ARKA JAIN University

Jharkhand

Estd. Under Jharkhand State Private University Act

Syllabus of

Bachelor of Technology in Electrical & Electronics Engineering

Semester-I-II-III-IV-V-VI-VII-VIII

For Batch (2020-24)

Table of Content

ARKA JAIN University Jharkhand

Syllabus of

B.Tech in Electrical & Electronics Engineering

Semester-I

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE
Scheme of Study (w.e.f Batch 2020-21)

SCHEME OF THE STUDY
SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SCHEME OF THE STUDY
SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Circuit Analysis	PCC	3	3	100	70	20	5	5
2	Electromagnetic Fields	PCC	4	4	100	70	20	5	5
3	Analog Electronic	PCC	3	3	100	70	20	5	5
4	Engineering Mathematics – III	BSC	4	4	100	70	20	5	5
5	Electrical Machines-I	PCC	4	4	100	70	20	5	5
6	Environmental Sciences	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Circuit Analysis Lab	PCC	1	2	50	35	5	5	5
8	Electrical Machines-I Lab	PCC	1	2	50	35	5	5	5
9	Analog Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**21**	**26**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Machines-II	PCC	4	4	100	70	20	5	5
2	Digital Electronics	PCC	3	3	100	70	20	5	5
3	Power Electronics	PCC	4	4	100	70	20	5	5
4	Signals and Systems	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
6	Essence of Indian Knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Machines II Lab	PCC	1	2	50	35	5	5	5
8	Digital Electronics Lab	PCC	1	2	50	35	5	5	5
9	Power Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**25**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Power Systems–I	PCC	3	3	100	70	20	5	5
2	Control Systems	PCC	3	3	100	70	20	5	5
3	Microprocessors	PCC	3	3	100	70	20	5	5
4	Program Elective – I Electrical Energy Conservation and Auditing Electrical Machine Design Industrial Electrical Systems	PEC	3	3	100	70	20	5	5
5	Open elective-I Electronic Devices Strength of Materials Data Structures and Algorithms	OEC	3	3	100	70	20	5	5
6	Professional practice law & ethics	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
7	Power Systems I Lab	PCC	1	2	50	35	5	5	5
8	Control Systems Lab	PCC	1	2	50	35	5	5	5
9	Microprocessors Lab	PCC	1	2	50	35	5	5	5
10	Summer Internship-1(3-4 Weeks)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**24**	**800**	**560**	**150**	**45**	**45**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Power Systems – II	PCC	3	3	100	70	20	5	5
2	Measurements and Instrumentation	PCC	3	3	100	70	20	5	5
3	Program Elective – II Digital Signal Processing Control Systems Design	PEC	3	3	100	70	20	5	5
4	Program Elective – III Line Commutated and Active Rectifiers High Voltage Engineering Electromagnetic Waves	PEC	3	3	100	70	20	5	5
5	Open Elective –II Wavelet Transforms Internet of Things Thermal and Fluid Engineering	OEC	3	3	100	70	20	5	5
6	IPR	HSMC	3	3	100	70	20	5	5
	Practical								
7	Power Systems II Lab	PCC	1	2	50	35	5	5	5
8	Measurements and Instrumentation Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**22**	**700**	**490**	**130**	**40**	**40**

SEMESTER VII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Professional Elective -IV Power System Protection Electrical and Hybrid Vehicles Computational Electromagnetic	PEC	3	3	100	70	20	5	5
2	Professional Elective - V Power System Dynamics andControl Power Quality and FACTS Electrical Drives	PEC	3	3	100	70	20	5	5
3	Open Elective - III Analog and Digital Communication Embedded Systems Fluid Machinery	OEC	3	3	100	70	20	5	5
4	Open Elective - IV Power Plant Engineering Image Processing Automobile Engineering	OEC	3	3	100	70	20	5	5
5	Project Management	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
9	Summer Internship-II(4-6 Weeks)	PROJ	3	0	100	70	30	0	0
10	Minor Project(Project to be carried over to next semester)	PROJ	3	6	100	70	30	0	0
	TOTAL		**21**	**21**	**600**	**490**	**160**	**25**	**25**

SEMESTER VIII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA	Attendance
1	Professional Elective - VI HVDC Transmission Systems Wind and Solar Energy Systems Advanced Electric Drives	PEC	3	3	100	70	20	5	5
2	Open Elective- V VLSI circuits Modern Manufacturing Processes Computer Networks	OEC	3	3	100	70	20	5	5
3	Open Elective - VI Electrical Materials Big Data Analysis	OEC	3	3	100	70	20	5	5
	PRACTICAL								
4	Major Project	PROJ	8	16	200	140	60	0	0
5	Extra-Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**17**	**25**	**600**	**420**	**150**	**15**	**15**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	4	12
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	8	18
4	Professional core courses (**PCC)**	24	54
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	6	18
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	64	160

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:

AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.

The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.

Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.

Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1].Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3].Design/Development of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion.

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.
[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Specify& analyze: An ability to identify, specify and analyze systems that inefficiently deliver technological solution in electrical & electronics engineering

[PSO.2]. Design/development of solutions: Design solutions for complex electronics engineering problem & design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, & the cultural, society & environmental considerations.

[PSO.3]. Modern tool usage: Create, select, & apply appropriate electrical techniques, resources & modern engineering including prediction & modeling to complex electrical systems with an understanding of the limitations & short comes.

[PSO.4]. Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Electrical systems & processes & communicate effectively with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions.

PROGRAM ARTICULATION MATRIX

SEM	Course Code	PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES															
		PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
	Engineering Chemistry-BTE22011	1		1		1	1						1		1		
	Engineering Mathematics–I-BTE21001	2			1		1					1	1	1		1	
	Basic Electrical Engineering-BTE21003	1	1	1	1	1		1	1	1	1				1	1	
I	Engineering Mechanics-BTE22009	1		1				1					1				1
	Engineering Chemistry Lab-BTE22015	1			1	1											1
	Basic Electrical Engineering Lab-BTE21005	1	1	1	1		1	1	1	1		1	1	1	1	1	1
	Engineering Mechanics Lab-BTE22013	1		1				1					1				1
	Engineering Graphics & Design-BTE21004	1				1				1		1		1	1		1
	Engineering PhysicsBTE22010	1	2	2	2	1					1		2		1		1
	Engineering Mathematics –II-BTE22008		2	1	1	2			2							1	1
II	Programming for Problem Solving-BTE21259	1	1		1			1									
	English for Communication-	1	1	1			1				2		1				1

	BTE22370																
	Constitution of India-BTE25095																
	Engineering physics Lab-BTE21261			2	2	1		1							1	1	1
	Programming for Problem Solving Lab-BTE21262																
	Workshop Practices-BTE22267	1	1	1	1		1						1				
	Electrical Circuit Analysis-BTE23379	3	1	2	2	3								3	2	3	3
	Electromagnetic Fields-BTE24075	2	2	2	2	2								3	3	3	
	Analog Electronic-BTE23380	1	1	2	3	2								3	3	2	
	Mathematics – III-BTE23046	2	2	2	2	2								3	2	2	
III	Electrical Machines-I-BTE23041	2	2	2	3	2								2	2	3	
	Environmental Sciences-BTE24085			2	1	2	2	2	2			1	2	2	2	2	1
	Electrical Circuit Analysis Lab-BTE23270	1	2	3	3	2								2	3	3	
	Electrical Machines Lab -1-BTE23043	3	3	2	3	2								3	3	3	
	Analog Electronics Lab-BTE23381	1	2	3	3	2								3	3	1	
	Electrical Machines-II-BTE24072	2	1	2	2	3								2	2	3	2
IV	Digital Electronics-BTE23029	1	3	1	3	3								2	3	3	
	Power Electronics-BTE25111	3	1	2	3	2								3	3	3	
	Signals And Systems-	2	2	1	3	1								3	3	2	

	BTE25112																
	Biology for Engineers-BTE25095	2	2		2		1	1	2				2	3		2	2
	Essence Of Indian Knowledge Tradition-BTE25095						2		2	2	2		2	2	1	2	2
	Electrical Machines II Lab -BTE24077	3	2	1	3	3								3		3	2
	Digital Electronics Lab-BTE23035	1	3	2	3	3								3	3	3	
	Power Electronics Lab-BTE25115		2	1	3	3								3	3	3	
	Power Systems-I-BTE25382	2	3	3	2	1								3	3	2	1
	Control Systems-BTE26154	1	2	1	3	3								3	2	3	
	Microprocessors-BTE25100	1	2	3	2	1								2	2	2	1
	Electrical Energy Conservation And Auditing-BTE25286	2	1	2	3	3								2	3	3	
	Electrical Machine Design-BTE25114	2	2	2	3	3								2	3	3	
V	Industrial Electrical Systems-BTE25287	2	3	2	3	1								3	3	2	
	Electronic Devices-BTE25288	1	1	3	3		2							2	3	2	1
	Strength Of Materials-BTE25289	2	2	2	3	2								3		2	3
	Data Structures And Algorithms-BTE25290	1	2	1	3	2	3							2		3	2
	Professional Practice, Law & Ethics-BTE25299						2	2	3		1	2	2	2		3	2
	Power Systems I- Lab-BTE25291	2	3	2	2	3								2	2	3	

	Control Systems Lab-BTE25292	2	3	2	3	2								2	3	2	1
	Microprocessors Lab-BTE25293	1	3	3	1	2								3	2	3	
	Summer Internship-1(3-4 Weeks)-BTE25285																
VI	Power Systems – II-BTE26383	1	3	2	3	3								3	1	3	
	Measurements And Instrumentation-BTE26303	1	2	2	3	3								3	2	3	
	Digital Signal Processing-BTE26155	2	2	2	3	3	2							3	3	3	
	Control Systems Design-BTE26304	2	3	3	2	2								3	3	3	
	Digital Control Systems-BTE26384	2	3	3	3	2								3	3	2	
	Line-Commutated And Active Rectifiers-BTE26305	1	2	2	3	3								3	3	2	
	High Voltage Engineering-BTE26153	1	3	3	3	1								3	3	2	
	Electromagnetic Waves-BTE26306	2	3	1	3	1								3	2	2	
	Wavelet Transforms-BTE26307	2	1	3	2	3								3	2	2	
	Internet Of Things-BTE27323	2	3	3	3	1								3	3	2	
	Thermal And Fluid Engineering-BTE26308	1	2	2	3	3								3	1	3	
	Intellectual Property Rights-BTE26385						2	1	2	1	2	1	2	2	2	2	2
	Power Systems II Lab -BTE26310	2	3	2	3	2								3	2	2	

	Measurements And Instrumentation Lab-BTE26311	3	2	3	2	2								3	1	3	
VII	Power System Protection-BTE27200	2	3	2	3	2								3	3	3	
	Electrical And Hybrid Vehicles-BTE27325	2	3	2	2	1								3	3	3	
	Computational Electromagnetic-BTE27326	2	2	2	3	3								3	1	3	1
	Power System Dynamics And Control-BTE27327	2	2	3	2	2								2	1	3	
	Power Quality And Facts-BTE27329	1	2	2	2	3								2	2	3	1
	Electrical Drives-BTE27330	2	2	2	3	3								3	3	3	1
	Analog And Digital Communication-BTE27331	2	2	1	3	3								2	3	3	
	Embedded Systems-BTE26106	2	2	3	3	3								2	2	3	
	Fluid Machinery-BTE26163	2	2	2	2	2								2	2	3	1
	Power Plant Engineering-BTE27211	1	2	1	3	2								2	3	3	2
	Image Processing-BTE27332	1	1	3	3	1								2	3	3	1
	Automobile Engineering-BTE28249	2	2	2	3	3								2	3	3	1
	Project Management-BTE28352							1	2	2	1	3	2	3	2	2	2
	Summer Internship-II(4-6 Weeks)-BTE27348																
	Minor Project(Project to be carried over to next semester)-BTE27349																

VIII	HVDC Transmission Systems-BTE28354	1	3	3	3	2								3	2	2	
	Wind And Solar Energy Systems-BTE28355	2	3	2	3	1								2	2	2	1
	Advanced Electric Drives-BTE28356	2	2	2	3	2								2	3	3	
	VLSI Circuit-BTE28357	1	2	1	3	3								3	2	2	
	Modern Manufacturing Processes-BTE28358		3		2	1						2	2	3	2	2	1
	Computer Networks-BTE26138	2	3	2	3	3								2	2	2	1
	Electrical Materials-BTE28359	2	2	2	3	3								3	3	2	1
	Big Data Analysis-BTE28360	2	3	2	3	3								2	2	2	
	Major Project – BTE28352																
	Extra-Curricular/ Co-Curricular Activity-BTE28390																
AVERAGE																	

Subject: Engineering Chemistry

Code: BTE22011

3 Credits | Semester 1

A. Introduction:

Following are the objectives of this course:

- To understand the Concepts of chemical bonding.
- To know the importance of the Periodic Table of the Elements, how it came to be, and its role in organizing chemical information.
- To learn about the basic concepts of Spectroscopy.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] To provide students with the skills required to succeed in graduate school, the chemical industry or professional school.

[CO2] The student will acquire a foundation of chemistry of sufficient breadth and depthto enable them to understand and critically interpret the primary chemical literature.

[CO3] Recognize the exigency and importance of engineering chemistry in the use of industrial and domestic determination.

[CO4] Design economically and new methods of synthesis of new materials and apply their knowledge for protection of environment and application in their field.

[CO5]To provide an insight into latest (R&D oriented) topics, to enable the engineering student upgrade the existing technologies and pursue further research.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

ATOMIC AND MOLECULAR STRUCTURE: Molecular orbital of diatomic molecules and plots of the multicentre orbital. Equations for atomic and molecular orbitals. Energy level diagrams ofdiatomic. Pi-molecular orbital of butadiene and benzene and aromaticity.Crystal field theoryand the energy level diagrams for transition metal ions and their magnetic properties. Numerical based on Crystal field stabilization energy. Bandstructure of solids

SPECTROSCOPIC TECHNIQUES AND APPLICATIONS: Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibration and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering

USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA: Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Cell potentials, the Nernst equation and applications, Relation of free energy with EMF. Acid base, oxidation reduction and solubility equilibrium .Corrosion, Types of corrosion, galvanic series, Cathodic and anodic reactions, corrosion prevention methods.

PERIODIC PROPERTIES: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies ofatoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries. Hard soft acids and bases (Classification, pearsons HSAB principle, its application and limitation), molecular geometries (VSEPR theory to NH_3, H_3O^+, SF_4, CLF_3,$ICl_2$and H_2O)

INDUSTRIAL CHEMISTRY: Polymers: types of polymer, polymerization, applications, and important synthetic polymers. Ceramics material: Classification and Applications, Water treatment, Air pollution and Control techniques.

E. TEXT BOOKS

T1. A textbook of Engg. Chemistry-ShashiChawla
T2. Engineering Chemistry by Wiley
T3. Physical Chemistry by Atkins
T4. Engineering chemistry by P.C. Jain (Dhantpat Rai Publishing company)
T5. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
T6. Fundamentals of Molecular Spectroscopy, by C. N. Banwell

F. REFERENCE BOOKS

R1. Environmental Engg. - Keiley
R2. Selected topics in inorganic chemistry-MMT
R3. I. A Levine, Physical chemistry, McGraw Hill
R4. Organic chemistry by clayden.
R5.Essentials of Physical chemistry, Bahl& Tuli, S. Chand Publishing.
R6. Inorganic Chemistry by J D Lee.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	**STATEMENT**	**CORRELATION WITH PROGRAM OUTCOMES**												**CORRELATION WITH PROGRAM SPECIFIC OUTCOMES**			
		PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
[CO1]	To provide students with the skills required to succeed in graduate school, the chemical industry or professional school.	2				1											
[CO2]	The student will acquire a foundation of chemistry of sufficient breadth and depthto enable them to understand and critically interpret the primary chemical literature.		2					1							1		
[CO3]	Recognize the exigency and importance of engineering chemistry in the use of industrial and domestic determination.			2			1								1		
[CO4]	Design economically and new methods of synthesis of new materials and apply their knowledge for protection of environment and application in their field.					2							1				1
[CO5]	To provide an insight into latest (R&D oriented) topics, to enable the engineering student upgrade the existing technologies and pursue further research.				2							1				1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mathematics–I

Code: BTE21001

Credit - 4 | Semester 1

A. Introduction:

- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level
- Serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Remembering differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications, they will have a basic understanding of Beta and Gamma functions

[CO2] Understanding the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems

[CO3] Appling the tool of power series and Fourier series for learning advanced Engineering Mathematics

[CO4] Analyzing the deal with functions of several variables that is essential in most branches of engineering

[CO5]Evaluating the essential tool of matrices and linear algebra in a comprehensive manner

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

CALCULUS: Evolutes and involutes, Evaluation of definite and improper integrals ,Beta and Gamma functions and their properties Application of definite integral, Curve tracing, area, evaluate surface areas and volumes of revolutions
CALCULUS: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders, Indeterminate forms and Hospitals rule, Maxima and minima

SEQUENCE AND SERIES: Convergence of sequence and series, tests for convergence,Power series, Taylors series, series for exponential, trigonometric and logarithmfunctions,2 Fourier series: Half range sine and cosine series, Parseval's theorem

MULTIVARIABLE CALCULUS (DIFFERENTIATION): Limit, continuity and partial derivatives, directional derivatives, total derivative, Tangent plane and normal line; Maxima, minima and saddle points, Method of Lagrange multipliers; Gradient, curl and divergence

MATRICES: Symmetric, skew- symmetric and orthogonal matrices, ,complex matrix, hermitian, skewhermitian matrix, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations, Eigen values and Eigen vectors; Diagonalization of matrices, Cayley-Hamilton Theorem, and Orthogonal transformation

E. TEXT BOOKS

T1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,2002
T2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006

F. REFERENCE BOOKS

R1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008
R2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
[CO1]	To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications, they will have a basic understanding of Beta and Gamma functions	1										1					1
[CO2]	The fallouts of Rolle's Theorem that is fundamentalto application of analysis to Engineering problems		2			1											1
[CO3]	The tool of power series and Fourier series for learning advanced Engineering Mathematics			2				1								1	
[CO4]	To deal with functions of several variables that is essential in most branches of engineering								2				1				
[CO5]	The essential tool of matrices and linear algebra in a comprehensive manner				1							1		1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Basic Electrical Engineering

Code: BTE21003

Credits- 4 | Semester 1

A. Introduction:

- To Enhancement in understanding the basic concepts of Core Electrical Engineering subjects. The topics covered under this subject will help
- To enhance the basic understanding of Electrical machines and power systems and basic electronics through the topic covered under this Subject

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency
[CO2] Predict the behavior of any electrical and magnetic circuits.
[CO3] Formulate and solve complex AC, DC circuits.
[CO4] Identify the type of electrical machine used for that particular application.
[CO5] Realize the requirement of transformers in transmission and distribution of electric power and other applications.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

A. SYLLABUS

D.C. CIRCUITS : Electrical circuit elements (R, L and C), voltage and current sources, dependent and independent sources, Units and dimensions, Source Conversion, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin's theorem and their application for analysis of series and parallel resistive circuits excited by independent voltage sources, Power & Energy in such circuits. Mesh & nodal analysis, Star Delta transformation & circuits and Norton theorems. Time- domain analysis of first-order RL and RC circuits.

