thermal constraints.
CEO3	To deploy the students on Finite Element Analysis (FEA) software-based design projects which will be used to model the performance and operation of electric machines
Course Outcomes: : *Upon successful completion of this course, students should be able to:*	
CO1	Acquired knowledge about computer aided design of machines.
CO2	Theoretically able to investigate and assess design peculiarities and properties according their specific working conditions.
CO3	Able to Formulate and solve the optimum design problems with computers.
CO4	Able to plan and carry out Finite Element analysis using software
CO5	To apply one`s knowledge and understanding for the formulation and analysis of electrical engineering problems

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1	1	2										
CO2			3	2	3										
CO3			2	2	3										
CO4			3	3	3										
CO5			3	2	2										
Avg.			2.4	2	2.6										

SYLLABUS

Unit I: [10 Hrs.]

CONCEPT OF COMPUTER-AIDED DESIGN AND OPTIMIZATION

Introduction; Computer Aided Design; Explanation of details of flow chart; Input data to be fed into the program; Applicable constraints Max or Minimum permissible limits; Output data to be printed after execution of program; Various objective parameters for optimization in an electrical machine; Selection of optimal design; Explanation of lowest cost and significance of "Kg/KVA"; Flowcharts.

UNIT II: BASIC CONCEPTS OF DESIGN [12 Hrs.]

Introduction: Specification; Output coefficient; Importance of specific loadings; Electrical **Materials:** Conducting Materials, Insulating Materials and Magnetic Materials; Magnetic circuit calculations; General procedure for calculation of Amp-Turns; Heating and Cooling; **Modes of heat dissipation:** Standard ratings of Electrical machines; Ventilation schemes in static machines (Transformers) and in rotating machines; Quantity of cooling medium; Types of enclosures; General design procedure; Steps to get optimal design.

UNIT III: [08 Hrs.]

APPLICATION OF FINITE ELEMENT METHOD IN DESIGN:

Introduction: Basics of Finite element, Shape functions, Single element computation. Assembly of elemental coefficient matrix, Global coefficient matrix, Application of FEM technique for design problems. Use of open source FEM software for 2D design. Computation of Capacitance of capacitor, cable, multi dielectric cable through FEM, Computation of electrostatic field for various geometry, skin

and proximity effect in conductors
UNIT IV: [14Hrs.] **COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS:** **Introduction:** Flowcharts and programs for computer aided design of Starters, field regulators, small transformers, choke coils. 2D FEM open source software based electrical apparatus design **COMPUTER AIDED DESIGN OF DC MACHINES**: Introduction; Flowcharts and programs for computer aided design of DC machines. 2D FEM open source software based DC machine part design **COMPUTER AIDED DESIGN OF TRANSFORMERS:**Introduction; Flowcharts and programs for computer aided design of transformers. 2D FEM open source software based transformer part design.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert
Text books / Reference Books: 1. *Computer aided design of electrical machines - K M Vishnu Murthy, B S Publications* 2. *Computer aided design of electrical machines – Maurya, Jallan, Shukla, Kataria publication* 3. *An Introduction to the Finite Element Method – J Reddy, TMH Publication*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPE5043	**Power Plant economics & Tariff regulations**	3	0	0	3	A

Course Educational Objectives

To develop different types of skills so that students are able to acquire following competency:

CEO1	Conceptual understanding of power generation leading to smooth running of plants
CEO2	Providing sufficient input to facilitate the process of taking technical and management decisions
CEO3	Understand the techno economic viability of new power projects and predicting their pros and cons
CEO4	To familiarize the students with the Tariff methods for electrical energy consumption in the prospect of optimum utilization of electrical energy.

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Understanding the design of various power plants
CO2	Understanding the working of various power plants and comparing them
CO3	Integrated energy resources planning and execution
CO4	Ability to calculate usage of electrical power
CO5	Ability to plot the power /Energy demand in the form of graph.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

CO1		2	2												
CO2		1	2												
CO3		2	1												
CO4		1	2												
CO5		1	1												
Avg.		1.4	1.6												

SYLLABUS

UNIT I:

Introduction: Electric energy demand and growth in India, electric energy sources. Thermal Power Plant: Site selection, general layout and operation of plant, detailed description and use of different parts. Hydro Electric Plants: Classifications, location and site selection, detailed description of various components, general layout and operation of Plants, brief description of impulse, reaction, Kaplan and Francis turbines, advantages & disadvantages, hydro-potential in India

UNIT II:

Nuclear Power Plant: Location, site selection, general layout and operation of plant. Brief description of different types of reactors Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste material, shielding. Gas Turbine Plant: Operational principle of gas turbine plant & its efficiency, fuels, open and closed-cycle plants, regeneration, inter-cooling and reheating, role and applications. Diesel Plants: Diesel plant layout, components & their functions, its performance, role and applications

UNIT III:

Power Plant Economics and Tariffs: Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of Load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff; Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements

UNIT IV:

Economic Operation of Power Systems: Characteristics of steam and hydro-plants, Constraints in operation, Economic load scheduling of thermal plants Neglecting and considering transmission Losses, Penalty factor, loss coefficients, Incremental transmission loss. Hydrothermal Scheduling

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1. B.R. Gupta, “Generation of Electrical Energy”, S. Chand Publication.
2. Soni, Gupta & Bhatnagar, “A text book on Power System Engg.”, Dhanpat Rai & Co.
3. P.S.R. Murthy, “Operation and control of Power System” BS Publications, Hyderabad

Subject Code	Name of the Subject	L	T	P	C	QP
BEEOE5044	**Photovoltaic, Wind& Hybrid energy Systems**	3	0	0	3	A

Course Educational Objectives

CEO1	To analyse solar PV and Solar thermal systems
CEO2	Analyse operating conditions like stand alone and grid connected of renewable sources
CEO3	Reproduce different Storage Systems, concept of Integration and Economics of Renewable Energy System
Course Outcomes: : ***Upon successful completion of this course, students should be able to:***	
CO1	Develop fundamental understanding about Solar Thermal and Solar Photovoltaic systems.
CO2	Provide knowledge about development of Wind Power plant and various operational as well as performance parameter/characteristics.
CO3	Explain the contribution of Hybrid Energy System in power generation.
CO4	Analyse different Storage systems, Integration and Economics of Renewable Energy System.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	3				3								
CO2		2	1				1								
CO3		1	1				1								
CO4		1	1				1								
Avg.		1	1.75				1.75								

SYLLABUS

UNIT-I [12 Hours]

Solar Thermal

Solar radiation at the earth's surface, Solar constant, Spectral distribution, Extraterrestrial Radiation, Solar Terrestrial Radiation, Solar radiation geometry, Computation of cosθ for any location having any orientation, Empirical equations for predicting the availability of solar radiation: Monthly average daily and hourly global and diffuse radiation, Beam and Diffuse radiation under cloudless skies, Solar radiation on tilted surfaces : a)Beam radiation, b)Diffuse radiation, c)Reflected radiation, d)Flux on tilted surface.

Instruments for measuring solar radiation, Devices for thermal collection and storage, Thermal applications, designing and Performance analysis of liquid flat plate collector for given heat removal factor and loss coefficient. Introduction to concentrating solar power (CSP) plants using technologies like a) Parabolic troughs b) Linear Fresnel reflector, c) Paraboloid Dish, etc.

UNIT-II [10 Hours]

Solar Photovoltaic

Introduction to family of solar film technology, Single c-Si, Poly c-Si PV Cell, Module and Array, Array Design (factors influencing the electrical design of the solar array) : a) Sun Intensity, b)Sun Angle, c) Shadow Effect, d) Temperature Effect, e) Effect of Climate, f) Electrical Load Matching, g) Sun Tracking, Peak Power Point Operation, Electrical characteristics of Silicon PV Cells and Modules, PV System Components, Efficiency of PV system, MPPT of solar system, PV system designing, PV powered water pumping.

UNIT-III [12 Hours]

Wind Energy System

Power Contained in Wind, Thermodynamics of Wind Energy, Efficiency Limit for Wind Energy Conversion, Maximum Energy obtained for a Thrust-operated converter (Efficiency limit), Design of

Wind Turbine Rotor, Power-Speed Characteristics, Torque-Speed Characteristics, Wind Turbine Control Systems: a) Pitch Angle Control, b) Stall Control, c) Power Electronics Control, d) Yaw Control, Control Strategy, Wind Speed Statistics, Statistical Wind Speed
Distributions, Site and Turbine Selection, Extraction of wind energy and wind turbine power. Introduction to Offshore Wind Energy System and its comparison with Wind Energy System

UNIT -IV **[8 Hours]**

Hybrid Systems
a) Fuel Cells: Operating principles of Fuel Cell, Fuel and Oxidant Consumption, Fuel Cell System Characteristics, Introduction to Fuel Cell Technology and its type, application and limits.
b) Storage systems: Hydrogen storage: Hydrogen production, relevant properties, Hydrogen as an Engine Fuel, methods of Hydrogen storage.
Batteries: Introduction to Batteries, Elements of Electro Chemical Cell, Battery classification, Battery Parameters, Factors affecting battery performance.
Introduction to other storage technologies: pump storage, SMES, compressed air storage

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1. S.*P. Sukhatme, "Solar Energy", Tata McGraw Hill*
2. *Mukund R. Patel, "Wind and Power Solar System", CRC Press*
3. *Tony Burton, Nick Jenkins, David Sharpe, "Wind Energy Hand Book-Second Edition", John Wiley & Sons, Ltd., Publication*
4. *Godfrey Boyle, "Renewable Energy", Third edition, Oxford University Press*
5. *Gilbert M. Masters, "Renewable and Efficient Electrical Power Systems", Wiley - IEEE Press, August 2004*
6. *Chetan Singh Solanki, "Solar Photovoltaics-Fundamentals, Technologies and Applications", PHI Second Edition.*
7. *H. P. Garg, J. Prakash, "Solar Energy-Fundamentals and Applications", Tata McGraw hill Publishing Co. ltd., First Revised Edition.*

Reference Books:

1. *D.P.Kothari, K.C.Singal, RakeshRajan,"Renewable Energy Sources and Emerging Technologies", PHI Second Edition*
2. *Paul Gipe, "Wind Energy Comes of Age", John Wiley & Sons Inc.*
3. *Donald L. Klass, "Biomass for Renewable Energy, Fuels, and Chemicals, Elsevier, Academic Press*

Subject Code	Name of the Subject	L	T	P	C	QP
BBSBS5061	**OPTIMIZATION IN ENGINEERING**	3			3	A

Course Educational Objectives	
CEO1	To know the formulation of different optimization problems.
CEO2	To solve the optimization problems by different conventional methods.
CEO3	To apply basic techniques in solving the real life optimization problems

Course Outcomes: : ***Upon successful completion of this course, students should be able to:***	
CO1	Understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
CO2	Understand and apply the concept of optimality criteria for various types of optimization problems.
CO3	Solve various constrained and unconstrained problems in single variable as well as multivariable.
CO4	Apply the methods of optimization in real life situation.
CO5	To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2	1	2											
CO2		2	1	2											
CO3		2	2	1											
CO4		2	2	2											
CO5		2	2	2											
Avg.		2	1.6	1.8											

SYLLABUS

UNIT-I **[10 Hours]**

Idea of Engineering optimization problems, Classification of optimization algorithms, modelling of problems and principle of modelling.

Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming

UNIT-II **[10 Hours]**

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method

Assignment problems: Hungarian method for solution of Assignment problems Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems

UNIT-III **[12 Hours]**

Non-linear programming: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method.

Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method

Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming.

UNIT -IV **[8 Hours]**

Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, multiple server, Finite sources, Queue discipline.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1. *Operations Research- Principle and Practice, A. Ravindran, D. T. Philips, J. Solberg, Second edition, Wiley India Pvt Ltd.*
2. *Operation Research, PrabhakarPai ,Oxford University Press*
3. *Optimization for Engineering Design, Kalyanmoy Deb, PHI Learning Pvt Ltd.*
4. *OperationsResearch, H.A.Taha, A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, Pearson Education, Eighth Edition.*
5. *Engineering Optimization, S S Rao, New Age International (P) Ltd, 2003.*

Reference Books:

1. *Linear and Non-linear Optimization, Stephen G. Nash, A. Sofer, McGraw Hill, 2ndEdition.*
2. *Engineering Optimization, A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, Wiley India Pvt. Ltd, Second edition.*
3. *Operations Research, F.S.Hiller, G.J.Lieberman, Tata McGraw Hill, Eighth Edition, 2005.*
4. *Operations Research, P.K.Gupta, D.S.Hira, S.Chand and Company Ltd, 2014.*

Subject Code	Name of the Subject	L	T	P	C	QP
BMSHS5062	**Organisational Behaviour**	3	0	0	3	A

Course Educational Objectives

CEO1	To develop an understanding of the behaviour of individuals and groups inside organizations
CEO2	To enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations.
CEO3	To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes.

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Define, explain and illustrate a range of organizational behaviour theories.
CO2	Analyse the behaviour of individuals and groups in organizations in terms of organizational behaviour theories, models and concepts.
CO3	To explain group dynamics and demonstrate skills required for working in groups (team building)
CO4	Communicate effectively in oral and written forms about organizational behaviour theories and their application using appropriate concepts, logic and rhetorical conventions.
CO5	To explain organizational culture and describe its dimensions and to examine various organizational designs

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							2	2							

CO2							2	3							
CO3							2	3							
CO4							2	2							
CO5							2	2							
Avg.							2	2.4							

SYLLABUS

Unit – I [14Hrs]

Fundamentals of OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behaviouristic and social cognitive), Limitations of OB.
Attitude: Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behaviour and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes.
Personality and values: Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality and job – fit theory), Personality Tests and their practical applications.
Perception: Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect).
Motivation: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories – Equity Theory of Work Motivation.

Unit - II [12Hrs]

Foundations of Group Behaviour: The Meaning of Group & Group behaviour & Group Dynamics, Types of Groups, The Five – Stage Model of Group Development.
Managing Teams: Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building.
Leadership: Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership, Success stories of today's Global and Indian leaders.

Unit – III [14 Hrs.]

Organizational Culture : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.

Unit – IV [8 Hrs.]

Organizational Change: Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change.
Implementing Organizational Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change &Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert
Text Books/Reference books: 1. *Understanding Organizational Behaviour, Parek, Oxford* 2. *Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.* 3. *Organizational Behaviour, K. Awathappa,HPH.* 4. *Organizational Behaviour, VSP Rao, Excel* 5. *Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.* 6. *Organizational Behaviour, Hitt, Miller, Colella, Wiley*

Laboratories

Subject Code	Subject Code	L	T	P	C	QP
BEEPC5110	**Power Electronics Lab**	0	0	2	1	

Course Educational Objectives	
CEO1	This course aims at obtaining characteristics of power electronic devices.
CEO2	To understand the commutation techniques used in power electronics circuits and to test different power electronics converters.
Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Elucidate the basic operation of various power semiconductor devices and passive components.
CO2	Analyze power electronics circuits
CO3	Apply power electronic circuits for different loads
CO4	Design various power electronic circuits

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2	2									2	
CO2				2	1									1	
CO3				1	1									1	
CO4				1	1									1	
Avg				1.5	1.25									1.25	

LIST OF EXPERIMENTS
1.Study of Characteristics of SCR, MOSFET & IGBT 2. Gate firing circuits for SCR's 3. Single Phase AC Voltage Controller with R and RL Loads 4. Single Phase fully controlled bridge converter with R and RL loads 5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E) 6. DC Jones chopper with R and RL Loads 7. Single Phase Parallel, inverter with R and RL loads 8. Single Phase Cycloconverter with R and RL loads 9. Single Phase Half controlled converter with R load 10. Three Phase half controlled bridge converter with R-load 11. Single Phase series inverter with R and RL loads 12.Single Phase Bridge converter with R and RL loads 13.Single Phase dual converter with RL loads

Subject Code	Subject Code	L	T	P	C	QP
BEEPC5120	**Microprocessors & Microcontrollers Lab**			**2**	**1**	

Course Educational Objectives	
CEO1	Extend existing testbeds through crowdsourcing, enabling richer and more distributed experiments
CEO2	Bring the researcher and the end-user together, with closer interactions between the experiments and the society
Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Understand the basic principles of 8051
CO2	Differentiate the features of various controllers
CO3	Programming of 8279 & 8259 controllers and additions and subtractions
CO4	Interfacing of the devices with microcontrollers

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				1	1										
CO2				2	2										
CO3				2	1										

CO4				1	2										
CO5				2	2										
CO6				2	3										
Avg				1.66	1.83										

LIST OF EXPERIMENTS

List of Experiment : 8085

1. Addition, subtraction, multiplication and division of two 8 bit numbers
2. Smallest/largest number among n numbers in a given data array, Binary to Gray code, Hexadecimal to decimal conversion

Interfacing

1. Generate square wave on all lines of 8255 with different frequencies
2. Study of stepper motor and its operations

Optional (any two)

1. Study of traffic light controller
2. Study of elevator simulator
3. Generation of square, triangular and saw tooth wave using D to A Converter
4. Study of 8253 and its operation(Mode0, Mode2, Mode3)
5. Study of Mode0,Mode1 and BSR Mode operation of 8255
6. Study of 8279 (keyboard and display interface)
7. Study of 8259 Programmable Interrupt Controller
8. 8051 Microcontroller: Initialize data to registers and memory using immediate, register, direct and indirect Addressing mode

Optional (any one)

1. Addition and subtraction of 16 bit numbers
2. Multiplication and division of two 16 bit numbers
3. Transfer a block of data to another memory location using indexing
4. Operation of 8255 using 8051 microcontroller 8086
5. 1.Addition , subtraction ,multiplication and division of 16 bit numbers, 2's complement of a 16 bit number

Optional (any one)

1. Finding a particular data element in a given data array
2. Marking a specific bit of a number using look-up table
3. Largest/smallest number of a given data array
4. To separate the odd and even numbers from a given data array
5. Sorting an array of numbers in ascending/descending order

Subject Code	Subject Code	L	T	P	C	QP
BEEPC5130	**Electrical power transmission & distribution lab**	**0**	**0**	**2**	**1**	
Course Educational Objectives						

CEO1	To learn the usage of passive elements in various Power Transmission Systems... Calculations such as transverse loading, conductor clearances, pole buckling and guying will be discussed in detail.
CEO2	To understand the factors affecting Insulators and also in Under Ground cables.
CEO3	To calculate the various parameters in Distribution System
Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Apply power system fundamentals to the design of a system that meet specific needs.
CO2	Design a power system solution based on the problem requirements and realistic Constraints
CO3	Develop a major design experience in power a system that prepares them for engineering practice.
CO4	Design a Transmission and distribution electric power system

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	2											
CO2			2	2											
CO3			1	2											
CO4			2	3											
Avg			1.75	2.25											

LIST OF EXPERIMENTS (Any 8 Experiments)

1. Study and of Ferranti Effect.
2. Determination of ABCD Parameter.
3. Determination of string efficiency.
4. Earth resistance measurement.
5. Series and shunt capacitance computation in transmission line.
6. Transformer oil test.
7. Study of various lightning arresters.
8. Distribution system power factor improvement using switched capacitor.
9. Software based design of the transmission & distribution network of a city.
10. Measurement of ground resistivity and ground electrode resistance.
11. To simulate a small Hydro Plant.
12. Study and Operation of HVDC Link.
13. Study and operation of Static VAR compensator

Subject Code	Subject Code	L	T	P	C	QP
BEEPC5140	**Skill development project & Hands on training**	**0**	**0**	**2**	**1**	A
Course Educational Objectives						
CEO1	To improve students' Employability skills and make them industry ready.					
CEO2	To Develop Group and team thinking skills of the students.					
Course Outcomes: ***Upon successful completion of this course, students should be able to:***						

CO1	Identify the benefits of developing 'soft skills'
CO2	Understand how soft skills complement hard skills
CO3	Identify the emotional richness of an asset
CO4	Develop Group and Team thinking skills

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1									2	2					
CO2									2	1					
CO3									0	2					
CO4									2	2					
Avg									1.5	1.75					

LIST OF EXPERIMENTS

Competency 1: Career View

Introduction to the EES Course- Importance of career, industry watch etc.
Statement of Purpose-1
Statement of Purpose-2
Presentation Techniques-1
Presentation Techniques-2
Attitude-1: Required for Job or Entrepreneurial Career
Attitude-2: How to Improve Attitude: Case Studies

Competency 2: Principles of effective communication

Business Vocabulary-1
Business Vocabulary-2
Resume Preparation-1: Layout, Format, Power Verbs etc
Resume Preparation-2: Discussion of How to- Incorporate Attributes, Analysis
Business Correspondence-1 Technical report Writing-1- Layout, Format
Business Correspondence-2 Technical report writing- 2-Language
Business Correspondence-3 Business/ Technical Proposal writing
Business Correspondence - 4
Adaptability: Cases and Workouts

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

VI SEMESTER									
S.N.	**Course Category**	**Subject Code**	**Subject**	**Hours per week**			**C**	**ISA**	**ESA**
				L	**T**	**P**			
1	PC	BEEPC6010	Switch gear & Protection	3	1	0	4	50	100
2	PC	BEEPC6020	Electric drives	3	0	0	3	50	100
3	PC	BEEPC6030	Communication Engineering	3	0	0	3	50	100
Professional Elective – II (Any One)									
4	PE	BEEPE6041	Smart Grid	3	0	0	3	50	100
		BEEPE6042	Traction						
		BEEPE6043	Advanced Power Electronics						
		BEEPE6044	Electrical Power Quality						
		Open Elective (*Any One*)							
5	OE	B**OE60**	Open Elective	3	0	0	3	50	100
6	BS/HS	BBSBS5061	Optimization in Engineering	3	0	0	3	50	100
		BMSHS5062	Organizational Behavior						
Laboratories									
7	PC	BEEPC6110	Energy management & Auditing lab	0	0	2	1	50	-
8	PC	BEEPC6120	Electric drives lab	0	0	2	1	50	-
9	PC	BEEPC6130	Photovoltaic & Wind Energy Systems lab	0	0	2	1	50	
10	PC	BEEPC6140	Advanced Lab 1 – IOT Lab	0	0	2	1	50	-
11	HS	BTPHS6160	# Soft skills & Employability skills	0	0	2	1	50	-
Total				**18**	**1**	**8**	**24**	**550**	**600**
Semester Marks: 1150				**Semester Credits: 24**					
Cumulative Marks: 6900				**Cumulative Credits: 144**					

To be Conducted by Training & Placement Department of the College

Subject Code	Subject Code	L	T	P	C	QP
BEEPC6010	**Switch gear & Protection**	3	1	0	4	A

Course Educational Objectives

CEO1	To introduce students to power system protection and switchgear.
CEO2	To teach students theory and applications of the main components used in power system protection for electric machines, transformers, bus bars, overhead and underground feeders.
CEO3	To teach students the theory, construction, applications of main types Circuit breakers, Relays for protection of generators, transformers and protection of feeders from over- voltages and other hazards. It emphasis on neutral grounding for overall protection
CEO4	To develop an ability and skill to design the feasible protection systems needed for each main part of a power system in students.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Know about various protective systems
CO2	Analyze different applications of the relays, circuit breakers; grounding for different elements of power system is also discussed in the subject.
CO3	Ability to discuss recovery and Restricting.
CO4	Analyze the characteristics of Oil circuit Breaker, Air Blast circuit Breakers, SF6 Circuit Breaker.
CO5	Analyze the characteristics of lighting arresters

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	2			1							2	
CO2			3	2			1							2	
CO3			3	2			1							1	
CO4			1	3			2							2	
CO5			3	2			2								
Avg.			2.4	2.2			1.4							1.75	

SYLLABUS

Unit – I **[12 Hrs]**

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage andRecovery voltages. - Restriking Phenomenon, Average and Max. RRRV, Numerical Problems. CurrentChopping and Resistance Switching. CB ratings and Specifications: Types and Numerical Problems. –Auto-reclosures.

Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

Unit - II [12Hrs]

Electromagnetic and Static Relays

Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc andInduction Cup relays. Relays Classification: Instantaneous, DMT and IDMT types. Application of relays: Over current/ under voltage relays, Direction relays, Differential Relays and Percentage

Differential Relays.
Universal torque equation, Distance relays: Impedance, Reactance and Mho and Off-Set Mho relays,Characteristics of Distance Relays and Comparison. Static Relays: Static Relays verses electromagnetic Relays.

Unit – III **[12 Hrs.]**

Protection

Generator Protection: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected.
Transformer Protection: Percentage Differential Protection, Numerical Problem on Design of CT sRatio, Buchholtz relay Protection.
Feeder and Bus-Bar Protection: Over Current, Carrier Current and Three-Zone distance relay protection using Impedance relays. Translay Relay. Protection of Bus bars – Differential protection.

Unit – IV **[12 Hrs.]**

Neutral Grounding & Protection against over voltages

Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system Performance. Methods of Neutral Grounding: Solid, Resistance, Reactance –Arcing Grounds and Grounding Practices.
Generation of Over Voltages in Power Systems. -Protection against Lightning over Voltages – Valve type and Zinc-Oxide Lighting Arresters. Insulation and Coordination -BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time Characteristics and Insulation Co-ordination

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. *Sunil S Rao "Switchgear Protection & Power Systems", Khanna Publishers*
2. *Badari Ram & D.N Viswakarma "Power System Protection and Switchgear", TMH publications*

Reference Book:

1. *Paithankar and S.R.Bhide, "Fundamentals of Power System Protection", PHI, 2003.*
2. *T S Madhav Rao, "Power System Protection: Static Relays", Tata McGraw-Hill, 2nd edition*
3. *C R Mason, "Art & Science of Protective Relaying", Wiley Eastern Ltd.*
4. *4.Cl Wadhwa, "Electrical Power Systems", New Age international (P) Limited, Publishers, 3rd editon*
5. *"Hand Book of Switchgears by BHEL", TMH Publications*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC6020	**ELECTRIC DRIVES**	3	0	0	3	A

Course Educational Objectives

CEO1	To provide students with a strong back ground in different types of electrical drives.
CEO2	To train the students to have the solid foundation in mathematical and technical concepts required to engineering problems.
CEO3	To prepare the students to excel in post graduate programs or to succeed in industry.
CEO4	To provide a foundation in the theory and applications of electrical machinery and their different types with respect to their control

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Understand the stable steady state operation and transient dynamics of motor-load system
CO2	Analyze characteristics and different control strategies ofsolid-state DC motors drives
CO3	Classify the role of power electronic converters in the control of DC motors drives
CO4	Distinguish the characteristics and control of various Induction motor drives
CO5	Determine the applications of various synchronous motor drives used in Industries
CO6	Develop the digital control methodology of AC and DC drives

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	2									1		
CO2			3	3									2		
CO3			2	2									2		
CO4			2	2									2		
CO5			2	2									2		
CO6			2	1									1		
Avg.			2.16	2									1.67		

SYLLABUS

UNIT I- REVIEW OF ELECTRIC DRIVES **08 HOURS**

Fundamentals of Electric Drives-Advantage of Electric Drives-selection of Motor power rating-Thermal model of motor for heating and cooling - Classes of duty cycle-Determination of motor rating -control of Electric drives- modes of operation - speed control and drive classifications -closed loop control of drives.

UNIT II- CONTROL OF DC DRIVES **10 HOURS**

DC Motor Drives: -DC motor and their performance-Braking - Transient analysis - Ward Leonard drives - Transformer and uncontrolled rectifier control – controlled rectifier fed DC drives - Chopper controlled DC drives - Time ratio control and current limit control - Single, two and four quadrant operations - Effect of ripples on the DC motor performance.

UNIT III- CONTROL OF AC DRIVES **14 HOURS**

Induction Motor Drives-Stator control-Stator voltage and frequency control-VSI, CSI and cyclo converter fed induction motor drives –open loop and closed VVVF control - Rotor resistance control and slip power recovery schematic control of rotor resistance using DC chopper-Vector Control basic concepts.