A.C. CIRCUITS : Representation and Generation of sinusoidal AC voltage, definition of average value, R.M.S. value, form factor and peak factor of AC quantity , Concept of phasor, Concept of Power factor, Concept of impedance and admittance, Active, reactive and apparent power, Analysis of single-phase ac circuits consisting of R, L, C R-L, R-C, R-L-C series

&parallel circuit Resonance Necessity and advantages of three phase systems, Meaning of Phase sequence, balanced and unbalanced supply and loads. Relationship between line and phase values for balanced star and delta connections. Power in balanced & unbalanced three-phase system and their measurements

TRANSFORMERS : Types of Magnetic Material ,BH characteristics(magnetization characteristics)of Ferro magnetic materials, self - inductance and mutual inductance, energy in linear magnetic systems, AC excitation in magnetic circuits, magnetic field produced by current carrying conductor, Force on a current carrying conductor. Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency Auto-transformer and three-phase transformer connections

ELECTRICAL MACHINES : Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators

POWER CONVERTERS &ELECTRICAL INSTALLATIONS:DC-DC buck and boost converters, duty ratio control Single-phase and three-phase voltage source inverters; sinusoidal modulation Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup

E. TEXT BOOKS

T1. B.L. Theraja & A.K Theraja, Electrical Technology Volume-I, S. Chand & Co

T2.V.N. Mittle, Basic Electrical Engineering, Tata McGraw Hill

T3. S.N. SinghBasic Electrical Engineering , P.H.I

T4. Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall

T5.C.L. WadhwaBasic Electrical Engineering, New Age International

T6.Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.

T7.Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

F. REFERENCE BOOKS

R1. L.S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press

R2. E. Hughes, Electrical and Electronics Technology, Pearson

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Understand the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency	2	1														
[CO2]	Predict the behavior of any electrical and magnetic circuits.			2	3										1		
[CO3]	Formulate and solve complex AC, DC circuits.					2		2								1	
[CO4]	Identify the type of electrical machine used for that particular application.						2		1								
[CO5]	Realize the requirement of transformers in transmission and distribution of electric power and other applications.									1	2						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mechanics

Code: BTE22009

Credits- 3 | Semester I

A. Introduction:

- To obtain resultant of various forces
- To obtain resultant of various forces
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

B. Course Outcomes: At the end of the course, students will be able

[CO1] Identify the force systems for given conditions by applying the basics of mechanics.
[CO2] Determine unknown force(s) of different engineering systems.
[CO3] Apply the principles of friction in various conditions for useful purposes.
[CO4] Find the centroid and center of gravity of various components in engineering systems.
[CO5]Select the relevant simple lifting machine(s) for given purposes.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BASICS OF MECHANICS AND FORCE SYSTEM: Basic concepts, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units. Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

EQUILIBRIUM: Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium**,**Lami's Theorem – statement and explanation, Application for various engineering problems. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple),Beam reaction for cantilever, simply supported beam with or without overhang –

subjected to combination of Point load and uniformly distributed load, Beam reaction graphically for simply supported beam subjected to vertical point loads only

FRICTION & VIRTUAL WORK: Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction.Introduction, laws of coulomb friction, simple contact friction problems, belt friction, the square crew thread rolling resistance, Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. Work of a force, Principle of Virtual work and its application.

CENTROID AND CENTRE OF GRAVITY& TRUSS: Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle), Centroid of composite figures composed of not more than three geometrical figures, Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) Centre ofGravity of composite solids composed of not more than two simple solids. The structural model, simple trusses, analysis of simple trusses: method of joints, Method of sections, graphical method.

SIMPLE LIFTING MACHINE: Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility, Velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block.

E. TEXT BOOKS

T1.D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
T2.Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
T3.Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
T4.Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.

F. REFERENCE BOOKS

R1.Dhade, Jamadar &Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
R2. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, CambridgeUniversity Press.
R3. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the force systems for given conditions by applying the basics of mechanics.	**3**	**3**										**3**				**2**
[CO2]	Determine unknown force(s) of different engineering systems.		**3**										**3**				**3**
[CO3]	Apply the principles of friction in various conditions for useful purposes.		**3**										**3**				**1**
[CO4]	Find the centroid and center of gravity of various components in engineering systems.	**3**			**3**												**2**
[CO5]	Select the relevant simple lifting machine(s) for given purposes.	**3**											**3**				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Chemistry Lab

Code: BTE22015

Credits- 1 | Semester I

A. Introduction:

- To expose the students to a breadth of experimental techniques using modern instrumentation.
- The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.

B. Course Outcomes: At the end of the course, students will be able

[CO1] The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering

[CO2] The students will learn to estimate rate constants of reactions from concentration of reactants/products as a function of time

[CO3] Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiments**
1	Determination of surface tension and viscosity.
2	To prepare buffer solution and standardization of pH meter.
3	Determination of chloride content of water.
4	Colligative properties using freezing point depression.
5	Determination of the rate constant of a reaction.
6	Determination of cell constant and conductance of solutions.

7	Chemical analysis of a salt.
8	Lattice structures and packing of spheres.
9	Models of potential energy surfaces.
10	Chemical oscillations- Iodine clock reaction
11	Determination of the amount of iron in an iron ore solution by $KMnO_4$
12	Adsorption of acetic acid by charcoal
13	To determine alkalinity of a given water sample.
14	Synthesis of a polymer/drug.
15	Saponification/acid value of oil.

E. TEXT BOOKS

T1. Practical Chemistry by S.S. Dara

T2.Practical Chemistry by D N Bajpai – S. Chand Publishing

F. REFERENCE BOOKS

R1.Advanced Practical Chemistry Book by pragatiprakashan

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	The chemistry laboratory course will consist of experiments illustrating the principles of Chemistry relevant to the study of science and engineering	**2**													**1**		
[CO2]	The students will learn to an ability to use modern instrumental techniques for engineeringPractice.				**2**											**1**	
[CO3]	The laboratory an ability to choose appropriate materials for various engineering purposes		**2**														
[CO4]	To bring adaptability to new developments in Engineering Chemistry and to acquire the Skills required to become a perfect engineer.					**2**											**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Basic Electrical Engineering Lab

Code: BTE21005

Credits- 1 | Semester I

A. Introduction:

- To impart a basic knowledge of electrical instruments voltmeter, ammeter, multi-meter, and oscilloscope. Real-life resistors, capacitors and inductors. Measurement such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- Emphasize the effects of electric shock and precautionary measures.
- Improve the ability to function on multi-disciplinary team.

B. Course Outcomes: At the end of the course, students will be able

[CO1] Study different meters and instruments for measurement of electrical quantities
[CO2] Study the linear and nonlinear characteristics of different types of loads experimentally
[CO3] Design and experiment potential divider circuits
[CO4] Experimentally verify the basic circuit theorems
[CO5] Measure power and power factor in ac circuits

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiments
1	Introduction to components/Equipments
2	Demonstrate the verification of Ohm’s law.
3	Demonstrate the verification of Resistance in series And parallel apparatus.
4	Demonstrate the verification of Kirchhoff’s current law (KCL).
5	Demonstrate the verification of Kirchhoff’s voltage law (KVL).
6	Demonstrate the verification of superposition theorem.

7	Demonstrate the verification of Thevenin's theorem.
8	Demonstrate the verification of Norton's theorem.

E. TEXT BOOKS

T1.D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, latest edition.
T2.S.N. Singh , Basic Electrical Engineering, P.H.I.,2013
T3.Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall,2014
T4.M.S. Sukhija, T. K. Nagsarkar, Basic Electrical and electronics engineering, Oxford University press, 2012

F. REFERENCE BOOKS

R1.C.L. Wadhwa, Basic Electrical Engineering. New Age International.
R2.B.L. Theraja & A.K Theraja Textbook of Electrical Technology - Vol. 1, S. Chand Publication
R3.E. Hughes & I.M. Smith Hughes Electrical Technology Pearson
R4.Vincent Del Toro Electrical Engineering Fundamentals

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Study different meters and instruments for measurement of electrical quantities	3	2														
[CO2]	Study the linear and nonlinear characteristics of different types of loads experimentally			2	2												
[CO3]	Design and experiment potential divider circuits			2									1		1	1	
[CO4]	Experimentally verify the basic circuit theorems						1	1									1
[CO5]	Select the relevant simple lifting machine(s) for given purposes.	3											3				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mechanics Lab

Code: BTE22013

Credits- 1 | Semester I

A. Introduction:

- To obtain resultant of various forces.
- To calculate support reactions through conditions of equilibrium for various structures
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

B. Course Outcomes: At the end of the course, students will be able

[CO1] Identify the force systems for given conditions by applying the basics of mechanics.

[CO2] Determine unknown force(s) of different engineering systems.

[CO3] Apply the principles of friction in various conditions for useful purposes.

[CO4] Find the centroid and centre of gravity of various components in engineering systems.

[CO5] Select the relevant simple lifting machine(s) for given purposes.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiments
1	To study various equipment’s related to Engineering Mechanics.
2	To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
3	To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
4	Derive Law of machine using Worm and worm wheel.
5	Derive Law of machine using Single purchase crab.

6	Derive Law of machine using double purchase crab.
7	Derive Law of machine using Weston's differential or wormed geared pulley block.
8	Determine resultant of concurrent force system applying Law of Polygon of forces using forcetable.
9	Determine resultant of concurrent force system graphically.
10	Determine resultant of parallel force system graphically.
11	Verify Lami's theorem.
12	Study forces in various members of Jib crane.
13	Obtain support reactions of beam using graphical method.
14	Determine coefficient of friction for motion on horizontal and inclined plane.
15	Determine centroid of geometrical plane figures.
16	Determine support reactions for simply supported beam.

E. TEXT BOOKS

T1.Bedi D.S., Engineering Mechanics, Khanna Publishing House
T2.Khurmi, R.S., Applied Mechanics, S.Chand& Co. New Delhi.
T3.Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
T4.Ramamrutham, Engineering Mechanics, S.,S Chand & Co. New Delhi.

F. REFERENCE BOOKS

R1. Dhade, Jamadar &Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
R2. Ram, H. D.; Chauhan, A. K. Foundations and Applications of Applied Mechanics, CambridgeUniversityPress.
R3. Meriam, J. L., Kraige, L.G. , Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
[CO1]	Identify the force systems for given conditions by applying the basics of mechanics.	1															
[CO2]	Determine unknown force(s) of different engineering systems.			1													
[CO3]	Apply the principles of friction in various conditions for useful purposes.							1									
[CO4]	Find the centroid and center of gravity of various components in engineering systems.												1				1
[CO5]	Select the relevant simple lifting machine(s) for given purposes.																

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Graphics & Design

Code: BTE21004

Credits- 2 | Semester I

A. Introduction:

- Increase ability to communicate with people
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic Auto Cad skills.
- Learn basic engineering drawing formats
- Prepare the student for future Engineering positions

B. Course Outcomes: At the end of the course, students will be able

[CO1] Perform basic sketching techniques
[CO2] Understandingof architectural and engineering scales will increase.
[CO3] Able to draw orthographic projections and sections.
[CO4] Ability to produce engineered drawings will improve
[CO5] Become familiar with office practice and standards.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

GENERAL INTRODUCTION : Significance of engineering drawing, Introduction to CAD, Lettering, Dimensioning, Scales, Sense of proportioning, Conic sections – General methods only, Different types of projections,

ORTHOGRAPHIC PROJECTIONS OF POINTS AND LINES: Orthographic projections, Projections of points, Projections of lines in different quadrants, traces, inclinations, and true lengths of the lines projections on auxiliary planes. shortest distance, intersecting and non-intersecting lines.

PROJECTIONS OF PLANE FIGURES: Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection.

PROJECTION OF SOLIDS &SECTION OF SOLID: Simple cases when solid are placed in different positions Axis faces and tines lying in the faces of the solid making given angles. Sectional orthographic views of geometrical solids.

DEVELOPMENT OF SURFACE & ISOMETRIC PROJECTION: Development of simple objects with and without sectioning, Concept of Isometric Projection.

E. TEXT BOOKS

T1. Engineering Graphics, N.D Bhatt, Charotar Publishing House Pvt. Limited
T2. Principle of Engineering Graphics And Drawing, R.K Dhawan, S. Chand Publishing
T3. Engineering Graphics And Drafting, P.S GILL,S. K. Kataria& Sons

F. REFERENCE BOOKS

R1. Engineering Drawing and Computer Graphics, Shah, M.B. & Rana B.C. PearsonEducation
R2. Engineering Graphics, Agrawal B. & Agrawal C. M ,TMH Publication
R3. Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah, Scitech Publishers

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	P 11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Perform basic sketching techniques	**1**															
[CO2]	Understandingof architectural and engineering scales will increase.	**1**															
[CO3]	Able to draw orthographic projections and sections											**1**		**2**			
[CO4]	Ability to produce engineered drawings will improve					**1**									**1**		
[CO5]	Become familiar with office practice and standards.									**1**							**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University Jharkhand

Syllabus of

B.Tech in Electrical & Electronics Engineering

Semester-II

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE
Scheme of Study (w.e.f Batch 2020-21)

SCHEME OF THE STUDY
SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SCHEME OF THE STUDY
SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Lab Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Circuit Analysis	PCC	3	3	100	70	20	5	5
2	Electromagnetic Fields	PCC	4	4	100	70	20	5	5
3	Analog Electronic	PCC	3	3	100	70	20	5	5
4	Engineering Mathematics – III	BSC	4	4	100	70	20	5	5
5	Electrical Machines-I	PCC	4	4	100	70	20	5	5
6	Environmental Sciences	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Circuit Analysis Lab	PCC	1	2	50	35	5	5	5
8	Electrical Machines-I Lab	PCC	1	2	50	35	5	5	5
9	Analog Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**21**	**26**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Machines-II	PCC	4	4	100	70	20	5	5
2	Digital Electronics	PCC	3	3	100	70	20	5	5
3	Power Electronics	PCC	4	4	100	70	20	5	5
4	Signals and Systems	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
6	Essence of Indian Knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Machines II Lab	PCC	1	2	50	35	5	5	5
8	Digital Electronics Lab	PCC	1	2	50	35	5	5	5
9	Power Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**25**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Power Systems–I	PCC	3	3	100	70	20	5	5
2	Control Systems	PCC	3	3	100	70	20	5	5
3	Microprocessors	PCC	3	3	100	70	20	5	5
4	Program Elective – I Electrical Energy Conservation and Auditing Electrical Machine Design Industrial Electrical Systems	PEC	3	3	100	70	20	5	5
5	Open elective-I Electronic Devices Strength of Materials Data Structures and Algorithms	OEC	3	3	100	70	20	5	5
6	Professional practice law & ethics	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
7	Power Systems I Lab	PCC	1	2	50	35	5	5	5
8	Control Systems Lab	PCC	1	2	50	35	5	5	5
9	Microprocessors Lab	PCC	1	2	50	35	5	5	5
10	Summer Internship-1(3-4 Weeks)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**24**	**800**	**560**	**150**	**45**	**45**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Power Systems – II	PCC	3	3	100	70	20	5	5
2	Measurements and Instrumentation	PCC	3	3	100	70	20	5	5
3	Program Elective – II Digital Signal Processing Control Systems Design	PEC	3	3	100	70	20	5	5
4	Program Elective – III Line Commutated and Active Rectifiers High Voltage Engineering Electromagnetic Waves	PEC	3	3	100	70	20	5	5
5	Open Elective –II Wavelet Transforms Internet of Things Thermal and Fluid Engineering	OEC	3	3	100	70	20	5	5
6	IPR	HSMC	3	3	100	70	20	5	5
	Practical								
7	Power Systems II Lab	PCC	1	2	50	35	5	5	5
8	Measurements and Instrumentation Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**22**	**700**	**490**	**130**	**40**	**40**

SEMESTER VII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Professional Elective -IV Power System Protection Electrical and Hybrid Vehicles Computational Electromagnetic	PEC	3	3	100	70	20	5	5
2	Professional Elective - V Power System Dynamics andControl Power Quality and FACTS Electrical Drives	PEC	3	3	100	70	20	5	5
3	Open Elective - III Analog and Digital Communication Embedded Systems Fluid Machinery	OEC	3	3	100	70	20	5	5
4	Open Elective - IV Power Plant Engineering Image Processing Automobile Engineering	OEC	3	3	100	70	20	5	5
5	Project Management	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
9	Summer Internship-II(4-6 Weeks)	PROJ	3	0	100	70	30	0	0
10	Minor Project(Project to be carried over to next semester)	PROJ	3	6	100	70	30	0	0
	TOTAL		**21**	**21**	**600**	**490**	**160**	**25**	**25**

SEMESTER VIII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA	Attendance
1	Professional Elective - VI HVDC Transmission Systems Wind and Solar Energy Systems Advanced Electric Drives	PEC	3	3	100	70	20	5	5
2	Open Elective- V VLSI circuits Modern Manufacturing Processes Computer Networks	OEC	3	3	100	70	20	5	5
3	Open Elective - VI Electrical Materials Big Data Analysis	OEC	3	3	100	70	20	5	5
	PRACTICAL								
4	Major Project	PROJ	8	16	200	140	60	0	0
5	Extra-Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**17**	**25**	**600**	**420**	**150**	**15**	**15**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	4	12
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	8	18
4	Professional core courses (**PCC)**	24	54
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	6	18
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	64	160

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1].Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3].Design/Development of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion.

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.
[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Specify& analyze: An ability to identify, specify and analyze systems that inefficiently deliver technological solution in electrical & electronics engineering

[PSO.2]. Design/development of solutions: Design solutions for complex electronics engineering problem & design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, & the cultural, society & environmental considerations.

[PSO.3]. Modern tool usage: Create, select, & apply appropriate electrical techniques, resources & modern engineering including prediction & modeling to complex electrical systems with an understanding of the limitations & short comes.

[PSO.4]. Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Electrical systems & processes & communicate effectively with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions.

Subject: Engineering Physics

Code: BTE22010

4 Credits | Semester II

A. Introduction:

- To acquire fundamental knowledge about nature and its phenomena including quantitative expression.
- To enhance intellectual, computational, experimental, communication and analytical skills of the students Physics is necessary to satisfy the basic sciences requirement, as appropriate for various engineering disciplines

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify and understand the kinds of experimental results which are incompatible with classical Physics leading to the development of a quantum theory of matter and light.
[CO2] Use basic concepts to analyze and design a wide range of semiconductor devices.
[CO3] Understand & solve different types of wave equations.
[CO4] Use the principles of optics to solve various complex engineering problems.
[CO5]Use fundamental laws and relations to solve problems in electricity, electromagnetism

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
EndSemester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

QUANTUM MECHANICS: Introduction to Quantum Physics, black body radiation , Explanation using the photon concept, Photoelectric effect, Compton effect, Wave particle duality, De-Broglie hypothesis, Heisenberg's Uncertainty principle.Born interpretation for wave function, Free-particle wave function and wave-packets, Time-dependent and time independent Schrodinger equation, particle in a box, Finite Potential barrier and tunneling.

ELECTRONIC MATERIALS AND SEMICONDUTOR: Free electron theory, Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, and Effective mass.Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction,

WAVES AND OSCILLATION: Simple harmonic motion, damped and forced simple harmonic oscillator Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, resonance.

OPTICS AND LASER: Introduction to interference, Analytical treatment of interference, Displacement of fringes, Thin film, Wedge shaped film, Newton's Ring,Concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and diffraction grating, Limit of Resolution, Resolving power of grating,Introduction to interaction of radiation with matter, Stimulated and spontaneous emission, Einstein's coefficient, principles and working of laser: population inversion, pumping, types of laser: He-Ne laser, Ruby laser , application of lasers.

ELECTROMAGNETISM: Electric field and electrostatic potential for a charge distribution; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution. Boundary conditions of electric field and electrostatic potential,Bio-Savart law, vector potential and calculating it for a given magnetic field; the equation for the vector potential and its solution for given current densities. Faraday's law of electromagnetic induction, Equation of continuity, displacement current, Maxwell's equation, Poyting theorem, Electromagnetic waves in free space, conducting and non - conducting medium

E. TEXT BOOKS

T1. Concept of Modern Physics by Arthur Beiser: Publication: TMH
T2.Elements of electro magnetics by Mathew N.O. Sadiku: Publication: Oxford University Press
T3.Introduction to electrodynamics by David J. Griffiths; Pub.: Pearson Education.
T4.Optics by Ajoy Ghatak Pub;TMH
T5.Fundamentals of Physics extended volume by Resnick, Halliday and Walker; Pub.:John Wiley & Sons. Inc. Asian Edition.
T6.P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
T7.Engineering Physics – Hitendra K.Malik & Ajay Kumar Singh by TMH Publication.
T8.The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
T9. Introduction to Quantum mechanics, Nikhil Ranjan Roy, 2016, Vikash Publishing House Pvt Ltd

F. REFERENCE BOOKS

R1. Modern Physics by G. Aruldhas & P. Rajagopal; Pub: Prentice Hall of India.
R2. Quantum Physics by H.C. Verma Pub.: Surya Publication .
R3. Lasers and Non-Linear Optics by B.B. Laud; Pub: New Age International (P) Ltd.
R4. Principles of electricity by Leigh Page and Normal llsley Adams, Pub.: Eurasia Publishing House, New Delhi.
R5. Feynmann Lecture Series on Physics
R6. Waves: Berkeley Physics Course, vol.3, Francis Crawford, 2007, Tata McGraw-Hill.
R7. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
R8. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify and understand the kinds of experimental results which are incompatible with Classical Physics leading to the development of a quantum theory of matter and light.	2	3										3				
[CO2]	Use basic concepts to analyze and design a wide range of semiconductor devices.			2		3									1		
[CO3]	Understand & solve different types of wave equations.				2								1				2
[CO4]	Use the principles of optics to solve various complex engineering problems.			3	2												
[CO5]	Use fundamental laws and relations to solve problems in electricity, electromagnetism		3								2						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mathematics –II

Code: BTE22008

4 Credits |Semester II

A. Introduction:

- To familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables.
- To equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines
- To equip the students with standard concepts and tools at an intermediate to advanced level

B. Course Outcomes: At the end of the course,

[CO1] Remembering the mathematical tools needed in evaluating multiple integrals and their usage.

[CO2]Understanding the effective mathematical tools for the solutions of differential equations that model physical processes.

[CO3] Appling the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems

[CO4]Calculate the analytic function**.**

[CO5]Evaluate complex integrals by using Cauchy-Goursat integral theorem.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

MULTIVARIABLE CALCULUS (INTEGRATION): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals,Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity.Triple integrals(Cartesian),orthogonal curvilinear coordinates,Simple applications involving cubes, sphere and rectangular parallelepipeds, Scalar line integrals, vector line integrals, scalar surface integrals,
vector surface integrals, Theorems of Green, Gauss and Stokes

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: solvable for p,solvable for y Equations solvable for x and Clairaut's equation

ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation
Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties

COMPLEX VARIABLE – DIFFERENTIATION: Differentiation, Cauchy-Riemann equations, Analytic functions, harmonic functions, finding harmonic conjugate, Elementary analytic functions (exponential, trigonometric, logarithm)and their properties, Conformal mappings, Mobius transformations and their properties.

COMPLEX VARIABLE – INTEGRATION: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof),Liouville's theorem and Maximum ,Modulus theorem (without proof)Taylor's series, zeros of analytic functions, singularities, Laurent'sseries; Residues, Cauchy Residue theorem (without proof),Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

E. TEXT BOOKS

T1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
T2.Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.

F. REFERENCE BOOKS

R1.W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
R2.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Remembering the mathematical tools needed in evaluating multiple integrals and their usage.		2		2												
[CO2]	Understanding the effective mathematical tools for the solutions of differential equations that model physical processes.			1		1											
[CO3]	Appling the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems				2			1								1	
[CO4]	Calculate the analytic function**.**					2											1
[CO5]	Evaluate complex integrals by using Cauchy-Goursat integral theorem.		1														

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Programming for Problem Solving

Code: BTE21259

3 Credits | Semester II

A. Introduction:

- To understand concept of algorithm and programming
- To know various logical components and
- Syntax used in programming
- To learn different ways of transforming a real world problem into system problem

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Formulate simple algorithms for arithmetic and logical problems.

[CO2] Test and execute the programs and correct syntax and logical errors and to implement conditional branching, iteration and recursion

[CO3] To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

[CO4] To use arrays, pointers and structures to formulate algorithms and programs

[CO5] To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

[CO6] To understand various types of files and operations on them

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FUNDAMENTALS OF INFORMATION TECHNOLOGY: Evolution of Computers, Generation and Classification of Computers Application of Computers and etc**.** Memory Hierarchy, RAM, ROM, Types of Secondary Storage Devices and etc.Information, Technology, Role of Information Technology, Information Technology and Internet and etc.**Introduction**, Evolution of Internet, Basic Internet Terms, Getting Connected to Internet, Internet Applications, Data over Internet, Web Browser, Browsing Internet Using Internet Explorer, E-mail, search Engines, Instant Messaging.E-Commerce, Electronic Data Interchange, Smart Cards, Mobile Communication and etc.

C FUNDAMENTALS, DECISION & LOOPING STATEMENTS:The C language. Phases of developing a running computer program in C.Data Concepts in C: Constants, Variables, Expressions, Operators, and operator precedence in C. Different basic data types and their sizes. Managing input and output statements, Sequential control statements. Decision making statements (If-Else constructs). Loop control statements (While construct, Do While construct, For construct).

ARRAYS, STRINGS &FUNCTIONS : One-dimensional Arrays: Declaration and Initialization. String variables, Reading and writing strings, Arithmetic operations on characters, Putting strings together, Comparison of two strings. Functions: The prototype declaration, Function definition.Function call: Passing arguments to a function (by value, by reference). Scope of variables. Recursive function calls, Tail recursion, Tree of recursion. Sorting problems: Selection sort, Insertion sort. Sorting in multidimensional arrays. Sorting in arrays. Search problems: Linear search and binary search. Recursive and iterative formulations.

POINTERS &STRUCTURE : Pointers: Declaring and dereferencing pointer variables. Pointer arithmetic.Accessing arrays through pointers. Pointer types, Pointer and strings. Structures in C: Motivation, examples, declaration, and use. Operations on structures.Passing structures as function arguments. Type defining structures.

LINKED LISTS & FILE HANDLING : Self-referential structures, Dynamic data structures, Linked lists with examples.File operations in C: Input, output, and error streams. Opening, closing, and reading from files. Searching through files using functions such as fseek(), ftell(), and rewind(). Programming for command line arguments.

E. TEXT BOOKS

T1. Byron Gottfried, Schaum’s Outline of Programming with C, McGraw-Hill .
T2.E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

F. REFERENCE BOOKS

R1.Let us C, Yashwant Kanetkar, BPI publications
R2.Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Formulate simple algorithms for arithmetic and logical problems.	1	1		1			1									
[CO2]	Test and execute the programs and correct syntax and logical errors and to implement conditional branching, iteration and recursion	1	1		1			1									
[CO3]	To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.	1	1		1			1									
[CO4]	To use arrays, pointers and structures to formulate algorithms and programs																
[CO5]	To decompose a problem into functions and synthesize a complete program using divide and conquer approach	1	1		1			1	1								

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

English for Communication

Code: BTE22370
3 Credits | Semester II

A. Introduction:

- To impart basic skills of Communication in English through intensive practice.
- Students of Engineering so as to enable them to enhance their communicative knowledge and soft skills.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Remembering the basic of the comm Represent unication process and to know the practical implementations in the work place.
[CO2] Understanding verbal and non-verbal modes of communication effectively in practical situations
[CO3] Analyzing vocalics and basic grammar.
[CO4] creating competence in reading and writing.
[CO5] Evaluation of speaking process.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

VOCABULARY BUILDING: 'Ancient Architecture in India' from prescribed textbook 'English for Engineers published by Cambridge University. Vocabulary: Synonyms and Antonyms Lexical set of words- Formation of hints with lexical set of words- Usage of Lexical sets in framing meaningful sentences. Standard Abbreviation in English.

IDENTIFYING COMMON ERRORS IN WRITING: Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

SELF DEVELOPMENT AND ASSESSMENT: Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning Self-esteem. Managing Time; Personal memory, Rapid reading,

ORAL COMMUNICATION : Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

NATURE AND STYLE OF SENSIBLE WRITING: Business letters: Enquiry/claim complaint and order. Technical reports, Email writing, Technical articles, Writing reports, Paragraph writing, Techniques for writing precisely. Graphic presentation, Project proposals.

E. TEXT BOOKS

T1. David F. Beer and David Mc Murrey, Guide to writing as an Engineer, John Willey. New York, 2004
T2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
T3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
T4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
T5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
T6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
T7. Xebec, Presentation Book, TMH New Delhi, 2000.
T8 . English for Engineers ,Cambridge university.

F. REFERENCE BOOKS

R1. Practical English Usage. Michael Swan. OUP. 1995.
R2. Remedial English Grammar. F.T. Wood. Macmillan.2007
R3. On Writing Well. William Zinsser. Harper Resource Book. 2001
R4. AICTE Modal

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Remembering the basic of the comm - unication process and to know the practical implementations in the work place.	2								2							
[CO2]	Understanding verbal and non-verbal modes of communication effectively in practical situations						2			2							
[CO3]	Analyzing vocalic and basic grammar		2														2
[CO4]	creating competence in reading and writing			2									2				
[CO5]	Evaluation of speaking process.						2				3						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Constitution of India

Code: BTE25095

0 Credits | Semester II

A. Introduction:

- The objective of the Constitution of India is to establish a society where there is: Justice - social, economic and political. Liberty - thought, expression, faith, belief and worship

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

UNION GOVERNMENT AND ITS ADMINISTRATION: Structure of the Indian Union: Federalism Centre- State relationship President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat Lok Sabha, Rajya Sabha

STATE GOVERNMENT AND ITS ADMINISTRATION: Governor: Role and Position, CM and Council of ministers State Secretariat: Organization, Structure and Functions.

LOCAL ADMINISTRATION: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal CorporationPachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

ELECTION COMMISSION: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

E. TEXT BOOKS

T1. Indian Polity' by Laxmikanth
T2. 'Indian Administration' by Subhash Kashyap

F. REFERENCE BOOKS

R1. 'Indian Constitution' by D.D. Basu
R2. 'Indian Administration' by Avasti and Avasti

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT .	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
[CO1]	Understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context work place												1				

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Physics Lab

Code: BTE21261
1 Credits | Semester II

A. Introduction:

- To study the use of physical principles and analysis in various fields of engineering and technology.
- To supplement the theoretical knowledge gained in the lecture by hands-on experience with the equipment. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.
- Demonstrate an ability to make physical measurements & understand the limits of precision measurement.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand calculation of specific resistance of wire by Carey Foster bridge
[CO2] Calculate thermal conductivity of poor conductors
[CO3] Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current
[CO4] Study the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance.
[CO5] Work with laboratory sodium light and lasers. Understand method to measure the wavelength of the light emitted from a laser and Sodium light.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination(Assessment)	05
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

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D. SYLLABUS

Sl. No.	Name of Experiments
1.	To determine the specific resistance of the material of a wire by Carey Foster bridge
2.	To determine the Planck's constant using LED.
3.	To determine the wavelength of sodium light by using Newton's ring apparatus.
4.	To find the wave length of sodium light using Fresnel's biprism
5.	To determine dispersive power of the material of the prism with the help of a Spectrometer

6.	To determine the number of lines per centimeter of the plane diffraction grating by using sodium light.
7.	To determine the thermal conductivity of following bad conductor (a) ebonite (b) mica sheet (c) wooden By Lee's disc method
8.	To determine the co-efficient of viscosity of glycerin by Stoke's method.
9.	To determine acceleration due to gravity by a Bar Pendulum.
10.	To determine input & output characteristics of a PNP Junction Transistor in CE and CB configuration.
11.	To determine input & output characteristics of a NPN Junction Transistor in CE and CB configuration
12.	To study resonance phenomena in LCR circuits with AC current
13.	To measure moment of inertia of Flywheel
14.	To determine the Lorentz force in a vacuum tube.
15.	To measure the numerical aperture of an optical fiber.
16.	To obtain the particle size by Laser
17.	To obtain forbidden energy gap of Semiconductor Diode.
18.	To obtain Dielectric constant.
19.	To obtain Curie temperature
20.	To determine the time constant of an RC circuit.

E. Text Book:

T1. A Text Book of Engineering Physics Practical by Dr. Ruby Das, C.S. Robinson, Dr. Rajesh Kumar & Prashant Kumar Sahu; Pub University Science Press

T2.Fundamentals of Physics extended volume by Resnick, Halliday and Walker; Pub.:John Wiley & Sons. Inc. Asian Edition.

F. Reference Books:

R1. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers.