Synchronous Motor Drives: - Speed control of three phase synchronous motors Voltage and current source fed synchronous motor-Cyclo converter fed synchronous motors-Effects of harmonics on the performance of AC motors

UNIT-IV: DIGITAL TECHNIQUE IN SPEED CONTROL 08 HOURS

Digital Control and Drive Applications-Digital technique in speed control of electric drive system-Advantages and limitations - microcontroller based control of drives- selection of drives and control schemes for electrical vehicle Application, paper mills, lifts and cranes.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1. *Dubey.G.K. "Fundamentals of Electrical drives", Narora publications, 1995.*
2. *Bose. B.K. "Power Electronics and Variable frequency drives", 1st edition, IEEE Press Standard Publications 2002.*

Reference Books:

1. *Mazidi and Mazidi, "Intel 8051 Microcontrollers", Pearson education, India, 2006.*
2. *R. Krishnan, "Electric motor drives Modeling, Analysis and Control", 1st edition, Pearson Publications, 2009.*
3. *Gaekward, "Analog and Digital control systems", Wiley Eastern Ltd, 1989.*
4. *VedamSubramanyan, "Thyristor control of Electrical Drives", Tata McGraw Hill, Publications, 1996.*
5. *Bimal K. Bose, "Modern Power Electronics and AC Drives", Prentice Hall of India, 2005*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC6030	**Communication Engineering**	3			3	A

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Derive time domain and frequency domain equations for all forms of amplitude modulation Schemes.
CO2	Student understand the basic knowledge necessary for transmitting and receiving information
CO3	Student understand different types of modulation and demodulation
CO4	Student can solve analog and digital modulation problems
CO5	Explain various methods of generating and detecting different forms of amplitude modulation.
CO6	Compare the performance of communication system by evaluating the figure of merit for different schemes of modulation.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	2											
CO2			2	3											
CO3			2	2											
CO4			2	2											
CO5			2	2											
CO6			1	1											
Avg.			1.83	2											

SYLLABUS

Unit:1 **[10hrs]**

INTRODUCTION:

Elements of an Electrical Communication System, Communication Channels and their Characteristics, Mathematical Models for Communication Channels

Unit - II[12Hrs]

ANALOG SIGNAL TRANSMISSION AND RECEPTION: Introduction to modulation, Amplitude Modulation (AM), Angle Modulation, Radio and Television broadcasting

Unit – III **[10 Hrs.]**

PULSE MODULATION SYSTEMS: Introduction, Sampling Theorem, Pulse amplitude modulation, Pulse Time Modulation

Unit – IV **[8 Hrs.]**

Delta Modulation (DM), Limitations of DM, Adaptive Delta Modulation, Noise in DeltaModulation, Comparison betweenPCM and DM, Delta or Differential PCM (DPCM), S-Array System

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. *John G.Proakis,M. Salehi, COMMUNICATION SYSTEMS ENGINEERING, 2nd ed. New Delhi,India: PHI Learning Private Limited, 2009.; Selected portion from Chapter 1,2 and 3 for module MODULE-I and MODULE-II of the course.*
2. *R.P Singh and S.D Sapre, COMMUNICATION SYSTEMS Analog & Digital, 2nd ed. New Delhi, India: Tata McGraw Hill Education Private Limited, 2009;*
   Selected portions from Chapter 7 and 8 of the books for MODULE-III.
3. *Simon Haykin, An Introduction to Analog and Digital Communications, John Wiley and Sons*
4. *B.P. Lathi, Modern Digital and Analog Communication Systems, Oxford*

Reference Books:

1. *Taub, Schilling, Saha, Taub's Principles of Communication Systems, TMH.*
2. *Modern Digital and Analog Communication Systems, by B.P. Lathi, Oxford*
3. *A.B. Carlson and P.B.Crilly, " Communication Systems An Introduction to Signals and Noise in Electrical Communication", 5th Edn., TMH*

Subject Code	Name of the Subject	L	T	P	C	QP
BELPE6041	**Smart Grid**	3	0	0	3	A

Course Educational Objectives

CEO1	Understand concept of smart grid and its advantages over conventional grid
CEO2	Know smart metering technique
CEO3	Learn wide area measurement technique

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand features of Smart Grid in the context of Indian Grid
CO2	Assess the role of automation in Transmission/Distribution
CO3	Apply Evolutionary Algorithms for the Smart Grid/Distribution Generation
CO4	Understand operation and importance of PMUs, PDCs, WAMS, Voltage and Frequency control in Micro Grids.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	1												
CO2	1	2	1												
CO3	3	2	1												
CO4	2	2	1												
Avg.	1.75	2	1												

SYLLABUS

Unit 1:

Evolution of Electric Power Grid, introduction to smart Grid, Concept, definitions, architecture and functions of Smart Grid. Need of Smart Grid. Difference between conventional & smart grid. Opportunities & Challenges of Smart Grid,

Introduction to Smart Meters, Real Time Pricing, Smart Appliances. Automatic Meter Reading (AMR). Outage Management System (OMS). Home & Building Automation, Substation Automation, Feeder Automation, Smart Sensors, Geographic Information System (GIS). Intelligent Electronic Devices (IED) & their application for Monitoring & Protection.

Unit 2:

Phasor Measurement Units (PMU), Wide Area Measurement System (WAMS), Wide-Area based Protection and Control Micro-grid concepts, need and application, Issues of Interconnection. Protection & control systems for micro-grid.

Unit 3:

Power Quality & EMC in smart Grid. Power Quality issues of Grid connected Renewable Energy Sources. Power Quality Conditioners for micro-grid. Web based Power Quality monitoring,

Power Quality Audit.

Unit 4:

Variable speed wind generators, fuel-cells, micro-turbines. Integration of renewables and issues

involved, Advantages and disadvantages of Distributed Generation. Storage systems including Battery, SMES, Pumped Hydro. Compressed Air Energy Storage
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert
Text Books: 1. Ali Keyhani, "Design of Smart power grid renewable energy systems" ,Wiley IEEE,2011. 2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRCPress, 2009. 3. Stuart Borlase, " Smart Grid: Infrastructure,Technology and solutions " CRC Press.
Reference Books: 1. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley. 2. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability: 1", Artech House Publishers July 2011 3. MladenKezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer

Subject Code	Name of the Subject	L	T	P	C	QP
BELPE6042	**Traction**	3	0	0	3	A

Course Educational Objectives

To develop different types of skills so that students are able to acquire following competency:

CEO1	Maintain traction systems
CEO2	Auxiliary equipment
CEO3	Electric locomotives and
CEO4	Traction motors.

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Distinguish different traction systems and latest trends in traction systems.
CO2	Understand and differentiate the services of traction system based on speed time curve.
CO3	To analyze the Control of different types of traction motors
CO4	Know the usage of various traction system auxiliaries
CO5	Explain the distribution system of a traction system in various applications

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1	2											
CO2			2	2											
CO3			1	2											
CO4			1	1											
CO5			2	2											
Avg.			1.4	1.8											

SYLLABUS

UNIT I: **10 HOURS**

TRACTION SYSTEMS AND LATEST TRENDS

Present scenario of Indian Railways – High speed traction, Metro, Latest trends in traction-Metro, monorail, Magnetic levitation Vehicle, Steam, diesel, diesel-electric, Battery and electric traction systems, General arrangement of D.C., A.C. Single phase,3phase, Composite systems, Choice of traction system - Diesel- Electric or Electric

UNIT II: MECHANICS OF TRAIN MOVEMENT **08 HOURS**

Analysis of speed time curves for main line, suburban and urban services, Simplified speed time curves. Relationship between principal quantities in speed time curves, Requirement of tractive effort, Specific energy consumption and Factors affecting it.

UNIT III: TRACTION MOTORS AND THEIR CONTROL 12 HOURS

Features of traction motors., Significance of D.C. series motor as traction motor, A. C. Traction motors-single phase, Three phase, Linear Induction Motor, Comparison between different traction motors, Series-parallel control, Open circuit, Shunt and bridge transition, Pulse Width Modulation control of induction motors, Types of electric braking system.

UNIT IV: 08 HOURS

AUXILARIES AND DISTRIBUTION SYSTEM OF TRACTION SYSTEM

Important features of electric locomotives, Different types of locomotives, Current collecting equipment, Coach wiring and lighting devices, Power conversion and transmission systems, Control and auxiliary equipment

Distribution systems pertaining to traction (distributions and feeders), Traction sub-station requirements and selection, Method of feeding the traction sub- station

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1. *Modern Electric Traction. Partab, DhanpatRai and Sons, New Delhi*
2. *Electric Traction. Upadhyay& S. N. Mahendra, Allied Publishers Ltd., DhanpatRai and Sons, Ne*
3. *Electric Traction, A.T. Dover & Mac Millan, DhanpatRai and Sons, New Delhi*
4. *Electric Traction Hand Book, R. B. Brooks, Sir Isaac Pitman and sons ltd. London*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPE6043	**Advanced Power electronics**	3	0	0	3	A

Course Educational Objectives

To develop different types of skills so that students are able to acquire following competency:

CEO1	to provide exposure of some power electronic converters that are utilized by the industries
CEO2	To provide utilities that are not taught in the basic courses on Power Electronics

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Evaluate different dc-dc voltage regulators
CO2	Simulate and analyze resonant converters
CO3	Select appropriate phase shifting converter for a multi-pulse converter
CO4	Evaluate various multi-level inverter configurations
CO5	Compare various FACTS devices for VAR compensation

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2										2		
CO2	1		2										1		
CO3	1		2										2		
CO4	2		1										1		
CO5	1.5		1.75										2		
Avg.	2		2										1.5		

SYLLABUS

UNIT I: 12 hrs

Switching Voltage Regulators

Introduction; Linear power supply (voltage regulators); Switching voltage regulators; Review of basic dc-dc voltage regulator configurations -Buck, Boost, Buck-Boost converters and their analysis for continuous and discontinuous mode; Other converter configurations like Fly back converter, Forward converter, Half bridge, Full bridge configurations, Push-pull converter, C'uk converter, Sepic Converter; Design criteria for SMPS; Multi-output switch mode regulator

UNIT II: 8 hrs

Resonant Converters

Introduction, need of resonant converters, Classification of resonant converters, load resonant converters, Resonant switch converters, zero voltage switching dc-dc converters, zero current switching dc-dc converters, clamped voltage topologies

UNIT III: 7hrs

Multi-level converters

Need for multi-level inverters, Concept of multi-level, Topologies for multi-level: Diode Clamped, Flying capacitor and Cascaded H-bridge multilevel Converters configurations; Features and relative comparison of these configurations applications, Introduction to carrier based PWM technique for multi-level converters

UNIT IV: 7hrs

Multi-pulse Converters

Concept of multi-pulse, Configurations for m-pulse (m=12,18,24 ….) converters, Different phase shifting transformer (Y-?1, Y-?2, Y-Z1 and Y-Z2) configurations for multi-pulse converters, Application

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1. Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics – Converters, Applications and Design", John Willey & sons, Inc., 3rd ed., 2003.
2. Muhammad H. Rashid, "Power Electronics - Circuits, Devices and Applications", Prentice Hall of India, 3rd ed., 2009.
3. Bin Wu, "High Power Converters and AC Drives", John Willey & sons, Inc., 2006.
4. Derek A. Paice "Power Electronic Converter Harmonics – Multi-pulse Methods for Clean Power", IEEE Press, 1996.

Subject Code	Name of the Subject	L	T	P	C	QP
BELPE6044	**Electrical power quality**	3			3	A

Course Educational Objectives

CEO1	Ability to understand and analyze power system operation, stability, control and protection

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the power quality issues in electrical distribution network
CO2	Evaluate the severity of voltage sag, voltage swell, harmonics, and transients in distribution networks
CO3	Understand the methods to improve the power quality
CO4	Design circuits to mitigate power quality issues

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3													
CO2	3	3													
CO3	3	3													
CO4					3										
Avg.	3	3			3										

SYLLABUS

Unit – I [14Hrs]

Introduction: Definition of Power quality, Power Quality –Voltage & Current Quality, Importance of Power Quality, Power quality Evaluation. Terms and Definitions: General Classes of Power quality Problems, Transients, Long-Duration Voltage Variations, Short-Duration Voltage Variations, Voltage Imbalance, Waveform Distortion, Voltage fluctuation, Power Quality Terms, CBEMA and ITI Curves

Unit - II [12Hrs]

Voltage Sags and Interruptions: Sources of Sags and Interruptions, estimating voltage Sag Performance, Fundamental Principles of Protection, Solution at the End-User Level, Motor –Starting Sags. Transient over Voltages: Sources of Transient Over voltages, Principles of Over voltage Protection, Devices for over voltage Protection, Utility Capacitor-Switching transients, Utility System Lightning Protection, Managing Ferro-resonance, Switching Transient Problems with Loads, Computer Tools for Transients Analysis

Unit – III[14 Hrs.]

Fundamentals of Harmonics: Harmonic Distortion, Voltage versus Current Distortion, Harmonics versus Transients, Harmonic Indexes, Harmonic Sources from Commercial Loads, Harmonic Sources from Industrial Loads, Locating Harmonic Sources, Effects of Harmonic distortion, inter harmonics, Harmonic distortion Evaluations, Principles for Controlling Harmonics, Harmonic Filter design: A Case Study, Standards of Harmonics. Long-Duration Voltage Variations: Principles of Regulating the Voltage, Devices for Voltage Regulation, Utility Voltage Regulator application, Capacitors for Voltage Regulation, End-Users Capacitors Application, and Regulating Utility Voltage with distributed Resources Flicker

Unit – IV [**8 Hrs.]**

Power Quality Monitoring: Monitoring considerations, Historical Perspective of Power quality Measuring Instruments, Power Quality Measurement Equipment, Assessment of Power Quality Measurement Data, Application of intelligent Systems, Power Quality Monitoring Standards, Monitoring considerations

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text books:

1. Electrical Power Systems Quality, Dugan Roger C, Santoso Surya, Mc Granaghan , Marks F. Beaty and H. Wayre, Mc Graw Hill
2. Power Systems Quality Assessment, J.Arillaga, N.R.Watson, S.Clon, John Wiley

Reference books:

1. Power Quality, C.Sankaran, CRC Press
2. Understanding power quality problems, Math H. Bollen, IEEE press

Laboratories

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPE6110	**Energy Management & Auditing Lab**	0	0	2	1	

List of Experiments

1. Calculation of Energy performance Index (EPI) of a building
2. Identifying various parameters and calculation of HT consumer Electricity bill
3. Measuring the power factor of 3 – phase induction motor and procedure for power factor correction
4. Preparing an Energy audit report of domestic load
5. Calculation procedure of ECBC standards and comparison
6. Assessment of Lighting Systems with ILER Calculation
7. Comparison analysis of DC and AC loads
8. Energy management and auditing analysis of a typical consumer load

Subject Code	Subject Code	L	T	P	C	QP
BEEPC6120	**Electric drives Lab**	**0**	**0**	**2**	**1**	

Course Educational Objectives

CEO1	To impart knowledge on Performance of the fundamental control practices associated with AC and DC machines using power electronics
CEO2	To impart industry oriented learning
CEO3	To evaluate the use of computer-based analysis tools to review the major classes of Machines and their