R2. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.

G.Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Understand calculation of specific resistance of wire by Carey Foster bridge	3															3
[CO2]	Calculate thermal conductivity of poor conductors			1	2												
[CO3]	Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current					3										1	
[CO4]	Study the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance.				3												
[CO5]	Work with laboratory sodium light and lasers. Understand method to measure the wavelength of the light emitted from a laser and Sodium light.			3				1							3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Programming for Problem Solving Lab

Code: BTE21262

Credits- 2 | Semester II

A. Introduction:

- To work with an IDE to create, edit, compile, run and debug programs
- To analyze the various steps in program development.
- To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.

B. Course Outcomes: At the end of the course, students will be able

[CO1] To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).To test and execute the programs and correct syntax and logical errors.

[CO2] To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

[CO3] To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination(Assessment)	05
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiments
1	a) Write a C program to find sum and average of three numbers. b) Write a C program to find the sum of individual digits of a given positive integer
2	a) Write a C program to generate the first n terms of the Fibonacci sequence b) Write a C program to generate prime numbers between 1 to n. c) Write a C program to check if the given number is Armstrong or not

3	a) Write a C program to check whether the given number is perfect or not b) Write a C program to check whether the given number is strong or not.
4	a) Write a C program to find the roots of a quadratic equation. b) Write a C program perform arithmetic operations using switch statement.
5	a) Write a C program to find factorial of a given integer using non-recursive function b) Write a C program to find factorial of a given integer using recursive function
6	a) Write C program to find GCD of two integers by using recursive function. b) Write C program to find GCD of two integers by using non-recursive function
7	a) Write a C program to find the largest and smallest number in a list of integers. b) Write a C program to Sort the Array in an Ascending Order. c) Write a C program to find whether the given matrix is symmetric or not.
8	a) Write a C program to perform addition of two matrices. b) Write a C program using function to perform multiplication of two matrices.
9	a) Write a C program to use function to insert a sub-string in to given main string from a given position. b)Write a C program to swap the values of two variables using (i) Call by value (ii) Call by reference
10	a) Write a C program using user-defined functions to determine whether the given string is palindrome or not. b) Write a C program that displays the position or index in the main string S where the sub string T begins, or - 1 if S doesn't contain T
11	a) Write C program to count the number of lines, words and characters in a given text. b) Write a C program to find the sum of integer array elements using pointers
12	a) Write a C Program to Calculate Total and Percentage marks of a student using structure

E. TEXT BOOKS

T1. C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
T2.Computer programming in C.V.RAjaraman, PHI Publishers.
T3.C Programming, E.Balagurusamy, 3rd edition, TMHPublishers.

F. REFERENCE BOOKS

R1. C Programming, M.V.S.S.N Venkateswarlu and E.V.Prasad,S.Chand Publishers.
R2. Mastering C,K.R.Venugopal and S.R.Prasad, TMH Publishers.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language). To test and execute the programs and correct syntax and logical errors.	2	3														
[CO2]	To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.			2	2												
[CO3]	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.					1											

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Workshop Practice

Code: BTE22267

2 Credits | Semester II

A. Introduction:

- To understand basic engineering processes for manufacturing and assembly
- To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment's
- To understand and interpret job drawings, produce jobs, and inspect the job for specified dimension.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines

[CO2] Understand job drawing and complete jobs as per specifications in allotted time

[CO3] Inspect the job for the desired dimensions and shape

[CO4] Operate, control different machines and equipment's adopting safety practices

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination(Assessment)	05
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FITTING SHOP: Introduction Of Workshop Tools & Measuring Instrument Fitting: - Demonstration of different fitting tools, safety practice and general guidelines. Cutting and Filing. Filing, Measurement and Finishing etc Practice: T-fitting , V-Fitting etc

CARPENTRY SHOP: Demonstration of power tools and equipment for carpentry, safety practices and general guidelines. Carpentry: Demonstration of different wood working tools / machines. Demonstration of Different Wood Working Processes Like Plaining Marking ,Chiseling ,Grooving ,Turning of Wood etc Practice: - T-Lap joint, Dovetail joint etc

WELDING SHOP: Demonstration of tools and equipment for welding, safety practices and general guidelines.Demonstration of different welding tools / machines. Demonstration on Arc Welding, Gas

Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding Practice : Butt , lap joint etc.

PLUMBING SHOP: Demonstration – plumbing tools, symbols and joints. Joining GI pipes by threading, PVC pipes by gluing and cementing Practice :- To Make Internal & External Thread

MACHINE SHOP: Demonstration of tools and equipment for Machine, safety practices and general guidelines. Demonstration of all machine like Lathe Machine, Drill machine, Milling Machine, Shaper machine etc. Practice :- To make Step Turning , Tapper Turning, Turning, Facing etc.

E. TEXT BOOKS

T1. Workshop Technology Vol-I,II,III Hajra Choudry., Media Promotors and Publishers P Ltd.
T2.Manufacturing Technology vol 1 by P.N. Rao Mc.Grow Hill.

F. REFERENCE BOOKS

R1. Workshop technology by R.S. Raghuwanshi.Dhanpat Ray & co
R2. Workshop technology by R.S. Khurmi&J.K.Gupta S.Chand co.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines	2								2							
[CO2]	Understand job drawing and complete jobs as per specifications in allotted time						2			2							
[CO3]	Inspect the job for the desired dimensions and shape		2														2
[CO4]	Operate, control different machines and equipment's adopting safety practices			2									2				

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University Jharkhand

Syllabus of

B.Tech in Electrical & Electronics Engineering

Semester-III

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE
Scheme of Study (w.e.f Batch 2020-21)

SCHEME OF THE STUDY
SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SCHEME OF THE STUDY
SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Circuit Analysis	PCC	3	3	100	70	20	5	5
2	Electromagnetic Fields	PCC	4	4	100	70	20	5	5
3	Analog Electronic	PCC	3	3	100	70	20	5	5
4	Engineering Mathematics – III	BSC	4	4	100	70	20	5	5
5	Electrical Machines-I	PCC	4	4	100	70	20	5	5
6	Environmental Sciences	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Circuit Analysis Lab	PCC	1	2	50	35	5	5	5
8	Electrical Machines-I Lab	PCC	1	2	50	35	5	5	5
9	Analog Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**21**	**26**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Machines-II	PCC	4	4	100	70	20	5	5
2	Digital Electronics	PCC	3	3	100	70	20	5	5
3	Power Electronics	PCC	4	4	100	70	20	5	5
4	Signals and Systems	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
6	Essence of Indian Knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Machines II Lab	PCC	1	2	50	35	5	5	5
8	Digital Electronics Lab	PCC	1	2	50	35	5	5	5
9	Power Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**25**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Power Systems–I	PCC	3	3	100	70	20	5	5
2	Control Systems	PCC	3	3	100	70	20	5	5
3	Microprocessors	PCC	3	3	100	70	20	5	5
4	Program Elective – I Electrical Energy Conservation and Auditing Electrical Machine Design Industrial Electrical Systems	PEC	3	3	100	70	20	5	5
5	Open elective-I Electronic Devices Strength of Materials Data Structures and Algorithms	OEC	3	3	100	70	20	5	5
6	Professional practice law & ethics	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
7	Power Systems I Lab	PCC	1	2	50	35	5	5	5
8	Control Systems Lab	PCC	1	2	50	35	5	5	5
9	Microprocessors Lab	PCC	1	2	50	35	5	5	5
10	Summer Internship-1(3-4 Weeks)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**24**	**800**	**560**	**150**	**45**	**45**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Power Systems – II	PCC	3	3	100	70	20	5	5
2	Measurements and Instrumentation	PCC	3	3	100	70	20	5	5
3	Program Elective – II Digital Signal Processing Control Systems Design	PEC	3	3	100	70	20	5	5
4	Program Elective – III Line Commutated and Active Rectifiers High Voltage Engineering Electromagnetic Waves	PEC	3	3	100	70	20	5	5
5	Open Elective –II Wavelet Transforms Internet of Things Thermal and Fluid Engineering	OEC	3	3	100	70	20	5	5
6	IPR	HSMC	3	3	100	70	20	5	5
	Practical								
7	Power Systems II Lab	PCC	1	2	50	35	5	5	5
8	Measurements and Instrumentation Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**22**	**700**	**490**	**130**	**40**	**40**

SEMESTER VII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Professional Elective -IV Power System Protection Electrical and Hybrid Vehicles Computational Electromagnetic	PEC	3	3	100	70	20	5	5
2	Professional Elective - V Power System Dynamics andControl Power Quality and FACTS Electrical Drives	PEC	3	3	100	70	20	5	5
3	Open Elective - III Analog and Digital Communication Embedded Systems Fluid Machinery	OEC	3	3	100	70	20	5	5
4	Open Elective - IV Power Plant Engineering Image Processing Automobile Engineering	OEC	3	3	100	70	20	5	5
5	Project Management	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
9	Summer Internship-II(4-6 Weeks)	PROJ	3	0	100	70	30	0	0
10	Minor Project(Project to be carried over to next semester)	PROJ	3	6	100	70	30	0	0
	TOTAL		**21**	**21**	**600**	**490**	**160**	**25**	**25**

SEMESTER VIII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA	Attendance
1	Professional Elective - VI HVDC Transmission Systems Wind and Solar Energy Systems Advanced Electric Drives	PEC	3	3	100	70	20	5	5
2	Open Elective- V VLSI circuits Modern Manufacturing Processes Computer Networks	OEC	3	3	100	70	20	5	5
3	Open Elective - VI Electrical Materials Big Data Analysis	OEC	3	3	100	70	20	5	5
	PRACTICAL								
4	Major Project	PROJ	8	16	200	140	60	0	0
5	Extra-Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**17**	**25**	**600**	**420**	**150**	**15**	**15**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	4	12
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	8	18
4	Professional core courses (**PCC)**	24	54
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	6	18
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	64	160

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:

AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.

The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.

Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.

Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1].Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3].Design/Development of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion.

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.
[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Specify& analyze: An ability to identify, specify and analyze systems that inefficiently deliver technological solution in electrical & electronics engineering

[PSO.2]. Design/development of solutions: Design solutions for complex electronics engineering problem & design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, & the cultural, society & environmental considerations.

[PSO.3]. Modern tool usage: Create, select, & apply appropriate electrical techniques, resources & modern engineering including prediction & modeling to complex electrical systems with an understanding of the limitations & short comes.

[PSO.4]. Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Electrical systems & processes & communicate effectively with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions.

Subject: Electrical Circuit Analysis

Code: BTE23379
3 Credits | Semester III

A. Introduction:

- Will able to articulate in working of various components of a circuit.
- Will be familiar with ac and dc circuits solving.
- Will be ready with the most important concepts like mesh and nodal analysis.
- Ability to Solve Circuits using Tree, Node, Branch, Cut set, Tie Set Methods.
- Ability to measure Three phase voltages and current, active, reactive powers
- Ability to convert Three phase Star to Three phase Delta circuits and Vice-Versa.
- Ability to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve

B.Course Outcomes: At the end of the course, students will be able to

[CO1]Identify the characteristics of circuit elements.
[CO2]Demonstrate the resonance in R-L-C series circuit.
[CO3] Apply network theorems for the analysis of electrical circuits.
[CO4]Analyze two port circuit behavior.
[CO5] Evaluate circuit parameters in the sinusoidal steady state (single-phase and three-phase) condition.
[CO6]Generate the transient and steady state response of electrical circuits.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

NETWORK THEOREMS: Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, and Compensation theorem. Analysis with dependent current and voltage sources, Node and Mesh Analysis. Concept of duality and dual networks.

SOLUTION OF FIRST AND SECOND ORDER NETWORKS: Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C. Initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

SINUSOIDAL STEADY STATE ANALYSIS: Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuit, Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS: Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs ,s, convolution integral, inverse Laplace transform, Transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

TWO PORT NETWORK AND NETWORK FUNCTIONS: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port
Networks.

STRUCTURE AND FILE HANDLING: Structures, Defining structures and Array of Structures, File handling (optional),

E. TEXT BOOKS

T1. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
T2. Electric Circuit Analysis, 3rd Edition David E. Johnson, Johnny R. Johnson, John L. Hilburn, Peter D. Scott, ISBN: 978-0-471-36571-6
T3. Electric Circuits, James W. Nilsson, Susan Riedel

F. REFERENCE BOOKS

R1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
R2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
R3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013
R4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
R5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the characteristics of circuit elements	2	1			1								3			
[CO2]	Demonstrate the resonance in R-L-C series circuit.	1															3
[CO3]	Apply network theorems for the analysis of electrical circuits	3				3										3	
[CO4]	Analyze two port circuit behavior.			2										3			
[CO5]	Evaluate circuit parameters in the sinusoidal steady state (single-phase and three-phase) condition.				2											2	
[CO6]	Generate the transient and steady state response of electrical circuits.			1	2	1									2	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Electromagnetic Fields

Code: BTE24075
4 Credits | Semester III

A. Introduction:

- To find difficult to visualize electric and magnetic fields.
- Instructors may demonstrate various simulation tools
- To visualize electric and Magnetic fields in practical devices like transformers, transmission lines and machines.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recall the basic laws of electromagnetism.
[CO2] Understand the propagation of EM waves
[CO3] Apply Maxwell’s equation in different forms and different media.
[CO4] Analyze time varying electric and magnetic fields.
[CO5]Interpret the electric and magnetic fields for simple configurations under static conditions.
[CO6] Design various devices that can work based on the forces generated by electric and magnetic fields.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

REVIEW OF VECTOR CALCULUS: Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator Del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

STATIC ELECTRIC FIELD: Coulomb’s law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density

CONDUCTORS, DIELECTRICS AND CAPACITANCE: Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials, Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line. Poisson’s equation, Laplace’s equation, Solution of Laplace and Poisson’s equation, Application of Laplace’s and Poisson’s equations

STATIC MAGNETIC FIELDS,MAGNETIC FORCES, MATERIALS AND INDUCTANCE Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density ,Scalar and Vector Magnetic potentials, Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements. Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

TIME VARYING FIELDS AND MAXWELL'S EQUATIONS, ELECTROMAGNETIC WAVES: Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions. Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Propagation in good conductors, Skineffect. Poynting theorem.

E. TEXT BOOKS

T1. Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford University Press.T2. Engineering Chemistry by Wiley
T2. Electromagnetic field theory fundamentals, Guru &Hizroglu, 2nd edition, Cambridge University Press
T3. Electromagnetic with application, Krause, 5th Edition, TMH.
T4. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

F. REFERENCE BOOKS

R1. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
R2. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
R3 G.W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
R4. W.J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
R5. W.J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
R6. E.G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
R7. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall the basic laws of electromagnetism.		2			1								1			
[CO2]	Understand the propagation of EM waves		1		2	1								2			
[CO3]	Apply Maxwell's equation in different forms and different media.	2		1		2										3	
[CO4]	Analyze time varying electric and magnetic fields.				2									3			
[CO5]	Interpret the electric and magnetic fields for simple configurations under static conditions.				1											2	
[CO6]	Design various devices that can work based on the forces generated by electric and magnetic fields.			2	1										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Analog Electronics

Code: BTE23380

3 Credits | Semester III

A. Introduction:

- To illustrate the students different electronic circuit and their application in practice.
- To impart knowledge on assessing performance of electronic circuit through monitoring of sensitive parameters.
- To evaluate the use of computer based analysis tools to review performance of semiconductor device circuit

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recall the characteristics of transistors.
[CO2] Understand the functioning of OP-AMP and design OP-AMP based circuits.
[CO3] Develop design competence in the area of discrete feedback amplifiers.
[CO4] Analyze various rectifier and amplifier circuits.
[CO5] Judge commonly used linear and non-linear applications of OP-AMP and Comparators.
[CO6] Design competence in linear and non-linear OP-AMP Circuits.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

DIODE CIRCUITS: P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

BJT CIRCUITS: Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

MOSFET CIRCUITS: MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier, small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers, small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

DIFFERENTIAL, MULTI-STAGE AND OPERATIONAL AMPLIFIERS: Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

LINEAR AND NON LINEAR APPLICATIONS OF OP-AMP: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion. Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot

E. TEXT BOOKS

T1. “Analog Electronic Circuit” by B Saha, New Age International Publications

T2. “Electronic Devices & Circuits: by J.B. Gupta, Katson Books Publications.

F. REFERENCE BOOKS

R1. “Design with Operational Amplifiers and Analog Integrated Circuits” by Sergio Franco, McGraw Hill publication.

R2. “Analog Electronics Circuits” by S N Ali, Vayu Education of India.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall the characteristics of transistors.					1								1			
[CO2]	Understand the functioning of OP-AMP and design OP-AMP based circuits.	1	1		2	2								2			
[CO3]	Develop design competence in the area of discrete feedback amplifiers.			2	1										2	1	
[CO4]	Analyze various rectifier and amplifier circuits.		1		3									3			
[CO5]	Judge commonly used linear and non-linear applications of OP-AMP and Comparators.			1	2									1		2	
[CO6]	Design competence in linear and non-linear OP-AMP Circuits.		1	1	2	2									3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Engineering Mathematics – III

Code:BTE23046

4 Credits | Semester III

A. INTRODUCTION:

- To introduce the solution methodologies for probability Equations with applications in engineering
- To provide an overview of statistics to engineers.

B. COURSE OUTCOMES: By the end of this course, students will be able to:

[CO 1]Recall about statistical parameter estimation.
[CO 2] Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution.
[CO 3] Solve the problems choosing the most suitable method.
[CO 4] Analyze the fundamental concepts of Probability, and the basic numerical methods for their resolution.
[CO 5] Evaluate solution using computational tools and applications of basic and applied statistics.
[CO 6] Formulate about regression and correlation analysis.

C. ASSESSMENT PLAN:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

BASIC PROBABILITY: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution. Infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality

CONTINUOUS PROBABILITY DISTRIBUTIONS: Continuous random variables and their properties, distribution functions and densities. Normal, exponential and gamma densities.

BIVARIATE DISTRIBUTIONS: Bivariate distributions and their properties, distribution of sums and quotients. Conditional densities, Bayes' rule.

BASIC STATISTICS AND APPLIED STATISTICS: Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second-degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference ofProportions, single mean, difference of means, and difference of standard deviations.

SMALL SAMPLES Test for single mean, difference of means and correlation coefficients, Test for ratio of variances -Chi-square test for goodness of fit and independence of attributes.

E. TEXT BOOK

T1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2000.
T2. T. Veerarajan, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010.

F. REFERENCES

R1. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 2006.
R2. P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, 2003.
R3S. Ross, “A First Course in Probability”, Pearson Education India, 2002.
R4. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, Wiley, 1968.
R5. N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2010.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall about statistical parameter estimation.		**1**			**2**								**2**			
[CO2]	Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution.	**1**	**2**		**1**	**2**								**2**			
[CO3]	Solve the problems choosing the most suitable method.	**2**		**2**	**1**	**1**										**2**	
[CO4]	Analyze the fundamental concepts of Probability, and the basic numerical methods for their resolution.		**2**											**3**			
[CO5]	Evaluate solution using computational tools and applications of basic and applied statistics.			**2**	**1**											**2**	
[CO6]	Formulate about regression and correlation analysis.		**1**	**1**	**2**	**2**									**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical Machines-I

Code:BTE23041

4 Credits | Semester III

A. INTRODUCTION:

- To study the basic components of Electrical Machines
- To understand the concept of Armature winding in DC
- To understand the basic components of design of DC Machines.
- To understand the basic components of design of Transformer

B. COURSE OUTCOMES: By the end of this course, students will be:

[CO.1] Recognize the concepts of magnetic circuits.
[CO.2] Understand the operation of dc machines.
[CO.3] Analyze single phase and three phase transformer circuits.
[CO.4] Compare the differences in operation of different dc machine configurations.
[CO.5] Evaluate performance parameters for transformer.
[CO.6] Formulate the equation to find efficiency of transformer.

C. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

MAGNETIC FIELDS AND MAGNETIC CIRCUITS: Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot-Savart Law , Visualization of magnetic fields produced by a bar magnet and a current carrying coil -through air and through a combination of iron and air; influence of highly permeable materials on the
Magnetic flux lines.

ELECTROMAGNETIC FORCE AND TORQUEB-H curve of magnetic materials; flux-linkage vs. current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; Torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency

DC MACHINES: Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, Induced EMFin an armature coil. Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation. Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction..

DC MACHINE - MOTORING AND GENERATION : 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 seriesmotors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

TRANSFORMERS: 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.

E. TEXT BOOK

T1. “Electrical Machine Design”, Sawhney, Dhanpath Rai & Co

T2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

F. REFERENCES

R1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education,2013.

R2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers,2004.

R3 . G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.

R5. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Recognize the concepts of magnetic circuits.					**2**								**2**			
[CO2]	Understand the operation of dc machines.	**2**	**1**		**3**	**1**								**2**			
[CO3]	Analyze single phase and three phase transformer circuits.	**1**		**2**	**1**	**1**										**3**	
[CO4]	Compare the differences in operation of different dc machine configurations.		**2**			**1**								**2**			
[CO5]	Evaluate performance parameters for transformer.			**1**	**1**											**2**	
[CO6]	Formulate the equation to find efficiency of transformer.		**1**	**1**	**2**	**1**									**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Environmental Science

Code: BTE24085

0 Credits | Semester III

A. INTRODUCTION:

- Solve various engineering problems applying ecosystem to produce eco – friendly products.
- Use relevant air and noise control method to solve domestic and industrial problems.
- Use relevant water and soil control method to solve domestic and industrial problems.
- To recognize relevant energy sources required for domestic and industrial applications.
- Solve local solid and e-waste problems.

B. COURSE OUTCOMES: By the end of this course, students will be:

[CO1] Define the ecosystem and terminology related.
[CO2] Understand the water and soil pollution, and control measures and act.
[CO3] Solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
[CO4] Compare different renewable energy resources and efficient process of harvesting.
[CO5] Estimate the suitable air, extent of noise pollution, and control measures and acts.
[CO6] Build relationships between natural resources, consumption, population, economics of consumerism, etc in an environmental context.

C. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	10
	Attendance	2.5
	Assignment	2.5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

INTRODUCTION TO ENVIRONMENTAL SCIENCE: Definition, Principles and scope of Environmental Science, Earth, Man and Environment. Ecosystems, Pathways in Ecosystems.Physico-chemical and Biological factors in the Environment. Geographical classification and zones'.

AIR AND NOISE POLLUTION: Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler), Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator) Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000

WATER AND SOIL POLLUTION: Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation**,** Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method:

Membrane separation technology, RO (reverse osmosis).Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

RENEWABLE SOURCES OF ENERGY: Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas, Wind energy: status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy, New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.

SOLID WASTE MANAGEMENT, ISO 14000 & ENVIRONMENTAL MANAGEMENT: Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries, Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste Air quality act 2004, air pollution control act 1981, water pollution, and control act1996.Structure and role of Central and state pollution control board. Concept of Carbon Credit, Carbon Footprint. Environmental management in fabrication industry. ISO14000: Implementation in industries, Benefits.

E. TEXT BOOK

T1. S.C. Sharma & M.P. Poonia, Environmental Studies,Khanna Publishing House,NewDelhi
T2.C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
T3. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and
T4. Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099.

F. REFERENCES

R1. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
R2. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication,2007, ISBN: 81-224-1835-X.
R3. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07-451871-8.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Define the ecosystem and terminology related.						**2**							**2**			
[CO2]	Understand the water and soil pollution, and control measures and act.							**2**						**2**			
[CO3]	Solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.			**1**	**1**				**2**							**2**	
[CO4]	Compare different renewable energy resources and efficient process of harvesting.			**2**		**2**		**1**						**2**			
[CO5]	Estimate the suitable air, extent of noise pollution, and control measures and acts.							**2**								**1**	**1**
[CO6]	Build relationships between natural resources, consumption, population, economics of consumerism, etc in an environmental context							**2**				**1**	**2**		**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical Circuit Analysis Lab

Code:23270

1 Credits | Semester III

A. Introduction:

- Fundamentals of Ohm's law, Kirchhoff's current and voltage laws and its practical Implementation
- Measurement of voltage, current, power and impedance of any circuit
- Analysis of a given circuit depending on types of elements - DC analysis, Transient analysis
- and Frequency analysis
- Measurement of frequency and amplitude of any signal using CRO
- Designing of circuits (at least proto type models) for a given set of specifications weather in time domain or in frequency domain

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recall practical implications of the fundamentals of Ohm's law, Kirchhoff's current and voltage laws.
[CO2] Understand the operation of DSO to measure the frequency, and amplitude of any signal.
[CO3] Carry out practical implementation of the fundamental electrical theorems and modeling of simple electrical systems.
[CO4] Classify the DC analysis, Transient analysis and Frequency analysis of a given circuit depending on types of elements.
[CO5] Measure the voltage, current, power and impedance of any circuit.
[CO6] Design a suitable series R-L-C circuit to operate at resonance condition.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

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D. SYLLABUS

Sr.No.	Name of Experiment
1	Verification of super position theorem using hard ware and digital simulation
2	Verification of reciprocity theorem using hardware and digital simulation
3	Verification of The venin's theorem using hard ware and digital simulation
4	Verification of maximum power transfer theorem using hardware and digital simulation

5	Verification of Norton's theorem using hard ware and digital simulation
6	Verification of series resonance using hard ware and digital simulation
7	Verification of parallel resonance using hard ware and digital simulation
8	Verification of self-inductance and mutual inductance by using hard ware
9	To study the Locus diagrams of RL & RC series circuits
10	Verification of compensation theorem
11	To study Z and Y parameters
12	Measurement of reactive power for star and delta connected balanced loads

E. TEXT BOOKS

T1. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
T2. Electric Circuit Analysis, 3rd Edition David E. Johnson, Johnny R. Johnson, John L. Hilburn, Peter D. Scott, ISBN: 978-0-471-36571-6
T3. Electric Circuits, James W. Nilsson, Susan Riedel

F. REFERENCE BOOKS

R1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
R2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
R3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013
R4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
R5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall practical implications of the fundamentals of Ohm's law, Kirchhoff's current and voltage laws.					**1**								**2**			
[CO2]	Understand the operation of DSO to measure the frequency, and amplitude of any signal.		**2**		**1**	**1**								**2**			
[CO3]	Carry out practical implementation of the fundamental electrical theorems and modeling of simple electrical systems.	**1**		**1**	**1**	**2**										**3**	
[CO4]	Classify the DC analysis, Transient analysis and Frequency analysis of a given circuit depending on types of elements.		**1**		**1**									**2**			
[CO5]	Measure the voltage, current, power and impedance of any circuit.			**3**	**3**									**2**			
[CO6]	Design a suitable series R-L-C circuit to operate at resonance condition.		**1**	**2**		**2**									**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical Machines Lab-I

Code:BTE23043

1 Credits | Semester III

A. Introduction:

- The ability to conduct testing and experimental procedures on different types of electrical machines.
- To expose the students to the operation synchronous and induction machines and give them experimental skills.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recall the fundamental principles and classification of electromagnetic machines.
[CO2]Understand the constructional details and principle of operation of dc machines.
[CO3] Apply the knowledge about testing and find performance characteristics of dc machines.
[CO4] Analyze by conducting various tests on transformers and obtaining their performance indices using standard analytical as well as graphical methods.
[CO5] Acquire knowledge about the constructional details, principle of operation, testing and applications of transformers.
[CO6] Formulate equivalent circuit parameters for various machines.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	Name of Experiment
1	Predetermination of Efficiency & Regulation of 1-phase transformer
2	Predetermination of Efficiency & Regulation of two identical 1-phase transformers
3	Determination of Efficiency & Regulation of 1-phase Transformer by direct test
4	Conversion of Three phase to two phase by using two identical transformers
5	Predetermination of Efficiency & Regulation of 1-phase transformer
6	Determination of critical resistance and critical speed of D.C. shunt generator
7	Predetermination of Efficiency of D.C. shunt machine & Speed control of D.C. shunt motor

8	Performance characteristics of D.C. shunt motor
9	Determination of efficiency of DC shunt machine by conducting back to back test
10	Separation of stray losses in a D.C. shunts motor.
11	Load characteristics of a separately excited D.C. Generator
12	Calculation of voltage regulation for a 1-phase transformer using lab-view

E. TEXT BOOK

T1. "Electrical Machine Design", Sawhney, Dhanpath Rai & Co
T2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

F. REFERENCES

R1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education,2013.
R2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers,2004.
R3 . G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
R5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

G. Course Articulation Matrix: (Mapping of Cos with Pos)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall the fundamental principles and classification of electromagnetic machines.					**2**										**2**	
[CO2]	Understand the constructional details and principle of operation of dc machines.		**1**		**2**	**1**								**2**			
[CO3]	Apply the knowledge about testing and find performance characteristics of dc machines.	**3**		**1**	**1**	**2**										**3**	
[CO4]	Analyze by conducting various tests on transformers and obtaining their performance indices using standard analytical as well as graphical methods.		**2**		**3**	**1**								**3**			
[CO5]	Acquire knowledge about the constructional details, principle of operation, testing and applications of transformers.	**2**												**2**			
[CO6]	Formulate equivalent circuit parameters for various machines.		**3**	**2**	**1**	**1**									**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Analog Electronics Lab

Code: BTE23381

1 Credits | Semester III

A. Introduction:

- To give the idea about fundamental properties of semiconductors.
- To prepare students to perform the analysis of any Analog electronics circuit.
- To empower students to understand the design and working of BJT / FET amplifiers, Oscillators and Operational Amplifier.
- To prepare the students for advanced courses in Communication system Circuit Design.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Acquire basic knowledge of physical and electrical conducting properties of semiconductors.

[CO2] Understand the characteristics of different semiconductor devices like diode, BJT, FET, UJT etc experimentally

[CO3] Develop the ability to understand the design and working of BJT / FET amplifiers.

[CO4] Analyze the effect of negative feedback on different parameters of an Amplifier and different types of negative feedback topologies.

[CO5] Develop the skill to build, and troubleshoot Analog circuits.

[CO6] Design amplifier circuits using BJT s and FET's and observe the amplitude and frequency responses of common amplifier circuits.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sl.No.	**Name of Experiment**
1	Study of diode characteristics.
2	Study of rectifier characteristics.
3	Study of clipping and clamping circuit.
4	To study the characteristics of bipolar junction transistor
5	To study the frequency response of CE amplifier.
6	To study the frequency response of CC amplifier.

7	To study the Frequency response of two stages -RC coupled amplifier.
8	To study the Frequency response of Common source FET amplifier.
9	To study the frequency response of Hartley oscillator.
10	To study the frequency response of Colpitt's oscillator.
11	To study the frequency response of RC Phase - Shift Oscillator.
12	To study the frequency response of Wein - Bridge Oscillator

E. TEXT BOOKS

T1. "Analog Electronic Circuit" by B Saha, New Age International Publications

T2. "Electronic Devices & Circuits: by J.B. Gupta, Katson Books Publications.

F. REFERENCE BOOKS

R1. "Design with Operational Amplifiers and Analog Integrated Circuits" by Sergio Franco, McGraw Hill publication.

R2. "Analog Electronics Circuits" by S N Ali, Vayu Education of India.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Acquire basic knowledge of physical and electrical conducting properties of semiconductors.					2										2	
[CO2]	Understand the characteristics of different semiconductor devices like diode, BJT, FET, UJT etc. experimentally		1		1	2								2			
[CO3]	Develop the ability to understand the design and working of BJT / FET amplifiers.	1		3	1	2									2	1	
[CO4]	Analyze the effect of negative feedback on different parameters of an Amplifier and different types of negative feedback topologies.		2		3									3			
[CO5]	Develop the skill to build, and troubleshoot Analog circuits.		1	3	1										2		
[CO6]	Design amplifier circuits using BJT s and FET's and observe the amplitude and frequency responses of common amplifier circuits.			2	3	1								1	3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University
Jharkhand

Syllabus of

B.Tech in Electrical & Electronics Engineering

Semester-IV

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE
Scheme of Study (w.e.f Batch 2020-21)

SCHEME OF THE STUDY
SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SCHEME OF THE STUDY
SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Circuit Analysis	PCC	3	3	100	70	20	5	5
2	Electromagnetic Fields	PCC	4	4	100	70	20	5	5
3	Analog Electronic	PCC	3	3	100	70	20	5	5
4	Engineering Mathematics – III	BSC	4	4	100	70	20	5	5
5	Electrical Machines-I	PCC	4	4	100	70	20	5	5
6	Environmental Sciences	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Circuit Analysis Lab	PCC	1	2	50	35	5	5	5
8	Electrical Machines-I Lab	PCC	1	2	50	35	5	5	5
9	Analog Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**21**	**26**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Machines-II	PCC	4	4	100	70	20	5	5
2	Digital Electronics	PCC	3	3	100	70	20	5	5
3	Power Electronics	PCC	4	4	100	70	20	5	5
4	Signals and Systems	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
6	Essence of Indian Knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Machines II Lab	PCC	1	2	50	35	5	5	5
8	Digital Electronics Lab	PCC	1	2	50	35	5	5	5
9	Power Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**25**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Power Systems–I	PCC	3	3	100	70	20	5	5
2	Control Systems	PCC	3	3	100	70	20	5	5
3	Microprocessors	PCC	3	3	100	70	20	5	5
4	Program Elective – I Electrical Energy Conservation and Auditing Electrical Machine Design Industrial Electrical Systems	PEC	3	3	100	70	20	5	5
5	Open elective-I Electronic Devices Strength of Materials Data Structures and Algorithms	OEC	3	3	100	70	20	5	5
6	Professional practice law & ethics	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
7	Power Systems I Lab	PCC	1	2	50	35	5	5	5
8	Control Systems Lab	PCC	1	2	50	35	5	5	5
9	Microprocessors Lab	PCC	1	2	50	35	5	5	5
10	Summer Internship-1(3-4 Weeks)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**24**	**800**	**560**	**150**	**45**	**45**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Power Systems – II	PCC	3	3	100	70	20	5	5
2	Measurements and Instrumentation	PCC	3	3	100	70	20	5	5
3	Program Elective – II Digital Signal Processing Control Systems Design	PEC	3	3	100	70	20	5	5
4	Program Elective – III Line Commutated and Active Rectifiers High Voltage Engineering Electromagnetic Waves	PEC	3	3	100	70	20	5	5
5	Open Elective –II Wavelet Transforms Internet of Things Thermal and Fluid Engineering	OEC	3	3	100	70	20	5	5
6	IPR	HSMC	3	3	100	70	20	5	5
	Practical								
7	Power Systems II Lab	PCC	1	2	50	35	5	5	5
8	Measurements and Instrumentation Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**22**	**700**	**490**	**130**	**40**	**40**

SEMESTER VII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Professional Elective -IV Power System Protection Electrical and Hybrid Vehicles Computational Electromagnetic	PEC	3	3	100	70	20	5	5
2	Professional Elective - V Power System Dynamics andControl Power Quality and FACTS Electrical Drives	PEC	3	3	100	70	20	5	5
3	Open Elective - III Analog and Digital Communication Embedded Systems Fluid Machinery	OEC	3	3	100	70	20	5	5
4	Open Elective - IV Power Plant Engineering Image Processing Automobile Engineering	OEC	3	3	100	70	20	5	5
5	Project Management	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
9	Summer Internship-II(4-6 Weeks)	PROJ	3	0	100	70	30	0	0
10	Minor Project(Project to be carried over to next semester)	PROJ	3	6	100	70	30	0	0
	TOTAL		**21**	**21**	**600**	**490**	**160**	**25**	**25**

SEMESTER VIII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA	Attendance
1	Professional Elective - VI HVDC Transmission Systems Wind and Solar Energy Systems Advanced Electric Drives	PEC	3	3	100	70	20	5	5
2	Open Elective- V VLSI circuits Modern Manufacturing Processes Computer Networks	OEC	3	3	100	70	20	5	5
3	Open Elective - VI Electrical Materials Big Data Analysis	OEC	3	3	100	70	20	5	5
	PRACTICAL								
4	Major Project	PROJ	8	16	200	140	60	0	0
5	Extra-Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**17**	**25**	**600**	**420**	**150**	**15**	**15**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	4	12
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	8	18
4	Professional core courses (**PCC)**	24	54
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	6	18
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	64	160

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1].Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3].Design/Development of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion.