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Identify relevant information to supplement to the Electric Drives course.
CO2	Set up control strategies to synthesize the voltages in dc and ac motor drives.
CO3	Develop testing and experimental procedures applying basic knowledge in electronics, electrical circuit analysis, electrical machines and microprocessors
CO4	An ability to use standard methods to determine accurate modeling/simulation parameters for various general- purpose electrical machines and power electronics devices required for designing a system and solve drives related problems

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2	0										
CO2				2	3										
CO3				2	0										
CO4				1	0										
CO5				2	2										
CO6				1	0										

Avg				1.66	2.5											

LIST OF EXPERIMENTS (Any 8 Experiments)

1. Speed Control of Single Phase Induction Motor by using Single Phase AC to ACConverter.
2. Speed Control of Separately Excited DC Shunt Motor using Single Phase FullyControlled AC to DC Converter.
3. Speed Control of Separately Excited DC Shunt Motor using Four-Quadrant Chopper.
4. Speed Control of Separately Excited DC Shunt Motor using Single Phase DualConverter.
5. Speed Control of Three Phase Squirrel Cage Induction Motor using Three Phase ACto AC Controller.
6. Speed Control of Three Phase Squirrel Cage Induction Motor using Three PhasePWM Inverter.
7. Speed Control of Three Phase Slip Ring Induction Motor using Rheostatic ControlMethod.
8. Speed Control of DC Shunt Motor using Three Phase AC to DC Converter.
9. Determination of the Transfer Function of DC Shunt Motor.
10. Determination of the Moment of Inertia of DC Shunt Motor Drive System by Retardation Test.
11. PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software
12. VSI / CSI fed Induction motor Drive analysis using MATLAB/DSPICE/PSIM Software
13. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software

Subject Code	Subject Code	L	T	P	C	QP
BEEPC6130	**Photovoltaic & Wind Energy Systems Lab**	**0**	**0**	**2**	**1**	A

Course Educational Objectives

CEO1	To analyse the basic components of Solar PV systems operation
CEO2	To Understand the characteristics of Solar PV modules

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Know the principles that underlie the ability of various natural phenomena to deliver solar energy
CO2	Outline the technologies that are used to harness the power of solar energy
CO3	Discuss the positive and negative aspects of solar energy in relation to natural and human aspects of the environment.
CO4	Examine the Solar PV system output with various options

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				1	3									2	
CO2				1	3									2	
CO3				2	3									3	
CO4				2	2									2	
Avg				1.6	2.8									2.2	

LIST OF EXPERIMENTS

1. I-V and P-V characters tics of PV module with varying temperature and radiation level
2. PV panel testing setup
3. Performance characteristics of mono-crystalline and poly-crystalline PV panels
4. Fill factor calculations of mono-crystalline and poly-crystalline PV panels
5. Series and Parallel combination of PV modules

6. Tilt angle calculations of PV modules
7. I-V and P-V characters tics of PV panel at various tilt angles
8. Testing and characters tics of solar batteries charging and discharging
9. Demonstration and effect of shading on PV modules
10. Testing of Solar inverter and load characteristics

Subject Code	Subject Code	L	T	P	C	QP
BEEPC6140	**Advanced Lab 1: IOT LAB**			**2**	**1**	

Course Educational Objectives

CEO1	Extend existing testbeds through crowdsourcing, enabling richer and more distributed experiments
CEO2	Bring the researcher and the end-user together, with closer interactions between the experiments and the society

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the basic principles of IoT.
CO2	Differentiate the features of various IoT platforms
CO3	Design simple IoT applications using Ardunio
CO4	Design simple IoT applications using Raspberry pi

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				1	1										1
CO2				2	2										2
CO3				2	1										1
CO4				1	2										2
CO5				2	2										2
CO6				2	3										2
Avg				1.66	1.83										1.66

LIST OF EXPERIMENTS

1. Interfacing DHT11 Humidity Sensor with Arduino Uno Board.
2. Intruder Detection using PIR Motion sensor and Arduino Uno Board.
3. Distance Measurement using Ultra Sonic Sensor (HC-SR04) and Arduino Uno Board.
4. ESP8266 WI-FI Module Interface with Arduino and DHT11 data upload to the cloud server.
5. Voice – Activated Arduino Bluetooth Android.3
6. Configuring Raspberry pi and sensor interfacing
7. Installation of NodeJS on Rasp
8. Raspberry Pi and simple Hello World Program
9. Complete study on ARM Cortex processor
10. Installation and testing of Intel Galileo and interfacing

Text books:

1. Kenneth J. Ayala, "8051 MICRO CONTROLLER ARCHITECTURE" Thomson Delmar Learning, 3rd Edition, 2005
2. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016

Reference books:

1. ArshdeepBahga, Vijay Madisetti" Internet of Things(A hands on approach)" 1ST edition, VPI publications,2014

VII SEMESTER [118									
S.N.	**Course Category**	**Subject Code**	**Subject**	**Hours per Week**			**C**	**ISA**	**ESA**
				L	**T**	**P**			
1	PC	BEEPC7010	Power System Operation & Control	3	0	0	3	50	100
2		BEEPC7020	FACTS	3	0	0	3	50	100
		Professional Elective – III *(Any one)*							
2	PE	BEEPE7031	Introduction to Robotics	3	0	0	3	50	100
		BEEPE7032	Advanced Power Systems						
		BEEPE7033	Digital Signal Processing						
		BEEPE7034	Neural Networks & Fuzzy Logic						
		Professional Elective – IV *(Any one)*							
4	PE	BEEPE7041	Generalized Theory of Electric Machines	3	0	0	3	50	100
		BEEPE7042	Principles of Entrepreneurship						
		BEEPE7043	Fundamentals of Cloud Computing						
		BEEPE7044	Big Data analytics						
		Open Elective – III *(Any one)*							
5	OE	B**OE7051	Open Elective - 1	3	0	0	3	50	100
		B**OE7052	Open Elective – 2						
		B**OE7053	Open Elective - 3						
		B**OE7054	Open Elective - 4						
Practical/ Sessional									
6	PC	BEEPC7110	Power System Operation & Control	0	0	2	1	50	-
7	PC	BEEPC7140	Advanced lab-II: Simulation	0	0	2	1	50	-

8	PC	BEEPC7150	Mini Project / Projects on Internet of Things	0	0	6	3	150	-
9	PC	BEEPE7160	## Massive Open Online Course (MOOC)	0	0	4	2	100	-
10	PC	BEEPC7170	^Summer Internship - II	0	0	2	1	50	-
Total				**15**		**12**	**23**	**650**	**500**
Semester Marks: 1150				**Semester Credits: 23**					
Cumulative Marks: 8050				**Cumulative Credits: 167**					

##Meeting with the global requirements, to inculcate the habit of self-learning and in compliance with ^UGC guidelines, Massive Open Online Course (MOOC) have been introduced as electives and it can be selected with the latest industrial requirement.

Subject Code	Subject Code	L	T	P	C	QP
BEEPC7010	**POWER SYSTEM OPERATION & CONTROL**	3	0	0	3	A

Course Educational Objectives

CEO1	To understand the economics of power system operation with thermal and hydro units
CEO2	To provide students the knowledge of optimization techniques used in the power system and Load Frequency Control (LFC).
CEO3	To provide a solid foundation in mathematical and engineering fundamentals required to control the governing system in Turbine models.
CEO4	To realize the requirements and methods of real and reactive power control in power system

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	Define p.u. system and represent the power system components in single line diagram.
CO2	Explain how to find the bus admittance matrix and the network incidence matrix
CO3	Choose the best method for load flow analysis for power system operation
CO4	Solve the unit commitment problems and understand the economic operation of power system.
CO5	Analyze operation of single area and two area load frequency control
CO6	Create mathematical models for dynamic and stability analysis of power systems

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1											0	
CO2	2	1	1											2	
CO3	3	2	3											2	
CO4	2	2	1											2	
CO5	3	3	3											2	
CO6	3	3	2											2	
Avg.	2.33	2	1.83											2	

SYLLABUS

Unit-I: **[14 Hrs.]**

Fundamentals of Power System: Introduction, Single Subscript Notation, Double Subscript Notation, Power in Single Phase AC Circuit, Complex Power, The Power Triangle, Direction of Power Flow, Voltage and Current in Balanced Three Phase Circuits, Power in Balanced Three Phase Circuits, Per- Unit Quantities, Changing the

Base in Per- Unit Quantities, Node Equations, The Single Line or One Line Diagram, Impedance and Reactance Diagrams.

The Admittance Models & Network Calculations: Branch and Node Admittances, Mutually Coupled Branches in Ybus, an Equivalent Admittance Network, Modification of Ybus, the Network Incidence Matrix and Ybus.

Power Flow Solutions: The Power-Flow Problem, the Gauss-Seidal Method, the Newton-Raphson Method, the Newton-Raphson Method, Power-Flow Studies in System Design and Operation, Regulating Transformers, the Decoupled Method.

Unit-II: [12 Hrs.]

Economic Operation of Power System: Distribution of Load between Units within a Plant, Distribution of Load between Plants, The Transmission-Loss Equation, An interpretation of Transformation C, Classical Economic Dispatch with Losses, Automatic Generation Control, Unit Commitment, Solving the Unit Commitment Problems.

Load Frequency Control, Control Area Concept: Automatic Load-Frequency Control of Single Area Systems: Speed-Governing System, Hydraulic Valve Actuator, Turbine-Generator Response, Static Performance of Speed Governor, Closing the ALFC Loop, Concept of Control Area, Static Response of Primary ALFC Loop, Dynamic Response of ALFC Loop, Physical Interpretation of Results, The Secondary ("Reset") ALFC Loop, Economic Dispatch Control.

Unit-III: [12 Hrs.]

Two Area Systems: ALFC of Multi-Control-Area Systems (Pool Operation): The Two Area Systems, Modelling the Tie-Line, Block Diagram Representation of Two Area System, Mechanical Analog of Two Area System, Dynamic Response of Two Area System, Static System Response, Tie-Line Bias Control of Multi-area Systems.

Unit-IV: [12 Hrs.]

Power System Stability: The Stability Problem, Rotor Dynamics and the Swing Equation, Further Considerations of the Swing Equations, The Power-Angle Equation, Synchronizing Power Coefficients, Equal-Area Criterion for Stability, Further Applications of the Equal-Area Criterion, Multi-machine Stability Studies: Classical Representation, Step-By-Step Solution of the Swing Curve, Computer Programs for Transient Stability Studies, Factors Affecting Transient Stability

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1. *Power System Analysis- By John. J. Grainger & W. D. Stevenson, Jr., TMH, 2003 Edition, Fifteenth Reprint.*
2. *An Introduction to Electric Energy System Theory- By O. I. Elgerd, TMH, Second Edition.*
3. *Power System Analysis, T K Nagsarkar and M S Sukhija, Oxford University Press*

Reference Book:

1. *Power System Analysis- By HadiSaadat, TMH, 2002 Edition, Eighth Reprint.*
2. *Power System Analysis Operation and Control- By A. Chakrabarti and S. Haldar, Third Edition, PHI Publications, 6th Reprint, 2010.*

Subject Code	Subject	L	T	P	C	QP
BEEPC7020	**FACTS**	3	0	0	3	A

Course Educational Objectives

CEO1	This course introduces the application of a variety of high power-electronic controllers for active and reactive power in transmission lines.
CEO2	Students are exposed to the basics, modelling aspects, control and scope for different types of FACTS controllers

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the importance of controllable parameters and benefits of different FACT controllers.
CO2	Ability to design a Compensators within realistic constraints
CO3	Know the significance of shunt, series compensation and role of FACTS devices on system control
CO4	Analyze the functional operation and control of GCSC, TSSC and TCSC
CO5	Describe the principles, operation and control of UPFC and IPFC.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	2										2	
CO2			3	2										3	
CO3			2	1										3	
CO4			3	2										2	
CO5			2	2										2	
Avg.			2.4	1.8										2.4	

SYLLABUS

Unit – I **[11Hrs.]**

FACTS concept and General System Considerations: Transmission Interconnections, Flow of Power in an AC System, What limits the Loading Capability, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic Types of FACTS Controllers, Basic Description and Definitions of FACTS Controllers.

Unit – II **[8 Hrs.]**

Static Shunt Compensation: Objectives of Shunt Compensation, Methods of Controllable VAR Generation, Static VAR Compensators, SVC and STATCOM.

Unit – III **12 Hrs.]**

Static Series Compensators: Objective of Series Compensation (GCSC, TSSC, TCSC), Variable Impedance

Type Series Compensators, Switching Converter Type Series Compensators (SSSC) Static Voltage and Phase Angle Regulators: Objectives of Voltage and Phase Angle Regulators, Approaches to Thyristor-Controlled Voltage and Phase Angle Regulators (TCVRs and TCPARs).

Unit – IV **[12 Hrs.]**

Combined Compensators: Introduction Unified Power Flow Controller (UPFC), TheInterline Power Flow Controller (IPFC), Generalized and Multifunctional FACTS Controllers.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. *"Understanding FACTS: Concepts & Technology of Flexible AC Transmission Systems" By N.G.Hingorani&L.Gyugyi, IEEE Press, Standard Publishers Distributors, Delhi*.

Reference Book:

1. Facts Controllers in Power Transmission & Distribution by K.R.Padiyan, New Age International.
2. Modelling & Simulation in Power Networks, Enrique Acha, ClandioEsquival&H.A.Perez, CACamcho , John Wiley & Sons.

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPE7031	**Introduction to Robotics**	3			3	A

Course Educational Objectives

CEO1	The participants will learn the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding and so on.
CEO2	The main purpose of this course is to help students to complete the understanding of the wireless communication system with other advanced courses in wireless communication.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Familiar with the history, concept development and key components of robotics technologies.
CO2	Familiar with various robot sensors and their perception principles that enable a robot toanalyse their environment, reason and take appropriate actions toward the given goal.
CO3	Understand and able to analyse and solve problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning.
CO4	Apply and demonstrate the learned knowledge and skills in practical robotics laboratories and experiments.
CO5	Design and implement a robotic project on a physical mobile robot platform, with tasks involving project specification, algorithm design, software programming, simulation and modelling, control and obstacle avoidance in a complex and interactive environment.
CO6	Enhancing communication skills through project report and seminar presentation.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2		2										
CO2			3		2										

CO3			2		2										
CO4			2		2										
CO5			2		2										
Avg.			2.2		2										

SYLLABUS

Unit – I **[14Hrs]**

Elements of robots -- joints, links, actuators, and sensors (5)

Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

Unit - II **[12Hrs]**

Kinematics of serial robots (4)

Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator.

Unit – III **[14 Hrs.]**

Velocity and statics of robot manipulators

Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics.

Unit – IV **[8 Hrs.]**

Motion planning and control

Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books:

1 *Robotics: Fundamental Concepts and Analysis*, Oxford University Press, Second reprint, May 2008.
2) Research work of my students and recent papers as mentioned in modules.
3) Material from other textbooks and robotics journals as mentioned.
4) All modules have Additional Material for self-study and reference

Reference Books:

1. Microcontrollers: Principles and Application, Ajit Pal, PHI Publication
2. Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096, Krishna Kant, PHI Publication, 2007.
3. Advanced Microprocessors and Peripherals, A.K. Ray, K M Bhurchandi, TMH
4. Textbook of Microprocessor and Microcontroller, Thyagarajan, Scitech Publication
5. The 8088 and 8086 Microprocessors Programming, Interfacing, Software, Hardware and Application; by Walter A.

Triebel& Avtar Singh ; Pearson India

Subject Code	Subject Code	L	T	P	C	QP
BEEPE7032	**Advanced Power Systems**	3	0	0	3	A

Course Educational Objectives

CEO1	To introduce different techniques of dealing with sparse matrix for large scale power systems.
CEO2	To impart in-depth knowledge on different methods of power flow solutions.
CEO3	To perform optimal power flow solutions in detail.
CEO4	To perform short circuit fault analysis and understand the consequence of different type of faults.
CEO5	To Illustrate different numeric al integration methods and factors influencing transient stability

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Apply the concepts of sparse matrix for large scale power system analysis
CO2	Analyse power system studies that needed for the transmission system planning.
CO3	**Formulate** the incidence, network matrices and **model** the power system components.
CO4	**Perform** steady state power flow analysis of power system networks using Gauss-Seidel, Newton-Raphson and Fast decoupled iterative methods

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3	2										2	
CO2			3	3										3	
CO3			2	3										2	
CO4			3	3										2	
Avg.			2.75	2.75										2.33	

SYLLABUS

Unit – I **[13Hrs]**

SOLUTION TECHNIQUE: Sparse Matrix techniques for large scale power systems: Optimal ordering schemes for preserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays – Factorization by Bi factorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

POWER FLOW ANALYSIS: Power flow equation in real and polar forms; Review of Newton‟s method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment

Unit - II **[10Hrs]**

OPTIMAL POWER FLOW: Problem statement; Solution of Optimal Power Flow (OPF) – The gradient method, Newton "method, Linear Sensitivity Analysis; LP methods – With real power variables only – LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs.

Unit – III **[12 Hrs]**

SHORT CIRCUIT ANALYSIS: Formation of bus impedance matrix with mutual coupling (single phase basis and three phase basis) - Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase – symmetrical and unsymmetrical faults.

Unit – IV **[10 Hrs]**

TRANSIENT STABILITY ANALYSIS:

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model; Factors influencing transient stability, Numerical stability and implicit Integration methods.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. *A.J.Wood and B.F.Wollenberg, "Power Generation Operation and Control", John Wiley and sons, New York, 1996.*
2. *W.F.Tinney and W.S.Meyer, "Solution of Large Sparse System by Ordered Triangular Factorization" IEEE Trans. on Automatic Control, Vol : AC-18, pp:333- 346, Aug 1973.*

Reference Book:

1. *K.Zollenkopf, "Bi-Factorization: Basic Computational Algorithm and Programming Techniques ; pp:75-96 ; Book on "Large Sparse Set of Linear Systems" Editor: J.K.Rerd,Academic Press, 1971.*
2. *M.A.Pai," Computer Techniques in Power System Analysis",Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.*
3. *G W Stagg , A.H El. Abiad, "Computer Methods in Power System Analysis", McGraw Hill, 1968.*
4. *P.Kundur, "Power System Stability and Control", McGraw Hill, 1994.*

Subject Code	Subject Code	L	T	P	C	QP
BEEPE7033	**DIGITAL SIGNAL PROCESSING**	3	0	0	3	A

Course Educational Objectives

CEO1	To understand the key theoretical principles underpinning DSP in a design procedure through design examples and case studies
CEO2	To learn how to use a powerful general-purpose mathematical package such as MATLAB to design and simulate a DSP systems
CEO3	To understand the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.
CEO4	To learn to design a real-time signal processing algorithms using the latest fixed-point processor.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Identify time domain and frequency domain sequences
CO2	Calculate the DFT of the time domain sequence
CO3	Apply the FFT algorithm to optimize the calculation process for DFT.
CO4	Determine the type of Filter to be used
CO5	Apply the proper filter characteristics and compute the filter coefficients
CO6	Describe the real-life applications based on the fundamental theory.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3	2											
CO2			3	2											
CO3			0	2											
CO4			3	0											
CO5			2	3											
CO6			2	2											
Avg.			2.6	2.2											

SYLLABUS

Unit – I **[15 Hrs]**

THE Z-TRANSFORM AND ITS APPLICATION TO THE ANALYSIS OF LTI SYSTEMS: The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain: Response of Systems

with rational System Functions, Transient and Steady-State Responses, Causality and Stability, Pole-Zero Cancellations.
THE DISCRETE FOURIER TRANSFORM: ITS PROPERTIES AND APPLICATIONS: Frequency Domain Sampling: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT; The Discrete Cosine Transform: Forward DCT, Inverse DCT, DCT as an Orthogonal Transform.

Unit- II [12Hrs]
IMPLEMENTATION OF DISCRETE-TIME SYSTEMS: Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures.
DESIGN OF DIGITAL FILTERS: General Considerations: Causality and Its Implications, Characteristics of Practical frequency-Selective Filters; Design of FIR Filters: Symmetric and Ant symmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation.

Unit – III [12 Hrs]
EFFICIENT COMPUTATION OF THE DFT: FAST FOURIER TRANSFORM ALGORITHMS: Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation.

Unit IV[8Hrs]
ADAPTIVE FILTERS: Application of Adaptive Filters: System Identification or System Modeling, Adaptive Channel Equalization, Adaptive Line Enhancer, Adaptive Noise Cancelling; Adaptive Direct-Form FIR Filters-The LMS Algorithm: Minimum Mean Square Error Criterion, The LMS Algorithm.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. *Digital Signal Processing – Principles, Algorithms and Applications by J. G.Proakis and D. G. Manolakis, 4th Edition, Pearson.*

Reference Book:

1. *Digital Signal Processing: a Computer-Based Approach – Sanjit K. Mitra, TMH*
2. *Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH.*
3. *Digital Signal Processing – Manson H. Hayes (Schaum's Outlines) Adapted by SubrataBhattacharya, TMH.*
4. *Digital Signal Processing: A Modern Introduction – Ashok Ambardar, Cengage Learning.*
5. *Modern Digital Signal Processing – Roberto Cristi, Cengage Learning.*
6. *Digital Signal Processing: Fundamentals and Applications – Li Tan, Academic Press, Elsevier*

Subject Code	Subject	L	T	P	C	QP
BEEPE7034	**Neural Networks and Fuzzy Logic**	3			3	A

Course Educational Objectives

CEO1	It deals with Introduction and different architectures of neural network
CEO2	It deals with the Application of Neural Networks
CEO3	It deals with Fuzzy Logic Controller
CEO4	It deals with applications of Fuzzy logic

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	The student will be able to obtain the fundamentals and types of neural networks.
CO2	The student will have a broad knowledge in developing the different algorithms for neural Networks.
CO3	Student will be able analyze neuralcontrollers
CO4	Student will have a broad knowledge in Fuzzy logic principles.
CO5	Student will be able to determine different methods of Deffuzification

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	3										2	
CO2			3	3										3	
CO3			2	3										3	
CO4			3	3										2	
CO5			1	2										2	
Avg.			2.2	2.8										2.4	

SYLLABUS

Unit – I **[11Hrs.]**

ARCHITECTURES: Introduction –Biological neuron-Artificial neuron-Neuron modeling Learning rules-Single layer-Multi layer feed forward network-Back propagation-Learning factors.

Unit – II **[8 Hrs.]**

NEURAL NETWORKS FOR CONTROL: Feedback networks-Discrete time hop field networks-Schemes of neuro –control, identification and control of dynamical systems-case studies.

Unit – III **12 Hrs.]** FUZZY SYSTEMS: Classical sets-Fuzzy sets-Fuzzy relations-Fuzzification – Defuzzification- Fuzzy rules FUZZY LOGIC CONTROL: Membership function – Knowledge base-Decision –making logic – Optimizations of membership function using neural networks-Adaptive fuzzy systems-Introduction to generate to genetic algorithm
Unit – IV **[12 Hrs.]** APPLICATION OF FLC: Fuzzy logic control-Washing machine-Image processing-Energy efficient fans-Building temperature control-Introduction to neuro fuzzy controller.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert
Text Book: 1. Kosko, B, "Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence", PrenticeHall, New Delhi, 2004. 2. Timothy J Ross, "Fuzzy Logic with Engineering Applications", John Willey and Sons, West Sussex, England, 2005
Reference Book: 1. Jack M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishing Co., Boston, 2002. 2. Klir G.J. &Folger T.A., "Fuzzy sets, Uncertainty and Information", Prentice –Hall of India Pvt. Ltd., New Delhi, 2008. 3. Zimmerman H.J., "Fuzzy set theory and its Applications", Kluwer Academic Publishers Dordrecht, 2001. 4. Driankov,Hellendroonb, "Introduction to fuzzy control", Narosa Publishers,2001. ***5.*** LauranceFausett, Englewood cliffs, N.J., "Fundamentals of Neural Networks", PearsonEducation, New Delhi, 2008

Subject Code	Subject Code	L	T	P	C	QP
BEEPE7041	**Generalized Theory of Electrical Machines**	3	0	0	3	A

Course Educational Objectives	
CEO1	Represent the electric machines in their non linear models
CEO2	Represent any rotating electric machines in d-q model.
CEO3	Analysis any global rotating machine into perpendicular d and q axes
CEO4	Extract the output power either electrical or mechanical from the model.
CEO5	Analysis and monitor the machine performance in both transient and steady state modes
CEO6	Construct a complete model for the whole system and study the effect of disturbances
Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Derive Kron's Primitive machine as an unified electrical machine model.
CO2	Derive the mathematical model of a separately excited DC motor & DC Series Motor
CO3	Analyze a three phase synchronous/ PM machine under transient conditions.
CO4	Derive the mathematical model and control a 3- phase Induction motor under transient /steady state
CO5	Analyze asymmetrical 2-phase / 1-phase induction motor under transient /steady state conditions

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2	1	1									3		
CO2		2	1	1									3		
CO3		1	2	1									3		
CO4		1	1	2									3		
CO5		1	2	1									2		
Avg.		1.4	1.4	1.2									2.8		

SYLLABUS

Unit–I **[11Hrs]**

MODELING CONCEPTS Basic Two-pole machine representation of commutator machines, 3- phase synchronous machine without damper bars and 3-phase induction machine, Kron's primitive machine-voltage, current and torque equations. Real time model of a two phase induction machine transformation to obtain constant matrices-three phase to two phase transformation- power invariance.

Unit -II **[12Hrs]**

REFERENCE FRAME THEORY & PM AC MACHINE Introduction–Background–Equations of Transformation–Stationary Circuit variables transformed to the Arbitrary Reference Frame– Commonly Used Reference Frames–Balanced Steady -State Phasor Relationships– Balanced Steady-State Voltage Equations. PM AC Machine: Voltage & Torque equations in Machine Variables and Rotor Reference Frame Variables

Unit – III **[12 Hrs]**

DC MACHINE MODELLING Mathematical model of a separately excited DC motor- Steady state and transient analyses - Transfer function of a separately excited DC machine – Mathematical model of a DC series motor, shunt motor linearization techniques for small perturbations

Unit – IV **[12 Hrs]**

AC MACHINE MODELLING: ANALYSIS OF SYNCHRONOUS MACHINE: Synchronous machine inductances – voltage equations in the rotor's dq0 reference frame- electromagnetic torque-current in terms of linkages. Dynamic performance of synchronous machine, three-phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria– simulation of three phase synchronous machine – Dynamic performance during a sudden change in input torque– Torque vs. rotor angle characteristics

MODELING OF THREE PHASE SYMMETRICAL INDUCTION MACHINE Generalized model in an arbitrary reference frame- Electromagnetic torque– Derivation of commonly used induction machine models– Stator reference frame model- Rotor reference frame model- Synchronously rotating frame model– Equations in flux linkages - per unit model Dynamic Simulation- Small signal equations of induction machine – derivation of dq flux linkage model – Control principles of Induction machine, Analysis under steady state operation.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. Dr. P. S. Bimbhra, "Generalized Theory of Electrical Machines" – Fifth edition, Khanna publishers (for UNIT- I: Chapters 1 & 2))
2. P.C.Krause, Oleg Wasynczuk, Scott D. Sudhoff "Analysis ofElectrical Machinery and Drive systems", 3rd Edition, IEEE Press (for UNIT – II, III, IV & V: Chapters 3,4,5 ,6, 9, part of 10)

Reference Book:

1. Chee Mun Ong "Dynamic simulation of Electric machinery usingMatlab / Simulink" –Prentice Hall
2. C.V. Jones: "The Unified Theory of Electrical Machines" Butterworth, London.

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPE7042	**Principles of Entrepreneurship**	3	0	0	3	A

Course Educational Objectives

CEO1	Explore the entrepreneurial mindset and culture that has been developing in companies of all sizes in virtually every industry
CEO2	Examine the entrepreneurial process involved in both pursuing an entrepreneurial venture within a large company and the creating and managing a new enterprise for implementation of an entrepreneurial venture.
CEO3	Discuss the dynamics of participating on a business team and the power inherent in a team relative to individual effort
CEO4	Provide the background and tools necessary to understand and participate in the entrepreneurial process within a large company, in a new venture or as an investor

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understanding the dynamic role of entrepreneurship and small businesses
CO2	Examine and Organizing a Small Business
CO3	Predict the Financial Planning and Control
CO4	Understand the Forms of Ownership for Small Business
CO5	Create New Product or Service Development
CO6	Illustrate the Business Plan Creation

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1									1		2				
CO2									1		2				
CO3									2		2				
CO4									1		2				
CO5									2		2				
Avg.									1.4		2				

SYLLABUS

Unit- I **[10Hrs]**

Introduction to Entrepreneurship: Definition of Entrepreneur Entrepreneurial Traits. Entrepreneur vs. Manager,

Creating and Starting the venture: Sources of new ideas, methods of generating ideas, creative problem solving – Writing Business Plan, Evaluating Business Plans. Launching formalities
Financing and Managing the new venture: Sources of capital, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and entrepreneurship, Internet advertising- New venture Expansion Strategies and Issues.