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.
[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Specify& analyze: An ability to identify, specify and analyze systems that inefficiently deliver technological solution in electrical & electronics engineering

[PSO.2]. Design/development of solutions: Design solutions for complex electronics engineering problem & design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, & the cultural, society & environmental considerations.

[PSO.3]. Modern tool usage: Create, select, & apply appropriate electrical techniques, resources & modern engineering including prediction & modeling to complex electrical systems with an understanding of the limitations & short comes.

[PSO.4]. Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Electrical systems & processes & communicate effectively with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions.

Electrical Machines-II

Code: BTE24072

4 Credits | Semester IV

A. Introduction:

- To identify & formulate solutions to problems relevant to synchronous machine.
- To identify & formulate solutions to problems relevant to Induction motor.
- To study and design various types of AC winding.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recognize different electrical machine.

[CO2] Understand the operation of ac machines.

[CO3] Apply the concepts of rotating magnetic fields to find characteristics of Induction motor.

[CO4] Ability to conduct experiments on Ac Machines to find the Characteristics.

[CO5] Evaluate performance characteristics of ac machines.

[CO6] Modify the characteristics of operation of Synchronous motor.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FUNDAMENTALS OF AC MACHINE WINDINGS: Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding-concentrated and distributed. Sinusoidally distributed winding, winding distribution factor

PULSATING AND REVOLVING MAGNETIC FIELDS: Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current. Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

INDUCTION MACHINES: Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

SINGLE-PHASE INDUCTION MOTORS: Constructional featuresdouble revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications

SYNCHRONOUS MACHINES: Constructional features, cylindrical rotor synchronous machine, generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics.

E. TEXT BOOKS

T1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
T2. "Electric Machines: by Ashfaq Husain and HarroonAshfaq, Dhanpat Rai & Co. Publications.
T3."Electric Machinery Fundamentals" by Stephen Chapman, McGraw Hill publication, 5th edition.
T4. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.

F. REFERENCE BOOKS

R1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
R2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
R3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
R4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize different electrical machine.					2										1	
[CO2]	Understand the operation of ac machines.		1		1	1								2			
[CO3]	Apply the concepts of rotating magnetic fields to find characteristics of Induction motor.	2				3										3	
[CO4]	Ability to conduct experiments on Ac Machines to find the Characteristics.		1	2	1												2
[CO5]	Evaluate performance characteristics of ac machines.		1	2												2	
[CO6]	Modify the characteristics of operation of Synchronous motor.			1	2	1									2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Digital Electronics

Code:BTE23029

3 Credits | Semester IV

A. Introduction:

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To prepare students to perform the analysis and design of various digital electronic circuits

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Identify the fundamental concepts and techniques used in digital electronics.

[CO2] Understand the process of Analog to Digital conversion and Digital to Analog conversion.

[CO3] Apply the defined technique to structure various number systems.

[CO4] Examine the structure of various number systems and its application in digital design.

[CO5] Interpret the use of PLDs to implement the given logical problem.

[CO6]Design and implement Combinational and Sequential logiccircuits.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes , Characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri- state logic.

COMBINATIONAL DIGITALCIRCUITS Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions, Don't care conditions, Multiplexer, De Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of Function realization.

SEQUENTIAL CIRCUITS AND SYSTEMS: A 1-bit memory, the circuit properties of Bi stable latch, the clocked SR flip flop, J- K-T and D types flip flops, Applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

A/D AND D/A CONVERTERS: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D Converter ICs.

SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

E. TEXT BOOKS

T1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
T2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
T3.A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

F. REFERENCE BOOKS

R1. Digital principles & Applications Albert Paul Malvino& Donald P. Leach McGraw Hill Education; Eighth edition ISBN: 978-9339203405.
R2. Digital Electronics Roger L. Tokheim Macmillian McGraw-Hill Education (ISE Editions); International 2 Revised ed edition ISBN: 978-0071167963
R3. Digital Electronics R. Anand Khanna Publications, New Delhi (Edition 2018) ISBN: 978-93 82609445
R4. Fundamentals of Logic Design Charles H. Roth Jr. Jaico Publishing House; First edition ISBN: 978-8172247744
R5. Digital Electronics – an introduction to theory and practice William H. Gothmann Prentice Hall India Learning Private Limited; 2 edition ISBN: 978-8120303485

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the fundamental concepts and techniques used in digital electronics.		3			1										3	
[CO2]	Understand the process of Analog to Digital conversion and Digital to Analog conversion.	1			1	1								2			
[CO3]	Apply the defined technique to structure various number systems.	1		1		3										3	
[CO4]	Examine the structure of various number systems and its application in digital design.		1		2									2			
[CO5]	Interpret the use of PLDs to implement the given logical problem.			1	3											2	
[CO6]	Design and implement Combinational and Sequential logic circuits.		1	1	3	2									3	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Power Electronics

Code: BTE25111

4 Credits | Semester IV

A. Introduction:

- To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
- To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
- To provide strong foundation for further study of power electronic circuits and systems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Recall the operation of DC-DC choppers.

[CO2] Understand the differences between signal level and power level devices.

[CO3] Apply the concept of commutation to turn off converter circuits.

[CO4] Analyze the operation of voltage source inverters.

[CO5] Choosesuitable power electronic devices by assessing the requirements of application fields.

[CO6] Design and implement Combinational and Sequential logic circuits.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

POWER SWITCHING DEVICES: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

THYRISTOR RECTIFIERS: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load, Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

DC-DC CONVERTER: Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

INVERTER: Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, Bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage, Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation, Introduction to Multi level inverter.

AC VOLTAGE CONTROLLERS Principle of On-Off and phase controls, Single-phase ac voltage controller with resistive and inductive loads, sequence control, Introduction to Matrix converter. Cyclo Converters: Basic principle of operation, single phase to single phase, three phase to single phase output voltage equation.

E. TEXT BOOKS

T1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Pearson India, 4th Edition,2018.

T2. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics:Converters, Applications and Design", Wiley India Ltd,2008

T3.P.C. Sen, " Power Electronics", McGraw Hill Education (India) Pvt. Ltd.

T4. P.S. Bhimbra, " Power Electronics", Khanna Publishers.

F. REFERENCE BOOKS

R1. M.S. JamilAsghar, "Power Electronics" Prentice Hall of India Ltd., 2004 Chakrabarti&Rai,

R2."Fundamentals of Power Electronics &Drives", DhanpatRai& Sons.

R3. V.R. Moorthy, " Power Electronics : Devices, Circuits and Industrial Applications" Oxford University Press,2007

R4.S.N. Singh, "A Text Book of Power Electronics" DhanpatRai& Sons

R5. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.

R6.L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall the operation of DC-DC choppers.					**1**										**2**	
[CO2]	Understand the differences between signal level and power level devices.		**1**		**1**	**1**								**2**			
[CO3]	Apply the concept of commutation to turn off converter circuits.	**3**		**1**		**1**										**3**	
[CO4]	Analyze the operation of voltage source inverters.				**3**									**3**			
[CO5]	Choose suitable power electronic devices by assessing the requirements of application fields.			**2**	**1**									**1**			
[CO6]	Design and implement Combinational and Sequential logic circuits.		**1**		**2**	**2**									**3**	**1**	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Signals and Systems

Code:BTE25112

3 Credits | Semester IV

A. Introduction:

- To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Recognize sampling theorem and its implications.

[CO2] Understand the concepts of continuous time and discrete time systems.

[CO3] Solve systems in complex frequency domain.

[CO4] Analyze the discrete time signals and system using different transform domain techniques.

[CO5] Evaluate the various signal responses.

[CO6]Design and implement LTI filters for filtering different real world signals.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO SIGNALS AND SYSTEMS: Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples.

BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS: Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equation, State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

FOURIER SERIES AND FOURIER TRANSFORM: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

LAPLACE AND Z- TRANSFORMS: Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

SAMPLING AND RECONSTRUCTION: The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

E. TEXT BOOKS

T1. “Signals and Systems: Continuous and Discrete” by R F Ziemer and D R Fannin
T2. “Signals and Systems” by A V Oppenheim and A S Willsky and I T Young
T3.“Signals and Systems : Pearson New International Edition” by Alan V Oppenheim and S Hamid
T4. “Problems and Solutions in Signals and Systems” by R Gopal
T5.”Continuous and Discrete Signals and Systems” by Samir S Soliman and Mandyam D Srinath
T6. “Fundamentals of Signals and Systems” by Michael Roberts and Govind Sharma

F. REFERENCE BOOKS

R1. A.V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India,1997
R2. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, andApplications”, Pearson, 2006.
R3. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010
R4. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.
R5. A.V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall,2009.
R6. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize sampling theorem and its implications.	**2**				**1**								**1**		**2**	
[CO2]	Understand the concepts of continuous time and discrete time systems.		**2**		**1**									**2**			
[CO3]	Solve systems in complex frequency domain.	**2**		**1**		**1**									**2**		
[CO4]	Analyze the discrete time signals and system using different transform domain techniques.		**1**		**3**									**3**			
[CO5]	Evaluate the various signal responses.			**1**	**2**									**3**		**2**	
[CO6]	Design and implement LTI filters for filtering different real world signals.		**1**	**1**	**3**	**1**									**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Biology for Engineers

Code: BTE23018

3 Credits | Semester IV

A. Introduction:

- To understand Biological concepts from an engineering perspective
- To understand the inter-connection between biology and future technologies
- To motivate technology application for biological and life science challenges

B. Course Outcomes: At the end of the course, students will be able to

[CO1**]** Understand the biological concepts from an engineering perspective

[CO2] Understand the concepts of biological sensing and its challenges

[CO3] Understand development of artificial systems mimicking human action

[CO4] Integrate biological principles for developing next generation technologies

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. Engineering designs inspired by examples in biology-- Micro- to Macro- scales. Comparing natural vs. human-made machines. Biosensor. Engineering aspects of some Nobel Prizes in Physiology and Medicine & Chemistry recent advances in Biology

TOOLS AND TECHNIQUES: Biosafety laboratory practices, Buffers in biology, buffering capacity and pKa, Observing cell surface and intracellular contents using light and/or fluorescence microscopy, Measuring mechanical strength of cells - osmolality and elasticity of biological membranes

CLASSIFICATION: A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E. coli, S. cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

BIO MOLECULES: Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis

GENETICS AND INFORMATION TRANSFER: Molecular Genetics covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept; Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis.Teach meiosis and Mitosis as a part of genetics. Meiosis and Mitosis be taught as a part of genetics.Emphasis to be give not to themechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

E. TEXT BOOKS

T1. Molecular Genetics (Second edition),Stent, G.S.; and Calendar, R.W.H.Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

T2. Microbiology, Prescott, L.MJ.P.HarleyandC.A.Klein1995.

F. REFERENCE BOOKS

R1. Biology:Aglobalapproach:Campbell,N.A.;Reece,J.B.;Urry,Lisa;Cain,M,L.;Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B.PearsonEducationLtd

R2. Outlines of Biochemistry, Conn, E.E;Stumpf, P.K;Bruening,G;Doi,R.H.,JohnWileyand Sons

R3. Principles of Biochemistry (VEdition),ByNelson, D.L.;andCox,M.M.W.H.Freemanand Company

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
[CO1]	Understand the biological concepts from an engineering perspective	3	1	1	1	-	-	-	-	-	1	1	1	3	1	1	1
[CO2]	Understand the concepts of biological sensing and its challenges	2	2	1	1	-	-	-	-	-	2	1	1	2	2	1	1
[CO3]	Understand development of artificial systems mimicking human action	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
[CO4]	Integrate biological principles for developing next generation technologies	2	2	1	1	-	-	-	-	-	2	1	1	2	2	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Essence of Indian Knowledge Tradition

Code:BTE25095

0Credits | Semester IV

A. Introduction:

- The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature.
- Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- Focus on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Label thought process, reasoning and inferencing.
[CO2] Understand the Indian Knowledge Systems and Indian perspective of modern scientific world-view.
[CO3]Focus on Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.
[CO4] Understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.
[CO5] Assess basic principles of Yoga and holistic health care systems
[CO6] Generate awareness to Indian society for historic Indian culture.

C. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	10
	Attendance	2.5
	Assignment	2.5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM: Basic structure of Indian Knowledge System: अष्टादशविद्या -४वेद,४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि)

BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM:
६वेदांग (शिक्षा, कल्प, निरुक्त, व्याकरण, ज्योतिष, छंद) ४ उपाड्ग , (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

MODERN SCIENCE AND INDIAN KNOWLEDGE SYSTEM: Modern Science and Indian Knowledge System.

YOGA AND HOLISTIC HEALTH CARE: Yoga and Holistic Health care,

CASE STUDIES: Case studies

E. Text Book:

T1.Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya

T2.VidyaBhavan, Mumbai. 5th Edition, 2014 Swami Jitatmanand, Modern Physics and Vedant, Bharatiya VidyaBhavan

T3. Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan

F. Reference Books:

R1. Fritzof Capra, Tao of Physics

R2. Fritzof Capra, The Wave of life

R3. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay

R4. Foundation, Velliarnad, Arnakulam Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata

R5. GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with VyasaBhashya,

R6. VidyanidhiPrakashan, Delhi 2016 RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi

R7. Prakashan, Delhi 2016 P B Sharma (English translation), ShodashangHridayan

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Label thought process, reasoning and inferencing.										**2**					**2**	
[CO2]	Understand the Indian Knowledge Systems and Indian perspective of modern scientific world-view.						**2**							**2**			
[CO3]	Focus on Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.								**2**								**2**
[CO4]	Understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.						**2**				**1**			**1**			
[CO5]	Assess basic principles of Yoga and holistic health care systems						**1**						**2**			**2**	
[CO6]	Generate awareness to Indian society for historic Indian culture.									**2**					**1**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical Machines II Lab

Code:BTE24077

1 Credits | Semester IV

A. Introduction:

- To prepare the students to have a basic knowledge of AC machine.
- To prepare the students to have a basic knowledge of induction motors.
- To prepare the students to have a basic knowledge of alternators.
- The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recognize constructional details and principle of operation of alternators.
[CO2] Explain about the working of synchronous machines as generators and motors.
[CO3] Apply the knowledge about testing and applications of synchronous machines.
[CO4] Analyze the principle of operation of three phase and single-phase induction motors.
[CO5] Evaluate performance indices by performing various tests on induction machine.
[CO6]Elaborate about the starting and speed control of induction motors.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	**Name of Experiment**
1	Speed control of a three phase induction motor using variable frequency drives
2	Determination of parameters of three phase induction motor from No load Test and Blocked Rotor Test
3	Determination of Efficiency, Plotting of Torque-Slip Characteristics of Three Phase Induction motor by Brake Test.
4	Performance of grid connected induction generator.
5	Determination of parameter of a single phase induction motor and study of Capacitor start induction motor
6	Capacitor start and capacitor run induction motor, Universal motor, Shaded pole motor
7	Determination of parameter of a single phase induction motor and study of Capacitor start induction motor
8	Determination of the voltage regulation of an alternator by synchronous impedance method

	and zero power factor (zpf) method
9	Determination of the V and inverted V curves of a synchronous motor
10	Determination of parameters of synchronous machine
11	Determination of power angle characteristics of an alternator
12	Study of parallel operation of two alternators
13	Measurement of direct and quadrature axis reactance of a salient pole synchronous machine Measurement of transient and sub transient reactance of a salient pole alternator

E. TEXT BOOKS

T1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

T2. "Electric Machines: by Ashfaq Husain and HarroonAshfaq, Dhanpat Rai & Co. Publications.

T3."Electric Machinery Fundamentals" by Stephen Chapman, McGraw Hill publication, 5th edition.

T4. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.