Unit - II **[10Hrs]**

Institutional/financial support: Schemes and functions of Directorate of Industries, District Industries Centres (DICs), Industrial Development Corporation (IDC), State Financial Corporation (SFCs), Small Scale Industries Development Corporations (SSIDCs). Khadi and Village Industries Commission (KVIC), Technical Consultancy Organisation (TCO), Small Industries Service Institute (SISI), National Small Industries Corporation (NSIC), Small Industries Development Bank of India (SIDBI).

Unit – III **[08 Hrs]**

Production and Marketing Management: Thrust areas of production management, Selection of production Techniques, Plant utilization and maintenance, Designing the work place, Inventory control , material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing

Unit – IV **[06 Hrs]**

Labour legislation, Salient Provisions of Health, Safety, and Welfare under Indian Factories Act, Industrial Disputes Act, Employees State Insurance Act, Workmen's Compensation Act and Payment of Bonus Act.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:

1. *Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 2009.Dollinger: Entrepreneurship, Pearson, 2009.*

Reference Book:

1. *Agarwal: Indian Economy, WishwaPrakashan 2009.*
2. *Dutt&Sundaram: Indian Economy,S.Chand, 2009*
3. *B D Singh.:Industrial Relations &Labour Laws, Excel, 2009.*
4. *ArunaKaulgud: Entrepreneurship Management by, Vikas publishing house, 2009.*
5. *Essential of entrepreneurship and small business management by Thomas W.Zimmerer& Norman M.Searborough, PHI-2009.*
6. *ND Kapoor: Industrial Law, Sultan Chand & Sons, 2009*

Subject Code	Subject	L	T	P	C	QP
BEEPE7043	**FUNDAMENTALS OF CLOUD COMPUTING**	3	0	0	3	A

Course Educational Objectives

CEO1	Understand the rationale behind the cloud computing revolution
CEO2	Introduce various models of cloud computing
CEO3	Understand how to design applications on cloud and the role of security
CEO4	Understand and design distributed systems for scalability

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the computing paradigm and cloud computing
CO2	Understand the architecture of cloud computing
CO3	Understand and use the service models and deployments
CO4	Work on any real cloud service
CO5	Understand the service management and security of cloud

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2	2										2
CO2					2										3
CO3				1	2										3
CO4				1	2										2
CO5					1										3
CO6				2	2										2
Avg.				1.5	1.83										2.5

SYLLABUS

Unit – I **[11Hrs]**

INTRODUCTION

Overview of computing paradigms, Recent trends in computing, evolution of cloud computing, Overview of cloud computing, Cloud computing-Concepts, properties, characteristics, Role of open standards.

CLOUD COMPUTING ARCHITECTURE

Cloud computing architecture, Cloud service delivery models (XAAS), Cloud Deployment models

Unit –II **[12Hrs]**

INFRASTRUCTURE AS A SERVICE

Introduction, Hypervisors, Resource virtualization, Examples, How to implement IAAS

PLATFORM AS A SERVICE

Introduction, Cloud Platform and Management, Examples, How to implement PAAS

Unit – III **[12 Hrs]**

SOFTWARE AS A SERVICE

Introduction, Web services, Web 2.0, Web OS, Examples, How to implement SAAS

SERVICE MANAGEMENT IN CLOUD COMPUTING

Service Orchestration -Cloud computing and Service Management, Service Level Agreements (SLAs), Billing & Accounting, Comparing scaling hardware, economics of scaling, managing data. Cloud performance, Existing project experience

Unit – IV **[12 Hrs]**

CLOUD SECURITY

Infrastructure security, Data Security, Storage Identity and Access Management, Access Control, Trust and Reputation, Authentication in Cloud computing

CASE STUDY ON OPEN SOURCE AND REAL CLOUD SERVICS

Eucalyptus, VMware Cloud, IBM Bluemix, Google Cloud services, Amazon Web services

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Book:

1. Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010
2. RajkumarBuyya, James Broberg, Andrzej M. Goscinski: "Cloud Computing: Principles and Paradigms", Wiley, 2011

Reference Book:

1. Nikos Antonopoulos, Lee Gillam: "Cloud Computing: Principles, Systems and Applications", Springer, 2012
2. Ronald L. Krutz, Russell Dean Vines: "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley-India, 2010
3. Tim Mather, Subra Kumara swamy, ShahedLatif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'Reilly Media, 2009

Subject Code	Subject Code	L	T	P	C	QP
BEEPE7044	**Big Data analytics**	3	0	0	3	A

Course Educational Objectives

CEO1	Provide an overview of Apache Hadoop
CEO2	Understand the Big Data Platform and its Use cases
CEO3	Provide HDFS Concepts and Interfacing with HDFS and understand Map Reduce Jobs
CEO4	Provide hands on Hodoop Eco System
CEO5	Apply analytics on Structured, Unstructured Data
CEO6	Exposure to Data Analytics with R.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Identify Big Data and its Business Implications.
CO2	List the components of Hadoop and Hadoop Eco-System
CO3	Access and Process Data on Distributed File System
CO4	Manage Job Execution in Hadoop Environment
CO5	Develop Big Data Solutions using Hadoop Eco System
CO6	Analyze Info sphere Big Insights Big Data Recommendations

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				3	2										3
CO2				3	2										3
CO3				1	3										2
CO4				2	1										3

CO5				2	3										2
CO6				1	2										3
Avg.				2	2.16										2.67

SYLLABUS

Unit– I **[11Hrs]**

INTRODUCTION TO BIG DATA AND HADOOP

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to InfosphereBigInsights and Big Sheets

Unit - II **[12Hrs]**

HDFS(Hadoop Distributed File System)

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures

Map Reduce

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features

Unit – III **[12 Hrs]**

Hadoop Eco System

Pig :Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

Hive :Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

Hbase :HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.

Big SQL : Introduction

Unit – IV **[12 Hrs]**

Data Analytics with R

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering.

Big Data Analytics with BigR.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2. Seema Acharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015

Reference Book:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
4. AnandRajaraman and Jefrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
6. Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007

7. Pete Warden, "Big Data Glossary", O'Reily, 2011.
8. Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
9. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012
10. Paul Zikopoulos ,DirkDeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

Laboratories

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC7110	**Power system operation and control lab**			2	1	A

Course Educational Objectives

To develop different types of skills so that students are able to acquire following competency:

CEO1	To provide students the knowledge of optimization techniques used in the power system and Load Frequency Control (LFC).
CEO2	To provide a solid foundation in mathematical and engineering fundamentals required to control the governing system in Turbine models.
CEO3	To provide the knowledge of Hydrothermal scheduling, reactive power control

Course Outcomes: : *Upon successful completion of this course, students should be able to:*

CO1	To make students express Economic operation of power system and importance of LFC control.
CO2	To allow students discuss about thermal and hydro power plants operation in meeting the load demand optimally.
CO3	To improve student's ability in solving problems (numerical problems at present) by posing different problem models related to Economic Load Dispatch, Load Frequency Control and reactive power control.
CO4	Ability to discuss single area load frequency control and two area load frequency control
CO5	Ability to model and design turbine and Automatic control

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	2										2	
CO2			3	3										3	
CO3			2	2										3	
CO4			3	3										2	
CO5			3	2										2	
Avg.			2.6	2.4										2.4	

LIST OF EXPERIMENTS
1. Determination of voltage and power at the sending end, voltage regulation using medium line model
2. Determination of line performance when loaded at receiving end
3. Formation of bus Admittance matrix
4. Load flow Solution using Gauss Seidel Method
5. Load flow solution using Newton Raphson method in Rectangular Coordinates
6. Optimal dispatch neglecting Losses and including Losses
7. Transient Response of an RLC Circuit
8. Three phase short circuit analysis in a Synchronous Machine
9. Unsymmetrical Fault Analysis
10. Zbus Building Algorithm
11. Obtain Symmetrical components of a set of Unbalanced currents
12. Obtain the original Unbalanced phase voltages from Symmetrical Components
13. Load Frequency control of a single area system
14. Load frequency control of a two area system

Subject Code	Subject	L	T	P	C	QP
BEELPC7140	**Advanced Lab – II- Simulation**					

Course Educational Objectives

CEO1	Acquire skills of using computer packages MATLAB coding and SIMULINK in power electronics and power system studies.
CEO2	Acquire skills of using ETAP software for power system studies

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Acquire skills of using computer packages MATLAB /SIMULINK in power electronics
CO2	Acquire skills of using computer packages using MATLAB in power systems
CO3	Acquire skills of using ETAP software for power system studies
CO4	An ability to identify, formulate, and solve engineering problems
CO5	An ability to design and conduct experiments, as well as to analyze and interpret results.
CO6	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic,environmental,social, political, ethical, health and safety, manufacturability, and sustainability

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				1	1									2	
CO2				2	3									2	
CO3				3	2									2	
CO4				3	2									2	

CO5				2	2									2	
CO6				3	3									2	
Avg.				2.33	2.16									2	

LIST OF EXPERIMENTS

1) Use of MATLAB for the following

1. Single phase half controlled converter with R and RL load.
2. Single phase fully controlled converter with R and RL load
3. Three phase fully controlled converter with R and RL load.
4. Single phase AC voltage controller with R and RL load.

2) Use of MATLAB coding for solving the following

1. Formation of Y-Bus by inspection method/analytical method.
2. Formation of Z-Bus matrix.
3. Load flow analysis for GS, NR and FDLF methods
4. Load flow solution for GS, NR and FDLF
5. Symmetrical and unsymmetrical fault analysis
6. Transient stability analysis

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Power electronics – P.S.Bimbhra
2. Power system analysis-Nagrath and Kothari

Ref. Books

Laboratory Manual

Subject Code	Subject	L	T	P	C	QP
BEEPC7160	**MOOC subject**					A

Course Educational Objectives

CEO1	One-stop web and mobile based interactive e-content for all courses from High School to University level.
CEO2	High quality learning experience using multimedia on anytime, anywhere basis
CEO3	State of the art system that allows easy access, monitoring and certification
CEO4	Peer group interaction and discussion forum to clarify doubts
CEO5	Hybrid model of delivery that adds to the quality of classroom teaching.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Ensure that all students with different personal and academic characteristics are able to follow the course information.
CO2	Course resources and tools should encourage students to participate. These may include social networking tools, authentic tasks, project-based assignments, and collaborative projects

CO3	Providing unique features (e.g., authentic e-learning activities) within the courses increases students' commitment and participation
CO4	Use peer and self-assessment for formative evaluation in conjunction with rubrics or other form of guidance to improve both students' learning and the accuracy of their assessments
CO5	Provide clear and structured assessments, and design the assessments by taking into account the students' profile and preferences in order to capture the students' attention
CO6	Ensure that feedback is personalized and contextualized to stimulate students' participation and engagement

Course features:

Pedagogy: Many of the reviewed studies explicitly explained the design and implementation process of the MOOCs, but only a limited number of studies examined how the design of MOOCs was related to students' learning activities or outcomes. The pioneering empirical studies concentrated on only two philosophical MOOC designs: cMOOCs and xMOOCs

Tools: Materials are the backbone of teaching-learning activities by supporting students with different learning styles in meaningful learning (Klimova&Poulova, 2013). MOOCs utilize commonly used teaching materials such as instruction videos, e-resources, e-books, and exercise sets.

Duration: Generally, the popular standard for MOOC length changes between 6-8 week classes. Longer MOOCs can make both developers and students feel overwhelmed. This may be why the duration of the MOOC is negatively associated with the completion rate.

Assessment and Feedback: Assessment is one of the most criticized issues in MOOCs (Clarà&Barberà, 2014), with studies mainly focused on the credibility of e-assessment as well as self and peer-assessment. Self and peer-assessment are distinguishing features of MOOCs since they relieve instructors from grading huge number of assignments and quizzes, and support learners in enhancing their learning and understanding.

References:

1. NPTEL: Technical / Engineering UG & PG degree programme.

Subject Code	Subject	L	T	P	C	QP
BEEPC7150	**Mini Project**			6	3	A

Course Educational Objectives

CEO1	Able to acquire practical knowledge within the chosen area of technology for project development
CEO2	Able to identify, analyze, formulate and handle electrical projects with a comprehensive and systematic approach
CEO3	Able to contribute as an individual or in a team in development of technical projects
CEO4	Able to develop effective communication skills for presentation of project related activities

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Formulate a real-world problem and develop its requirements
CO2	Develop design solutions for a set of requirements
CO3	Test and validate the conformance of the developed prototype against the original requirements of the problem
CO4	Work as a responsible member and possibly a leader of a team in developing software solutions
CO5	Express technical and behavioral ideas and thought in oral settings
CO6	Participate in and possibly moderate, discussions that lead to making decisions

VIII SEMESTER[140-154]

S. No.	Course Category	Subject Code	Course Title	Hours per week			C	ISA	ESA
				L	T	P			
		Theory							
		Professional Elective-V *(Any One)*							
1	PE	BEEPE8011	Illumination Engineering	3	0	0	3	50	100
		BEEPE8012	Computer Networks						
		BEEPE8013	Industrial safety & Hazard management						
		BEEPE8014	Satellite Communication						
		Professional Elective - VI *(Any One)*							
2	PE	BEEPE8021	Fundamentals of Global Positioning system	3	0	0	3	50	100
		BEEPE8022	Biomedical Instrumentation						
		BEEPE8023	Green Buildings Technology						
		BEEPE8024	Hybrid Electric Vehicles						
		Open Elective *(Any One)*							
3	OE	B**OE**31	Open Elective	3	-	-	3	50	100
		PRACTICAL/SESSIONAL							
4	PC	BEEPC8150	Major project/ Industrial project /Startup training cum project	0	0	12	6	300	-
5	PC	BEEPC8180	Seminar and Technical Writing	0	0	4	2	100	-
6	PC	BEEPC8190	Comprehensive VIVA	0	0	4	2	100	-
				9	**0**	**20**	**19**	**650**	**300**
Semester Marks: 950				**Semester Credits: 19**					
Cumulative Marks: 9000				**Cumulative Credits: 186**					

Subject Code	Subject	L	T	P	C	QP
BEEPE8011	**Illumination engineering**	3	0	0	3	A

Course Educational Objectives

CEO1	To get the detailed information about modern lamps and their accessories.
CEO2	To get detailed insight of indoor and outdoor illumination system components, its controls and design
CEO3	To know the requirements of energy efficient lighting.
CEO4	To introduce the modern trends in the lighting

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Able to analyze the performance characteristics of human visual system
CO2	Define and reproduce various terms in illumination.
CO3	Identify various parameters for illumination system design.
CO4	Design indoor and outdoor lighting systems.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	1											0
CO2			2	1											0
CO3			1	2											0
CO4			2	2											2
Avg.			1.75	1.5											2

SYLLABUS

Unit – I

Importance of Lighting in Human Life: [12 hrs]

Optical systems of human eye ,Dependence of human activities on light, performance characteristics of human visual system, External factors of vision-visual acuity, contrast, sensitivity, time illuminance, colour, visual perception, optical radiation hazards, Good and bad effects of lighting & perfect level of illumination, Artificial lighting as substitute to natural light, Ability to control natural light, Production of light, physics of generation of light, Properties of light, Quantification & Measurement of Light.