F. REFERENCE BOOKS

R1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

R2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

R3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

R4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize constructional details and principle of operation of alternators.		**1**			**1**										**3**	
[CO2]	Explain about the working of synchronous machines as generators and motors.		**2**		**1**	**1**								**2**			**1**
[CO3]	Apply the knowledge about testing and applications of synchronous machines.	**3**				**3**										**3**	
[CO4]	Analyze the principle of operation of three phase and single-phase induction motors.		**1**		**3**									**3**			
[CO5]	Evaluate performance indices by performing various tests on induction machine.			**1**	**2**									**2**		**1**	
[CO6]	Elaborate about the starting and speed control of induction motors			**1**	**2**	**1**											**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Digital Electronics Lab

Code:BTE23035

1Credits | Semester IV

A. Introduction:

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To prepare students to perform the analysis and design of various digital electronic circuits.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify combinational circuit
[CO2] Explain basic concept of logic circuits.
[CO3] Apply half and full adders to perform
[CO4] Analyze the operation of counters and registers.
[CO5] Interpret use of flip-flops& memory units.
[CO6] Design various gates.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	**Name of Experiment**
1	Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EXNOR, Invert and Buffer gates, use of Universal NAND Gate.
2	Gate-level minimization: Two level and multi level implementation of Boolean functions.
3	Combinational Circuits: design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segment display.
4	Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number of Gates.
5	Design with multiplexers and de-multiplexers.
6	Flip-Flop: assemble, test and investigate operation of SR, D & J-Kflip-flops.
7	Shift Registers: Design and investigate the operation of all types of shift registers with parallel load
8	Counters: Design, assemble and test various ripple and synchronous counters -decimal counter, Binary counter with parallel load.
9	Memory Unit: Investigate the behavior of RAM unit and its storage capacity –16 * 4 RAM: testing, simulating and memory expansion.
10	Clock-pulse generator: design, implement and test.

11	Parallel adder and accumulator: design, implement and test.
12	Binary Multiplier: design and implement a circuit that multiplies 4-bit unsigned numbers to produce an 8-bitproduct.
13	Verilog/VHDL simulation and implementation of Experiments listed at Sl. No. 3 to 12

E. TEXT BOOKS

T1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
T2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
T3.A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

F. REFERENCE BOOKS

R1. Digital principles & Applications Albert Paul Malvino& Donald P. Leach McGraw Hill Education; Eighth edition ISBN: 978-9339203405.
R2. Digital Electronics Roger L. Tokheim Macmillian McGraw-Hill Education (ISE Editions); International 2 Revised ed edition ISBN: 978-0071167963

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	**STATEMENT**	**CORRELATION WITH PROGRAM OUTCOMES**												**CORRELATION WITH PROGRAM SPECIFIC OUTCOMES**			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Identify combinational circuit		**3**			**1**										**3**	
[CO2]	Explain basic concept of logic circuits.		**2**		**1**									**2**			
[CO3]	Apply half and full adders to perform	**1**				**3**										**3**	
[CO4]	Analyze the operation of counters and registers.		**1**		**3**									**3**			
[CO5]	Interpret use of flip-flops& memory units.			**1**	**2**											**3**	
[CO6]	Design various gates.			**2**	**3**										**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Power Electronics Lab

Code:BTE25115

1 Credits | Semester IV

A. Introduction:

- The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
- Maintain the proper functioning of power electronic devices.
- The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Select power electronic devices for specific applications..
[CO2]Understand industrial control circuits.
[CO3] Apply troubleshoot for turn-on and turn-off circuits of Thyristors.
[CO4] Analyze performance of phase-controlled rectifiers.
[CO5] Estimate the performance of Thyristors.
[CO6] Design the control strategies for various converters.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	**Name of Experiment**
1	Study of the V-I characteristics of SCR, TRIAC, IGBT and MOSFET.
2	Study of the cosine controlled triggering circuit
3	To measure the latching and holding current of a SCR
4	Study of the single phase half wave controlled rectifier and semi converter circuit with R and R-L Load
5	Study of single phase full wave controlled rectifier circuits (mid point and Bridge type) with R and R-L Load
6	Study of three phase full wave controlled rectifier circuits (Full and Semi converter) with R and R-L Load

7	Study of the Buck converter and boost converter.
8	Study of the single-phase PWM voltage source inverter.
9	Study the performance of three phase VSI with PWM control.
10	Study of the forward converter and flyback converter.

E. TEXT BOOKS

T1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Pearson India, 4th Edition,2018.

T2. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics:Converters, Applications and Design", Wiley India Ltd,2008

T3.P.C. Sen, " Power Electronics", McGraw Hill Education (India) Pvt. Ltd.

T4. P.S. Bhimbra, " Power Electronics", Khanna Publishers.

F. REFERENCE BOOKS

R1. M.S. JamilAsghar, "Power Electronics" Prentice Hall of India Ltd., 2004 Chakrabarti&Rai,

R2."Fundamentals of Power Electronics &Drives", DhanpatRai& Sons.

R3. V.R. Moorthy, " Power Electronics : Devices, Circuits and Industrial Applications" Oxford University Press,2007

R4.S.N. Singh, "A Text Book of Power Electronics" DhanpatRai& Sons

R5. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.

R6.L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Select power electronic devices for specific applications..					**3**										**3**	
[CO2]	Understand industrial control circuits.		**2**			**1**								**2**			
[CO3]	Apply troubleshoot for turn-on and turn-off circuits of Thyristors.			**1**	**1**	**2**										**3**	
[CO4]	Analyze performance of phase-controlled rectifiers.		**1**		**3**									**3**			
[CO5]	Estimate the performance of Thyristors.			**1**	**2**											**3**	
[CO6]	Design the control strategies for various converters.		**2**	**1**		**2**									**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University Jharkhand

Syllabus of

B.Tech in Electrical & Electronics Engineering

Semester-V

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE
Scheme of Study (w.e.f Batch 2020-21)

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SCHEME OF THE STUDY
SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Lab Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Circuit Analysis	PCC	3	3	100	70	20	5	5
2	Electromagnetic Fields	PCC	4	4	100	70	20	5	5
3	Analog Electronic	PCC	3	3	100	70	20	5	5
4	Engineering Mathematics – III	BSC	4	4	100	70	20	5	5
5	Electrical Machines-I	PCC	4	4	100	70	20	5	5
6	Environmental Sciences	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Circuit Analysis Lab	PCC	1	2	50	35	5	5	5
8	Electrical Machines-I Lab	PCC	1	2	50	35	5	5	5
9	Analog Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**21**	**26**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Machines-II	PCC	4	4	100	70	20	5	5
2	Digital Electronics	PCC	3	3	100	70	20	5	5
3	Power Electronics	PCC	4	4	100	70	20	5	5
4	Signals and Systems	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
6	Essence of Indian Knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Machines II Lab	PCC	1	2	50	35	5	5	5
8	Digital Electronics Lab	PCC	1	2	50	35	5	5	5
9	Power Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**25**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Power Systems–I	PCC	3	3	100	70	20	5	5
2	Control Systems	PCC	3	3	100	70	20	5	5
3	Microprocessors	PCC	3	3	100	70	20	5	5
4	Program Elective – I Electrical Energy Conservation and Auditing Electrical Machine Design Industrial Electrical Systems	PEC	3	3	100	70	20	5	5
5	Open elective-I Electronic Devices Strength of Materials Data Structures and Algorithms	OEC	3	3	100	70	20	5	5
6	Professional practice law & ethics	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
7	Power Systems I Lab	PCC	1	2	50	35	5	5	5
8	Control Systems Lab	PCC	1	2	50	35	5	5	5
9	Microprocessors Lab	PCC	1	2	50	35	5	5	5
10	Summer Internship-1(3-4 Weeks)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**24**	**800**	**560**	**150**	**45**	**45**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Power Systems – II	PCC	3	3	100	70	20	5	5
2	Measurements and Instrumentation	PCC	3	3	100	70	20	5	5
3	Program Elective – II Digital Signal Processing Control Systems Design	PEC	3	3	100	70	20	5	5
4	Program Elective – III Line Commutated and Active Rectifiers High Voltage Engineering Electromagnetic Waves	PEC	3	3	100	70	20	5	5
5	Open Elective –II Wavelet Transforms Internet of Things Thermal and Fluid Engineering	OEC	3	3	100	70	20	5	5
6	IPR	HSMC	3	3	100	70	20	5	5
	Practical								
7	Power Systems II Lab	PCC	1	2	50	35	5	5	5
8	Measurements and Instrumentation Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**22**	**700**	**490**	**130**	**40**	**40**

SEMESTER VII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Professional Elective -IV Power System Protection Electrical and Hybrid Vehicles Computational Electromagnetic	PEC	3	3	100	70	20	5	5
2	Professional Elective - V Power System Dynamics andControl Power Quality and FACTS Electrical Drives	PEC	3	3	100	70	20	5	5
3	Open Elective - III Analog and Digital Communication Embedded Systems Fluid Machinery	OEC	3	3	100	70	20	5	5
4	Open Elective - IV Power Plant Engineering Image Processing Automobile Engineering	OEC	3	3	100	70	20	5	5
5	Project Management	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
9	Summer Internship-II(4-6 Weeks)	PROJ	3	0	100	70	30	0	0
10	Minor Project(Project to be carried over to next semester)	PROJ	3	6	100	70	30	0	0
	TOTAL		**21**	**21**	**600**	**490**	**160**	**25**	**25**

SEMESTER VIII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA	Attendance
1	Professional Elective - VI HVDC Transmission Systems Wind and Solar Energy Systems Advanced Electric Drives	PEC	3	3	100	70	20	5	5
2	Open Elective- V VLSI circuits Modern Manufacturing Processes Computer Networks	OEC	3	3	100	70	20	5	5
3	Open Elective - VI Electrical Materials Big Data Analysis	OEC	3	3	100	70	20	5	5
	PRACTICAL								
4	Major Project	PROJ	8	16	200	140	60	0	0
5	Extra-Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**17**	**25**	**600**	**420**	**150**	**15**	**15**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	4	12
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	8	18
4	Professional core courses (**PCC**)	24	54
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC**)	6	18
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	64	160

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:

AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.

The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.

Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.

Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1].Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3].Design/Development of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion.

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.
[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Specify& analyze: An ability to identify, specify and analyze systems that inefficiently deliver technological solution in electrical & electronics engineering

[PSO.2]. Design/development of solutions: Design solutions for complex electronics engineering problem & design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, & the cultural, society & environmental considerations.

[PSO.3]. Modern tool usage: Create, select, & apply appropriate electrical techniques, resources & modern engineering including prediction & modeling to complex electrical systems with an understanding of the limitations & short comes.

[PSO.4]. Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Electrical systems & processes & communicate effectively with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions.

Power Systems-I

Code: BTE25382

3 Credits | Semester V

A. Introduction:

- To understand the concepts of power systems.
- To know how to evaluate fault currents for different types of faults.
- To learn the basic protection schemes.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify and explain the different methods of generation, distribution, control and compensation involved in the operation of power systems.

[CO2] Design the mathematical models of the mechanical and electrical components involved in the operation of power systems and demonstrate the understanding of the open loop and closed loop control practices associated with the voltage and frequency control of single area or interconnected multi area power systems.

[CO3] Specify the equivalent electrical parameters of transmission line to prepare and analyze models to predict the range and ratings of the equipments to be used, the protection required against line transients and determine the appropriate methods of compensation required for operational stability.

[CO4] Solve the problems related to the economic dispatch of power, plant scheduling, unit commitment and formulate strategies to minimize transmission line losses and penalties imbibed.

[CO5] Designprotection schemes required for the system to safeguard against faults after identifying and determining the severity of the faults occurring during the period of operation and design testing strategies to determine the performance characteristics of the compensating equipment to be used in the system.

[CO6]Assess the different methods of control and compensation to choose the best option so that social and environmental problems are minimized and recognize the need to continuously follow the advancements in technology and incorporate them in the present system to improve efficiency and increase the flexibility and quality of operation.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BASIC CONCEPTS: Evolution of Power Systems and Present-Day Scenario, Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources, Distributed Energy Resources, Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous

Grids and Asynchronous (DC) interconnections, Review of Three-phase systems, Analysis of simple three-phase circuits, Power Transfer in AC circuits and Reactive Power.

POWER SYSTEM COMPONENTS: Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona, Parameters of lines and cables, Capacitance and Inductance calculations for simple configurations, Travelling-wave Equations, Sinusoidal Steady state representation of Lines: Short, medium and long lines, Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines. Transformers: Three-phase connections and Phase-shifts, Three-winding transformers, autotransformers, Neutral Grounding transformers, Tap-Changing in transformers, Transformer Parameters, Single phase equivalent of three-phase transformers. Synchronous Machines: Steady-state performance characteristics, Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators, Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub-transient equivalent circuits, Loads: Types, Voltage and Frequency Dependence of Loads, Per-unit System and per-unit calculations.

OVER-VOLTAGES AND INSULATION REQUIREMENTS: Generation of Over-voltages: Lightning and Switching Surges, Protection against Over-voltages. Insulation Coordination, Propagation of Surges, Voltages produced by traveling surges & Bewley Diagrams.

FAULT ANALYSIS AND PROTECTION SYSTEMS: Method of Symmetrical Components (positive, negative and zero sequences), Balanced and Unbalanced Faults, Representation of generators, lines and transformers in sequence networks, Computation of Fault Currents, Neutral Grounding. Switchgear: Types of Circuit Breakers, Attributes of Protection schemes, Back-up Protection, Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

INTRODUCTION TO DC TRANSMISSION & RENEWABLE ENERGY SYSTEMS:DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC), LCC and VSC based dc link, Real Power Flow control in a dc link, Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine, Fixed and variable speed turbines, Permanent Magnetic Synchronous Generators and Induction Generators, Power Electronics interfaces of wind generators to the grid.

E. TEXT BOOKS

T1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.

T2. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.

F. REFERENCE BOOKS

R1. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.

R2. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

R3. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems",Wiley, 2012.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify and explain the different methods of generation, distribution, control and compensation involved in the operation of power systems.		3											3			
[CO2]	Design the mathematical models of the mechanical and electrical components involved in the operation of power systems and demonstrate the understanding of the open loop and closed loop control practices associated with the voltage and frequency control of single area or interconnected multi area power systems.			2	2										3		1
[CO3]	Specify the equivalent electrical parameters of transmission line to prepare and analyze models to predict the range and ratings of the equipments to be used, the protection required against line transients and determine the appropriate methods of compensation required for operational stability.	2				1								3			

[CO4]	Solve the problems related to the economic dispatch of power, plant scheduling, unit commitment and formulate strategies to minimize transmission line losses and penalties imbibed.		**2**												**2**		
[CO5]	Design protection schemes required for the system to safeguard against faults after identifying and determining the severity of the faults occurring during the period of operation and design testing strategies to determine the performance characteristics of the compensating equipment to be used in the system.			**3**	**1**										**3**		
[CO6]	**Assess** the different methods of control and compensation to choose the best option so that social and environmental problems are minimized and recognize the need to continuously follow the advancements in technology and incorporate them in the present system to improve efficiency and increase the flexibility and quality of operation.	**2**														**2**	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Control Systems

Code:BTE26154

3 Credits | Semester V

A. Introduction:

- To understand the concept of control system.
- To know the concept of stability, linear-time invariant systems & state-space representations.
- To learn how to Design simple feedback controllers.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Learn the features of different types of compensators & to design compensators using time-domain and frequency domain specifications.
[CO2] Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.
[CO3] Apply the concept of stability and its assessment for linear-time invariant systems.
[CO4] Analyse the system response and stability of systems represented in state space form and to design compensators for systems modelled in state space form.
[CO5] Obtain models of dynamic systems in transfer function and state space forms.
[CO6] Model and to analyse the response of discretized systems.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO CONTROL PROBLEM: Industrial Control examples. Mathematical models of physical systems, Control hardware and their Models, Transfer function models of linear time-invariant systems, Feedback Control: Open-Loop and Closed-loop system, Benefits of Feedback, Block diagram algebra.

TIME RESPONSE ANALYSIS: Standard test signals, Time response of first and second order systems for standard test inputs, Application of initial and final value theorem, Design specifications for second-order systems based on the time-response, Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique, Construction of Root-loci.

FREQUENCY-RESPONSE ANALYSIS: Relationship between time and frequency response, Polar plots, Bode plots, Nyquist stability criterion, Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

INTRODUCTION TO CONTROLLER DESIGN: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design, Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

STATE VARIABLE ANALYSIS & NON-LINEAR CONTROL: Concepts of state variables, State space model, Diagonalization of State Matrix, Solution of state equations. Eigenvalues and Stability Analysis, Concept of controllability and observe ability, Pole-placement by state feedback. Discrete-time systems, Difference Equations, State-space models of linear discrete-time systems, Stability of linear discrete-time systems. Performance Indices, Regulator problem, Tracking Problem, Nonlinear system–Basic concepts and analysis.