Lamp materials: Filament, glass, ceramics, gases, phosphors and other metals and non-metals. Discharge Lamps: Theory of gas Discharge phenomena, lamp design considerations, characteristics of low and high mercury and Sodium vapour lamps, Low Vapour Pressure discharge lamps - Mercury Vapour lamp, Fluorescent Lamp, Compact Fluorescent Lamp (CFL) High Vapour Pressure discharge lamps - Mercury Vapour lamp, Sodium Vapour lamp, Metal halide Lamps, Solid Sodium Argon Neon lamps, SOX lamps, Electro luminescent lamps, Induction lamps.

Unit - II **[6Hrs]**

Electrical Control of Light Sources:

Ballast, igniters and dimmers for different types of lamps, Photometric Control of Light Sources and their Quantification: Types of Luminaries, factors to be considered for designing luminaries Types of lighting fixtures. Optical control schemes, design procedure of reflecting and refracting type of luminaries. Lighting Fixture types, use of reflectors and refractors, physical protection of lighting fixtures, types of lighting fixtures according to installation type, types of lighting fixtures according to photometric usages, luminaries standard (IEC-598-Part I).

Unit – III **[10 Hrs]**

Zonal cavity method for general lighting design, determination for zonal cavities and different shaped ceilings using COU (coefficient of utilization), beam angles and polar diagrams. Factors to be considered for design of indoor illumination scheme Indoor illumination design for following installations, Residential (Numerical), Educational institute, Commercial installation, Hospitals, Industrial lighting Special purpose lighting schemes, Decorative lighting, Theatre lighting, Aquarium, swimming pool lighting

Unit – IV **[12 Hrs]**

Factors to be considered for design of outdoor illumination scheme Outdoor Lighting Design: Road classifications according to BIS, pole arrangement, terminology, lamp and luminaire selection, different design procedures, beam lumen method, point by point method, isolux diagram, problems on point by point method.

Outdoor illumination design for following installations, Road lighting (Numerical), Flood lighting (Numerical), Stadium and sports complex, Lighting for advertisement/hoardings , Modern trends in illumination, LED luminary designs, Intelligent LED fixtures, Natural light conduiting, Organic lighting system, LASERS, characteristics, features and applications, non-lighting lamps, Optical fiber, its construction as a light guide, features and applications

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. *H. S. Mamak, "Book on Lighting", Publisher International lighting Academy*
2. *Joseph B. Murdoch, "Illumination Engineering from Edison's Lamp to Lasers" Publisher - York, PA : Visions Communications*
3. *M. A. Cayless, A. M. Marsden, "Lamps and Lighting", Publisher-Butterworth-Heinemann(ISBN 978-0-415-50308-2)*
4. *Designing with light: Lighting Handbook., Anil Valia; Lighting System 2002*

Reference Book:

1. *"BIS, IEC Standards for Lamps, Lighting Fixtures and Lighting", ManakBhavan, New Delhi*
2. *D. C. Pritchard, "Lighting", 4th Edition, Longman Scientific and Technical, ISBN 0-582-23422- 0.*
3. *"IES Lighting Handbook", (Reference Volume 1984), Illuminating Engineering Society of North America.*
4. *"IES Lighting Handbook", (Application Volume 1987), Illuminating Engineering Society of North America*
5. *IESNA lighting Handbook., Illuminating Engineering Society of North America 9th edition*

2000

Subject Code	Subject Code	L	T	P	C	QP
BEEPE8012	**COMPUTER NETWORKS**	3	0	0	3	A

Course Educational Objectives

CEO1	To discuss the digital data communication techniques
CEO2	Gain knowledge on basic concepts of data communication layers, protocols and performance
CEO3	Understand a few representative protocols and network components
CEO4	To introduce the functions of different layers from deployed examples
CEO5	To introduce standards employed in computer networking
CEO6	To introduce the fundamentals of security in data communication

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	At the end of the course the students will be able to:
CO2	Describe the hardware and software commonly used in data communications
CO3	Analyze the services and features of various layers of data networks
CO4	Design, implement and analyze simple networks that need data communication.
CO5	Analyze the features and operations of application protocols like TCP/UDP, FTP, HTTP etc.
CO6	Have read a couple of published papers and appreciate the contemporary issues and solution in area of data communication

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2	1										
CO2				2	2										
CO3				2	3										
CO4					3										
CO5				2	3										
CO6					3										
Avg.				2	2.3										

SYLLABUS

UNIT:1 **(12 Hours)**

Overview of Data Communications and Networking.

Networks models – TCP/IP Protocol Suite , OSI model – Layers in OSI Digital Transmission: Line coding, Block coding, Sampling, Transmission mode. Analog Transmission: Modulation of Digital and Analog Data; Transmission Media: Guided Media, Unguided media (wireless) Circuit switching: Circuit switching (Data gram Networks and Virtual circuit networks)

UNIT:2 **(12 Hours)**

Data Link Layer

Error Detection and correction: Types of Errors, Detection, Error Correction Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC. Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack, Multiple Access Random Access, Controlled Access, Channelization.

UNIT:3 **(10 Hours)**

Local area Network: Ethernet. Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Token bus, token ring Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

Network Layer:

Host to Host Delivery: Internetworking, addressing and Routing Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6

UNIT:4 **(10 Hours)**

Transport Layer: Process to Process Delivery: UDP; TCP congestion control and Quality of service.
Application Layer:Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

TEXT BOOKS:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

Reference Books:

1 Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4th Ed
2 Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3 Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9th Ed.
4 Data communication & Computer Networks: Gupta, Prentice Hall of India Network for Computer Scientists & Engineers: Zheng, Oxford University Press

Subject Code	Subject	L	T	P	C	QP
BEEPE8013	**INDUSTRIAL SAFETY &HAZARD MANGEMENT**	3	0	0	3	A

Course Educational Objectives

CEO1	To know about Industrial safety programs and toxicology, Industrial laws , regulations and source models
CEO2	To understand about fire and explosion, preventive methods, relief and its sizing methods
CEO3	To analyse industrial hazards and its risk assessment

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Analyze the effect of release of toxic substances. identification and preventive measure
CO2	Understand the industrial laws, regulations and source models.
CO3	Apply the methods of prevention of fire and explosions.
CO4	Understand the relief and its sizing methods
CO5	Understand the methods of hazard

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

CO1						3	3								
CO2						3	3								
CO3						3	2								
CO4						2	3								
CO5						2	1								
Avg.						2.6	2.4								

SYLLABUS

Unit: 1 **10 Hours**

Introduction: Safety Programs, Engineering Ethics, Accident and Loss Statistics, Acceptable Risk, Public Perceptions, Nature of the Accident Process, Inherent Safety, Seven Significant Disasters. Toxicology: Effect of Toxicants on Biological Organisms, Toxicological Studies, Dose versus Response, Models for Dose and Response Curves, Relative Toxicity, Threshold Limit Values, National Fire Protection Association (NFPA) Diamond.

Unit: 2 **13 Hours**

Industrial Hygiene: Government Laws and Regulations, OSHA: Process Safety Management, EPA: Risk Management Plan, DHS: Chemical Facility Anti-Terrorism Standards (CFATS) Industrial Hygiene: Anticipation and Identification, Evaluation, Control.

Source Models: Introduction to Source Models, Flow of Liquid through Holes, and Pipes, Flow of Gases or Vapors through Holes and Pipes, Flashing Liquids, Liquid Pool Evaporation or Boiling, Conservative Analysis

Unit: 3 **10 Hours**

Fires and Explosions: The Fire Triangle, Distinction between Fires and Explosions, Definitions, Flammability Characteristics of Liquids and Vapors, Limiting Oxygen Concentration and Inerting, Flammability Diagram, Ignition Energy , Auto ignition , Auto-Oxidation , Adiabatic Compression, Ignition Sources, Sprays and Mists, Explosions Concepts to Prevent Fires and Explosions: Inerting, Static Electricity and its Control, Explosion-Proof Equipment and Instruments, Ventilation, Sprinkler Systems, Miscellaneous Concepts for Preventing Fires and Explosions.

Unit :4 **4 Hours**

Introduction to Reliefs: Relief Concepts, Definitions, Location of Reliefs, Relief Types and Characteristics, Relief Scenarios, Data for Sizing Reliefs, Relief Systems. Relief Sizing : Conventional Spring-Operated Reliefs in Liquid and in Vapour or Gas Services, Rupture Disc Reliefs in Liquid in Vapour or Gas Services, Two-Phase Flow during Runaway Reaction Relief , Pilot-Operated and Bucking-Pin Reliefs, Deflagration Venting for Dust and Vapor Explosions, Venting for Fires External to Process Vessels, Reliefs for Thermal Expansion of Process Fluids

Hazards Identification: Process Hazards Checklists, Hazards Surveys, Hazards and Operability Studies, Safety Reviews, Other Methods, Risk Assessment: Review of Probability Theory, Event Trees, Fault Trees, QRA and LOPA

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. D.A. Crowl and J.F. Louvar, Chemical Process Safety (Fundamentals with Applications), Prentice Hall, 2011.

Reference Book:

1. R.K. Sinnott, Coulson & Richardson's, Chemical Engineering, Vol. 6, Elsevier India, 2006.
2. Fawcett H.H. and W.S.Wood, Safety and accident prevention in Chemical operations

2ndediton John Wiley and Sons Inc. (1982).

Subject Code	Subject	L	T	P	C	QP
BEEPE8014	**Satellite Communication**	3	0	0	3	A

Course Educational Objectives

CEO1	Explain the principles, concepts and operation of satellite communication systems
CEO2	Describe the concepts of signal propagation affects, link design, rain fading and link availability and perform interference calculations
CEO3	Understand modulation techniques and error correction codes for satellite communication
CEO4	Critically analyse the design requirements and the performance of satellite communication systems

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the motion of satellite in the orbit and its link design.
CO2	Compute the coverage angle, angle of visibility and consequently determine the coverage area.
CO3	Demonstrate the impacts of GPS, Navigation, constellation design for tracking and launching with various multiple access techniques like TDMA, CDMA, FDMA, and DAMA
CO4	Relate the coverage area with the beam width of satellite antenna and analyze the propagation on satellite with hydrometric and non-hydrometric effect.
CO5	Design antenna systems to accommodate the needs of a particular satellite system.
CO6	Able to study the design of Earth station and tracking of the satellites.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3	2											
CO2			3	2											
CO3				2											
CO4			3												
CO5			2	3											
CO6			2	2											
Avg.			2.6	2.2											

SYLLABUS

Unit:1 (12 hrs)

INTRODUCTION TO SATELLITE COMMUNICATION: Orbital mechanics and parameters look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system (AOCS), TT&C, Description of spacecraft System ; Transponders, SATELLITE LINK DESIGN: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

Unit:2 **(10 hrs)**

ANALOG TELEPHONE AND TELEVISION TRANSMISSION: Energy dispersal, digital transmission
MULTIPLE ACCESSES: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA; Spread Spectrum Transmission and Reception; Estimating Channel requirements, SPADE, Random access

Unit:3 (11hrs)

PROPAGATION ON SATELLITE: Earth paths and influence on link design; Quantifying attenuation and depolarization, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects.
SATELLITE ANTENNAS: Types of antenna and relationships; Basic Antennas Theory – linear, rectangular & circular aperture; Gain, pointing loss,

Unit:4 (7hrs)

EARTH STATION TECHNOLOGY: Earth station design; Design of large antennas – Cassegrain antennas, optimizing gain of large antenna, antenna temperature, feed system for large cassegrain antennas,
DESIGN OF SMALL EARTH STATION ANTENNAS: Front fed parabolic reflector antennas, offset fed antennas, beam steering, Global Beam Antenna, equipment for earth station

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books

1. Satellite Communication, T. Pratt, C. Bostian, John Wiley Co, 2nd Edition.
2. Satellite Communication, Principles & Applications, R.N.Mutagi, Oxford University Press, 1st Edition, 2016

Ref. Books

1. Digital Communication with Satellite and Fiber Optic Application, HarlodKolimbins, PHI
2. Satellite Communication, Robert M. Gagliardi, CBS Publishers
3. Satellites Communication Systems, Richharia. BSP BOOKS PVT LTD.
4. Satellites Communication Engg., MichealKolawole, BSP BOOKS PVT LTD

Subject Code	Subject	L	T	P	C	QP
BEEPE8021	Fundamentals of Global Positioning system	3	0	0	3	A

Course Educational Objectives

CEO1	introduce students to the basic principles of Global Positioning System and the equipment that are deployed
CEO2	teach students to carry out locationing and basic mapping using hand-held GPS equipment; and
CEO3	Provide students with the skills required to link locational data to certain projections and present same as maps using ILWIS.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	explain the workings of GPS, and understand the acquisition of locational data using the hardware
CO2	Produce a simple map from field data acquired using hand-held GPS.
CO3	Handling of GPS data
CO4	Implement analysis for research and a variety of planning and management applications

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES	PSOs

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	2										2	
CO2			3	3										3	
CO3			2	2										3	
CO4			3	3										2	
Avg.			2.6	2.4										2.4	

SYLLABUS

Unit – I **[11Hrs.]**

Overview of GPS : Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture.

GPS Signals Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

Unit – II **[8 Hrs.]**

GPS coordinate frames, Time references: Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 (WGS 84), GPS time

Unit – III **12 Hrs.]**

GPS orbits and satellite position determination : GPS orbital parameters, description of receiver independent exchange format (RINEX) – Observation data and navigation message data parameters, GPS position determination

Unit – IV **[12 Hrs.]**

GPS error sources – clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill publications, New Delhi, 2010

Reference Book:

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', Springer – Wien, New York (2001).
2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).

Subject Code	Subject Code	L	T	P	C	QP
BEEPE8022	**Biomedical Instrumentation**	3	0	0	3	A

Course Educational Objectives

CEO1	Interpret technical aspects of medicine
CEO2	Solve Engineering Problems related to medical field
CEO3	Understand medical diagnosis and therapy

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Define and recognize several signals which are drawn out from the human body.
CO2	Employ quality assurance, risk assessment, and ethical issues in the context of instrumentation for

CO3	Examine & interpret the simulated and experimental data.
CO4	Set up the students to familiarize with various medical equipments and their technical aspects
CO5	Appraise independent thinking & learning for decision making in complex and unpredictable situations.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			0	0											
CO2			1	0											
CO3			2	2											
CO4			3	2											
CO5			0	0											
Avg.			2	2											

SYLLABUS

Unit – I **[14Hrs]**

Introduction to Bioengineering, Biochemical Engineering, Biomedical Engineering, Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, use of microprocessors in medical instruments, PC based medical Instruments, general constraints in design of medical Instrumentation system & Regulation of Medical devices. Bioelectrical Signals & Electrodes: Origin of Bioelectric Signals, Electrocardiogram, Electroencephalogram, Electromyogram, Electrode-Tissue Interface, Polarization, Skin Contact Impedance, Motion Artifacts.

Unit - II **[12Hrs]**

Electrodes for ECG: Limb Electrode, Floating Electrodes, Propelled disposable Electrodes, Electrodes for EEG, Electrodes for EMG. Physiological Transducers: Introduction to Transducers, Classification of Transducers, Performance characteristics of Transducers, Displacement, Position and flow and pressure Transducers. Strain gauge pressure transducers, Thermocouples, Electrical Resistance Thermometer, The mister, Photovoltaic transducers, Photo emissive Cells & Biosensors or Biochemical sensor

Unit – III **[08 Hrs]**

Recording Systems: Basic Recording systems, General considerations for Signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling)

Unit – IV **[05 Hrs]**

Transformation techniques in biomedical signals ie. Laplace transform, Z-transform, DFT, DTFT, STFT, Wavelet transform, Effects of noise in biomedical instruments- filtering in biomedical instruments.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. Hand Book of Biomedical Instrumentation-2nd Ed by R.S.Khandpur, Tata McGraw Hill, 2003
2. Introduction to Biomedical Engineering by Michael M. Domach, Pearson Education Inc,-2004

Reference Book:

1. Introduction to Biomedical equipment technology, 4e. By JOSEPH.J.CAAR& JOHN M.BROWN (Pearson education publication)
2. Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & sons publications

Subject Code	Subject	L	T	P	C	QP
BEEPE8023	Green Buildings Technology	3	0	0	3	A

Course Educational Objectives

CEO1	Understand the role green building plays in the context of climate change, energy scarcity, materials, and carbon.
CEO2	Understand the importance of life cycle analysis for construction materials.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Students should have an understanding of core building science fundamentals (to include but not limited to: thermodynamics as related to wind, air, moisture, pressure, and heat).
CO2	Students will be able to communicate these fundamentals clearly.
CO3	Students will understand and perform some building sustainability concepts (to include, but not limited to, site layout, building design, advanced framing, and insulation)
CO4	Students will understand energy efficiency in relation to cost performance, ROI, etc.
CO5	Students will understand and perform some building performance testing (ex. energy audit, HERS Rating) and be exposed to different agencies (ex. BPI, RESNET) involved in the testing.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2	2											2
CO2			2	1											3
CO3			2	3											3
CO4			2	1											2
CO5			3	2											2
Avg.			2.2	1.8											2.4

SYLLABUS

Unit – I **[11Hrs.]**

Environmental implications of buildings energy, carbon emissions, water use, waste disposal;

Building materials: sources, methods of production and environmental Implications. Embodied

Energy in Building Materials: Transporation Energy for Building Materials; Maintenance Energy for Buildings

Unit – II **[8 Hrs.]**

Implications of Building Technologies Embodied Energy of Buildings: Framed Construction,

Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of

Industrial and Buildings Wastes. Biomass Resources for buildings.

Unit – III **12 Hrs.]**

Comforts in Building: Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

Unit – IV **[12 Hrs.]**

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

Green Composites for buildings: Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
2. Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.

Reference Book:

1. Green My Home!: 10 Steps to Lowering Energy Costs and Reducing Your Carbon Footprint, by Dennis C. Brewer, ISBN:9781427798411, Publisher: Kaplan Publishing, Publication Date: October 2008.
2. B. Givoni, Man, Climate and Architecture Elsevier, 1969.
3. T. A. Markus and E. N. Morris Buildings Climate and Energy. Pitman, London, 1980. ArvindKishan et al (Ed)
4. Climate Responsive Architect ure. TataMcGraw Hill, 2001.
5. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.
6. O. H. Koenigs Berger, T. G. Ingersoll, Alan Mayhew and S. V. Szokolay. Manual of Tropical Housing and Building. Orient Long man, 1975.

Subject Code	Subject	L	T	P	C	QP
BEEPE8024	**Hybrid Electric Vehicles**	3	0	0	3	A

Course Educational Objectives

CEO1	To present a comprehensive overview of Electric and Hybrid Electric Vehicles
CEO2	To make understand the Technology and sizing of the components – electric machines, power electronics, and energy storage

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.
CO2	Design and develop basic schemes of electric vehicles and hybrid electric vehicles
CO3	Choose proper energy storage systems for vehicle applications
CO4	Identify various communication protocols and technologies used in vehicle networks.
CO5	Understanding the Vehicle characteristics, driving cycles, and performance parameters of the vehicle

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2					1								2
CO2	3	2					1								2
CO3	3	2					1								3
CO4	1	3					2								3
CO5	3	2					1								2
Avg.	2	2					1								2

SYLLABUS

Unit: 1 **[10 Hours]**

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance

Unit: 2 **[13 Hours]**

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis

Unit: 3 **[10 Hours]**

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy

storage devices

Unit :4 **[4 Hours]**

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology,
Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Book:

1. *Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003*

Reference Book:

1. *James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.*
2. *MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004*

Subject Code	Subject	L	T	P	C	QP
BEEPC8180	**Seminar and Technical Writing**			6	3	A

Course Educational Objectives

CEO1	To expose students to the 'real' working environment and get acquainted with the organization structure, business operations and administrative functions.
CEO2	To set the stage for future recruitment by potential employers
CEO3	To improve student's speaking skills in various professional contexts and enable one to develop the art of public speaking.
CEO4	To improve student's speaking skills in various professional contexts and enable one to develop the art of public speaking.
CEO5	To develop the necessary skills through actual practice in presenting information, giving seminars, participating in group talk etc.

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Work in actual working environment
CO2	Utilize technical resources effectively
CO3	Write technical documents and give oral presentations related to the work completed.
CO4	Promote and develop presentation skills and import a knowledgeable society

Contents and Format of Report

This course provides effective presentation training tools and skills include good content, organization, delivery, audience, and analysis. These enhance students' traits in becoming a more critical consumer of information and delivery of speeches within a public setting and group discussion. Emphasis is on research, preparation, delivery, and evaluation of informative, persuasive, and special occasion public speaking.
At the end, students submit a technical report and their performance will be evaluated based on these

following parameters

1. Public Speaking- an overview- Significance to professionals- Importance of Listening and Speaking
2. Skills.
3. Credibility & Confidence- Preparation of Speech & Audience Analysis.
4. Organization of Speech- Platform Manners & Use of Microphones- Modes of Delivery.
5. Use of Visual Aids- Psychology of Persuasion- Speeches for Special Occasions.
6. Speech Practice.

The procedure for preparation of the report has to follow the format determined by the Faculty based on certain guidelines.

Mode of Evaluation: Assignments, Written Examination (Internal Only)

Text Book:

1. *PushpLata and Sanjay Kumar. Communicate or Collapse New Delhi: Prentice Hall of India, 2007.*

References:

1. *Lucas, Stephen E. The Art of Public Speaking. Third Edition, Singapore: McGraw- Hill, 1989.*
2. *Deanna D Sell now Public Speaking A Process Approach Media Edition, Wadsworth/Thomson, 2003.*
3. *Jaffe, Clella. Public Speaking New Delhi: Cengage Learning India Pvt. Ltd, 2008.*
4. *Bellingham, Jo. Giving Presentations Delhi: Oxford University Press. 2003.*
5. *Qubein, Nido. How to be a Great Communicator New Delhi: Viva. 1997.*

Subject Code	Name of the Subject	L	T	P	C	QP
BEEPC8150	**Major Project**	0	0	6	3	A

Course Educational Objectives

CEO1	Able to acquire practical knowledge within the chosen area of technology for project development
CEO2	Able to identify, analyze, formulate and handle electrical projects with a comprehensive and systematic approach
CEO3	Able to contribute as an individual or in a team in development of technical projects
CEO4	Able to develop effective communication skills for presentation of project related activities

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Formulate a real world problem and develop its requirements
CO2	develop a design solution for a set of requirements
CO3	Test and validate the conformance of the developed prototype against the original requirements of the problem
CO4	Work as a responsible member and possibly a leader of a team in developing software solutions
CO5	Express technical and behavioral ideas and thought in oral settings
CO6	Participate in and possibly moderate, discussions that lead to making decisions

Open Electives

S. N.	Subject Code	Open Electives		S. N.	Subject Code	Open Electives
01	BBTOE5051	Biology for Engineering		25	BBTOE6051	Micro Biology
02	BBTOE5052	Genetic Engineering		26	BBTOE6052	Bioinformatics
03	BBTOE5053	Fundamentals of Biotechnology		27	BBTOE6053	Plant Biotechnology
04	BCHOE5051	Upstream Process Engineering		28	BCHOE6051	Biochemical Reaction Engineering
05	BCHOE5052	Basic Chemical Engineering		29	BCHOE6052	Novel Separation Techniques
06	BCHOE5053	Process Utility and Industrial Safety		30	BCHOE6053	Corrosion Engineering
07	BCEOE5051	Bridge Structures		31	BCEOE6051	Housing Planning & Management
08	BCEOE5052	Town Planning		32	BCEOE6052	Green Building Techniques
09	BCEOE5053	System Approach in Civil Engineering		33	BCEOE6053	Air & Noise Pollution
10	BCSOE5051	Operating Systems		34	BCSOE6051	Computer Networks
11	BCSOE5052	Computer Organization		35	BCSOE6052	Real Time Systems
12	BCSOE5053	Distributed Computing		36	BCSOE6053	Artificial Intelligence And Expert Systems
13	BEEOE5051	Power Electronics		37	BEEOE6051	Renewable Energy Sources
14	BEEOE5052	Electrical Machine Design		38	BEEOE6052	Computer Aided Analysis and Design of Machines
15	BEEOE5053	Industrial Electrical Systems		39	BEEOE6053	Green Buildings and Energy Conversion
16	BECOE5051	Microprocessors and Microcontrollers		40	BECOE6051	Digital Signal Processing
17	BECOE5052	Fiber Optics and Optoelectronic Devices		41	BECOE6052	Nano Electronics
18	BECOE5053	Communication System Engineering		42	BECOE6053	Internet of Things
19	BEIOE5051	Sensors and Transducers		43	BEIOE6051	Process Simulation and Modelling
20	BEIOE5052	Optoelectronic Devices and Instrumentation		44	BEIOE6052	Industrial Process Control and Dynamics
21	BEIOE5053	Process Instrumentation		45	BEIOE6053	Robotics and Robot Applications
22	BMEOE5051	Fluid Mechanics and Hydraulic Machines		46	BMEOE6051	Non-Destructive Evaluation and Testing
23	BMEOE5052	Mechanics of Solids		47	BMEOE6052	Advance Mechanics of Solids
24	BMEOE5053	Material Science		48	BMEOE6053	Advanced Fluid

						Mechanics

S. N.	Subject Code	Open Electives		S. N.	Subject Code	Open Electives
49	BBTOE7051	Environmental Biotechnology		73	BBTOE8031	Food Biotechnology
50	BBTOE7052	Nano Biotechnology		74	BBTOE8032	Biostatistics
51	BBTOE7053	Biosensors and Diagnostics		75	BBTOE8033	Fermentation Technology
52	BCHOE7051	Fuel and Energy Technology		76	BCHOE8031	Integrated Solid Waste Management
53	BCHOE7052	Green Technology		77	BCHOE8032	Pollution and Its Control
54	BCHOE7053	Battery Technology		78	BCHOE8033	Treatment of Industrial Effluent
55	BCEOE7051	Municipal Solid Waste Management		79	BCEOE8031	Repair and Rehabilitation of Structures
56	BCEOE7052	Disaster Management		80	BCEOE8032	Remote Sensing Techniques and GIS
57	BCEOE7053	Construction Planning and Scheduling		81	BCEOE8033	Modern Construction Materials
58	BCSOE7051	Software Engineering		82	BCSOE8031	Data Mining
59	BCSOE7052	Cloud Computing		83	BCSOE8032	Software Project Management
60	BCSOE7053	Soft Computing Techniques		84	BCSOE8033	Mobile Computing
61	BEEOE7051	Energy Management & Auditing		85	BEEOE8031	Electric & Hybrid Vehicles
62	BEEOE7052	Industrial Automation and Control		86	BEEOE8032	Power Plant Engineering
63	BEEOE7053	Illumination Engineering		87	BEEOE8033	Introduction to Robotics
64	BECOE7051	Digital VLSI Design		88	BECOE8031	Satellite Communication
65	BECOE7052	Embedded Systems		89	BECOE8032	Digital Image and Video Processing
66	BECOE7053	Mobile Communication		90	BECOE8033	Wavelet Transforms
67	BEIOE7051	Biomedical Instrumentation		91	BEIOE8031	Micro-Electro-Mechanical Systems
68	BEIOE7052	Industrial Automation & Control		92	BEIOE8032	Industrial Instrumentation
69	BEIOE7053	Analytical Instrumentation		93	BEIOE8033	Optimal Control
70	BMEOE7051	Automobile Engineering		94	BMEOE8031	Advance Computer Graphics and Solid Modelling
71	BMEOE7052	CAD/CAM		95	BMEOE8032	Quality Control and Reliability
72	BMEOE7053	Industrial Engineering		96	BMEOE8033	Composite Materials