E. TEXT BOOKS

T1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
T2. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

F. REFERENCE BOOKS

R1. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
R2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Learn the features of different types of compensators & to design compensators using time- domain and frequency domain specifications.	1				1								2	1		
[CO2]	Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.		2		1									2			
[CO3]	Apply the concept of stability and its assessment for linear-time invariant systems.				1	3										3	
[CO4]	Analyse the system response and stability of systems represented in state space form and to design compensators for systems modelled in state space form.		1		3									3			
[CO5]	Obtain models of dynamic systems in transfer function and state space forms.	1	2													2	
[CO6]	Model and to analyse the response of discretized systems.			1		2									2	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Microprocessors

Code:BTE25100
3 Credits | Semester V

A. Introduction:

- To understand interfacing design of peripherals like I/O, A/D, D/A, timer etc.
- To learn C-language programming & assembly language programming.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Learn configuring and using different peripherals in a digital system like I/O, A/D, D/A, timer etc.
[CO2] Understand the working of a microprocessor/microcontroller.
[CO3]Compile and debug a Program.
[CO4]Generate an executable file and use it.
[CO5] Evaluating logic of particular dedicated task.
[CO6] Develop systems using different microprocessor/ microcontrollers.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FUNDAMENTALS OF MICROPROCESSORS: Fundamentals of Microprocessor Architecture. 8-bit Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

THE 8051 ARCHITECTURE: Internal Block Diagram, CPU, ALU, address, data and control bus. Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

INSTRUCTION SET AND PROGRAMMING: Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing, 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs, Assemblers and compilers, Programming and debugging tools.

I MEMORY AND I/O INTERFACING: Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, and memory devices.

EXTERNAL COMMUNICATION INTERFACE: Synchronous and Asynchronous Communication, RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee. LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, Sensor interfacing.

E. TEXT BOOKS

T1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, "The8051Microcontroller and Embedded Systems: Using Assembly and C",Pearson Education, 2007.

T2. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.

F. REFERENCE BOOKS

R1. R. Kamal, "Embedded System", McGraw Hill Education, 2009.

R2. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996

R3. D.A. Patterson and J.H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.

R4. D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Learn configuring and using different peripherals in a digital system like I/O, A/D, D/A, timer etc.	**1**				**1**								**2**			
[CO2]	Understand the working of a microprocessor/microcontroller.		**1**		**2**	**1**								**2**			
[CO3]	Compile and debug a Program.			**1**	**2**											**2**	
[CO4]	Generate an executable file and use it.		**2**	**1**											**2**		
[CO5]	Evaluating logic of particular dedicated task.				**2**											**2**	**1**
[CO6]	Develop systems using different microprocessor/ microcontrollers		**2**	**3**											**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical Energy Conservation and Auditing

Code:BTE25286

3 Credits | Semester V

A. Introduction:

- To understand the concepts of energy management.
- To know the usage of different energy efficient devices.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Acquire the knowledge of fundamentals of economic operation of an electrical system.
[CO2] Understand the concepts of energy management.
[CO3] Apply the methods of improving energy efficiency in different electrical systems.
[CO4]Analyse the concept of Transformer loading and Feeder loss evaluation methods, scheme for reactive power management, energy efficient illumination system.
[CO5] Choose efficient control strategies, optimal selection, sizing, operation of variable speed drives like pumps and fans.
[CO6] Create innovative energy conservation measures and optimal operation methods for electic load like air conditioning, refrigeration, gysers-solar water heaters, compressors, electrolytic process.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

ENERGY SCENARIO: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, Restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

BASICS OF ENERGY AND ITS VARIOUS FORMS: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors,
Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

ENERGY MANAGEMENT & AUDIT: Definition, energy audit, need, types of energy audit.
Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy

requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

ENERGY EFFICIENCY IN ELECTRICAL SYSTEMS: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS: Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers. Energy Efficient Technologies in Electrical Systems:Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

E. TEXT BOOKS

T1. S. C. Tripathy, “Utilization of Electrical Energy and Conservation”, McGraw Hill, 1991.

F. REFERENCE BOOKS

R1. M Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
R2. Guide books for National Certification Examination for Energy Manager / Energy Auditors
R3. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Acquire the knowledge of fundamentals of economic operation of an electrical system.	1				1								1		2	
[CO2]	Understand the concepts of energy management.		1		1									2			
[CO3]	Apply the methods of improving energy efficiency in different electrical systems.	2			1	3										3	
[CO4]	Analyse the concept of Transformer loading and Feeder loss evaluation methods, scheme for reactive power management, energy efficient illumination system.			1	3										2		
[CO5]	Choose efficient control strategies, optimal selection, sizing, operation of variable speed drives like pumps and fans.			2	1									1		2	
[CO6]	Create innovative energy conservation measures and optimal operation methods for electic load like air conditioning, refrigeration, gysers-solar water heaters, compressors, electrolytic process.	1	1			2									3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical Machine Design

Code:BTE25114
3 Credits | Semester V

A. Introduction:

- To understand theconstruction and performance characteristics of electrical machines.
- To know the principles of electrical machine design and carry out a basic design of an AC & DC machine.
- To learn the various factors which influence the electrical machine design.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] List the constructional parts and performance characteristics of electrical machines.
[CO2] Understand the various factors that influence the design: electrical, magnetic and thermal loading of electrical machines
[CO3] Apply the principles of electrical machine design and carry out a basic design of an AC machine.
[CO4] Discover software tools to do design calculations.
[CO5] Interpret the information required for the fabrication of the alternator with an estimate of various performance indices.
[CO6] Generate a detailed design of an induction machine and provide the information required for the fabrication of the same along with an estimate of various performance indices.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Major considerations in electrical machine design, Electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, Thermal considerations, heat flow, temperature rise, rating of machines

TRANSFORMERS: Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, Window space factor, overall dimensions, operating characteristics, Regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

INDUCTION MOTORS: Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, Design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, Leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

SYNCHRONOUS MACHINES: Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design. Armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

COMPUTER AIDED DESIGN (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation **.** Introduction to FEM based machine design, Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

E. TEXT BOOKS

T1. A. K. Sawhney, “A Course in Electrical Machine Design”, DhanpatRai and Sons, 1970.
T2. M.G. Say, “Theory & Performance & Design of A.C. Machines”, ELBS London.

F. REFERENCE BOOKS

R1. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and IBH Publishing, 2006.
R2. K. L. Narang, “A Text Book of Electrical Engineering Drawings”, SatyaPrakashan, 1969.
R3. A. Shanmugasundaram, G. Gangadharan and R. Palani, “Electrical Machine Design Data Book”, New Age International, 1979.
R4. K. M. V. Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 2008.
R5.Electrical machines and equipment design exercise examples using Ansoft’s Maxwell 2D machine design package.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	List the constructional parts and performance characteristics of electrical machines.					3								1		2	
[CO2]	Understand the various factors that influence the design: electrical, magnetic and thermal loading of electrical machines		2		1									2			
[CO3]	Apply the principles of electrical machine design and carry out a basic design of an AC machine.	2				3										3	
[CO4]	Discover software tools to do design calculations.		2		2										2		
[CO5]	Interpret the information required for the fabrication of the alternator with an estimate of various performance indices.			1	3									1		2	
[CO6]	Generate a detailed design of an induction machine and provide the information required for the fabrication of the same along with an estimate of various performance indices.		1	2		1									3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Industrial Electrical Systems

Code:BTE25287

3 Credits | Semester V

A. Introduction:

- To understand thevarious components of industrial electrical systems.
- To learn & understand electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Recognize the fundamentals of electrical Installations like requirements, design considerations, testing, estimating and costing.
[CO2] Understand various components of industrial electrical systems.
[CO3] Utilize design procedure, estimation and costing method, safety aspect of electrical installation in a commercial building, hospital, industries.
[CO4] Analyze and select the proper size of various electrical system components.
[CO5] Interpret design procedure, estimation and costing methods of outdoor and indoor substations.
[CO6] Formulate designing aspect of earthing system and lightning protection scheme.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

ELECTRICAL SYSTEM COMPONENTS: LT system wiring components, selection of cables, wires, switches, distribution box, meteringsystem, Tariff structure, Protection components- Fuse, MCB, MCCB, ELCB, Inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, Earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

ILLUMINATION SYSTEMS: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

INDUSTRIAL ELECTRICAL SYSTEMS: HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection,
Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation,Introduction to PCC, MCC panels, Specifications of LT Breakers, MCB and other LT panel components. DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

INDUSTRIAL ELECTRICAL SYSTEM AUTOMATION: Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation

E. TEXT BOOKS

T1. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.
T2. S.L. Uppal and G.C. Garg, “Electrical Wiring, Estimating &Costing”, Khanna publishers, 2008.

E. REFERENCE BOOKS

R1. S. Singh and R. D. Singh, “Electrical estimating and costing”, DhanpatRai and Co., 1997.
R2. Web site for IS Standards.
R3. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.

F. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize the fundamentals of electrical Installations like requirements, design considerations, testing, estimating and costing.					2								2			
[CO2]	Understand various components of industrial electrical systems.		1		1									2			
[CO3]	Utilize design procedure, estimation and costing method, safety aspect of electrical installation in a commercial building, hospital, industries.	2			2											2	
[CO4]	Analyze and select the proper size of various electrical system components.		1		3									3			
[CO5]	Interpret design procedure, estimation and costing methods of outdoor and indoor substations.				3										2	2	
[CO6]	Formulate designing aspect of earthing system and lightning protection scheme.		3	2		1									3		

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Electronic Devices

Code:BTE25288

3 Credits | Semester V

A. Introduction:

- To understand the phenomena behind working of semiconductor materials.
- To learn how to & where to use different various semiconductor devices.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Acquire the knowledge of principles of semiconductor Physics.
[CO2] Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.
[CO3] Develop analysis capability in BJT and FET Amplifier Circuits.
[CO4] Distinguish competence in frequency response analysis of discrete amplifiers.
[CO5] Interpret design competence in signal and power amplifiers using BJT and FET.
[CO6] Design trade-offs in various digital electronic families with a view towards reduced power consumption.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO SEMICONDUCTOR PHYSICS: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams, Energy bands in intrinsic and extrinsic silicon, Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors

GENERATION AND RECOMBINATION OF CARRIERS: Generation and recombination of carriers, Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models, Avalanche breakdown, Zener diode, Schottky diode& its application

TRANSISTORS: Bipolar Junction Transistor, different configurations, I-V characteristics, Application**,** Ebers-Moll Model,MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell.

ICS: Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, Chemical vapor deposition, sputtering, twin-tub CMOS process.

PCBs:PCB and its Beginnings, Defining the Layout Cross Section, Design Rules Checking, Working with Constraints, PCB Electrical Design Consideration, Through Hole Technology, SMD technology, Multi-layer PCB.

E. TEXT BOOKS

T1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2014.

T2. D. Neamen, D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education

F.REFERENCE BOOKS

R1. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley &Sons, 2006.

R2. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.

R3. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Acquire the knowledge of principles of semiconductor Physics.	1				2								2			
[CO2]	Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.		1		1									2			
[CO3]	Develop analysis capability in BJT and FET Amplifier Circuits.	1		3	1										2		
[CO4]	Distinguish competence in frequency response analysis of discrete amplifiers.		1		2									1			
[CO5]	Interpret design competence in signal and power amplifiers using BJT and FET.			1	3											2	1
[CO6]	Design trade-offs in various digital electronic families with a view towards reduced power consumption.			3	3										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Strength of Materials

Code:BTE25289

3 Credits | Semester V

A. Introduction:

- To understand the nature of internal stresses that will develop within the components.
- To know how to evaluate the strains and deformation that will result due to the elastic stresses developed within the materials.
- To learn various types of loads applied on machine components.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components.

[CO2]Demonstrate the stress and strain relationship and also distinguish the determinate an indeterminate structures.

[CO3] Solve deflection of beams under various loading condition.

[CO4]Analyse the shear force and bending moment diagrams for various beams.

[CO5] Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.

[CO6]Predict principle stresses, knowledge of calculating deformation in thin cylindrical and spherical shells.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DEFORMATION: Deformation in solids- Hooke's law, stress and strain- tension. Compression and shear stresses-elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.

MOMENTUM BALANCE: Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.

MOMENT OF INERTIA: Moment of inertia about an axis and polar moment of inertia, Deflection of a beam using double integration method, Computation of slopes and deflection in beams, Maxwell's reciprocal theorems.

BENDING: STRESS AND STRAINS: Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs

DEFORMATION FOR CYLINDERS & SPHERES: Axial and hoop stresses in cylinders subjected to internal pressure, Deformation of thick and thin cylinders, Deformation in spherical shells subjected to internal pressure.

E. TEXT BOOKS

T1. R. Subramanian, Strength of Materials, Oxford University Press, 2007.

F.REFERENCE BOOKS

R1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001

R2. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005.

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G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components.	2				1								2			
[CO2]	Demonstrate the stress and strain relationship and also distinguish the determinate an indeterminate structures.		2			2											3
[CO3]	Solve deflection of beams under various loading condition.			1	1	2										2	
[CO4]	Analyse the shear force and bending moment diagrams for various beams.		1		3									3			
[CO5]	Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.			1	1											2	
[CO6]	Predict principle stresses, knowledge of calculating deformation in thin cylindrical and spherical shells.			2	1	1										2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Data Structures and Algorithms

Code:BTE25290

3 Credits | Semester V

A. Introduction:

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques.
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To enable them to write algorithms for solving problems with the help of fundamental data structures.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Recall basic terminologies related to Data Structures.

[CO2] Compare Graph search and traversal algorithms and determine the time and computation complexity.

[CO3] Model an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.

[CO4] Analyze the algorithms to determine the time and computation complexity and justify the correctness.

[CO5] Interpret a given problem of Stacks, Queues and linked list and analyze the same to determine the time and computation complexity.

[CO6] Formulate solution for a given Search problem (Linear Search and Binary Search).

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Basic Terminologies, Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc. Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off, Searching**:** Linear Search and Binary Search Techniques and their complexity analysis

STACKS AND QUEUES: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation –corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue, Operations on each types of Queues: Algorithms and their analysis.

LINKED LISTS: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list, Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis, Circular Linked Lists: all operations their algorithms and the complexity analysis.

TREES: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, Tree operations on each of the trees and their algorithms with complexity analysis.45, Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

SORTING AND HASHING: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance, Comparison among all the methods, Hashing, Graph:Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

E. TEXT BOOKS

T1. Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.

F.REFERENCE BOOKS

R1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company

R2. How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Recall basic terminologies related to Data Structures.	**1**				**2**								**2**			
[CO2]	Compare Graph search and traversal algorithms and determine the time and computation complexity.		**2**		**1**									**2**			
[CO3]	Model an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.			**1**		**1**										**3**	
[CO4]	Analyze the algorithms to determine the time and computation complexity and justify the correctness.		**1**		**3**									**2**			
[CO5]	Interpret a given problem of Stacks, Queues and linked list and analyze the same to determine the time and computation complexity.		**1**		**3**												**2**
[CO6]	Formulate solution for a given Search problem (Linear Search and Binary Search).				**1**		**3**									**2**	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Professional Practice, Law & Ethics

Code: BTE25299

3 Credits | Semester V

A. Introduction:

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.
- To develop some ideas of the legal and practical aspects of their profession.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Understand what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession.

[CO2] Compare into contracts and contracts management in engineering, dispute resolution mechanisms; laws governing engagement of labor.

[CO3] Apply the understanding of Intellectual Property Rights, Patents.

[CO4] Distinguish various constitutional laws & ethics.

[CO5] Justify the types of roles they are expected to play in the society as practitioners of the engineering profession.

[CO6] Build good ideas of the legal and practical aspects of their profession.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

PROFESSIONAL PRACTICE & ETHICS: Professional Practice - Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards). Professional Ethics- Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures

GENERAL PRINCIPLES OF CONTRACTS MANAGEMENT: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy ofcontract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts;Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"RedFlag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions. Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build- Own-Operate & variations; Public- Private Partnerships; International Commercial Terms;

ARBITRATION, CONCILIATION AND ADR (ALTERNATIVE DISPUTE RESOLUTION) SYSTEM: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law –Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance, Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; LokAdalats.

ENGAGEMENTOF LABOUR AND LABOUR & OTHER CONSTRUCTION-RELATED LAWS: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining **.**Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

LAW RELATING TO INTELLECTUAL PROPERTY: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet –Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;

E. TEXT BOOKS

T1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
T2. The National Building Code, BIS, 2017
T3. RERA Act, 2017
T4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
T5. Neelima Chandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
T6. Avtar singh (2002), Law of Contract, Eastern Book Co.

F.REFERENCE BOOKS

R1. Dutt (1994), Indian Contract Act, Eastern Law House

R2. Anson W.R. (1979), Law of Contract, Oxford University Press
R3 Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
R4. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
R5. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
R6. Bare text (2005), Right to Information Act
R7. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
R8. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
R9. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
R10.Vee, Charles &Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UP Ltd
R11.American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
R12.Ethics in Engineering- M.W.Martin & R.Schinzinger, McGraw-Hill
R13.Engineering Ethics, National Institute for Engineering Ethics, USA

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Understand what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession.						1							2			
[CO2]	Compare into contracts and contracts management in engineering, dispute resolution mechanisms; laws governing engagement of labor.						1					2		2			
[CO3]	Apply the understanding of Intellectual Property Rights, Patents.							2								3	
[CO4]	Distinguish various constitutional laws & ethics.						2		3							2	
[CO5]	Justify the types of roles they are expected to play in the society as practitioners of the engineering profession.						1				1						2
[CO6]	Build good ideas of the legal and practical aspects of their profession.												2			2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Power Systems-I Lab

Code:BTE25291

1Credits | Semester V

A. Introduction:

- To understand the different components of a protection system.
- To know how to select correct protective scheme for particular system.
- To learn various protection schemes for different power system components.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify the different types of faults.
[CO2]Understand basic protection schemes.
[CO3] Apply the protection schemes for different power system components.
[CO4]Distinguish various types of existing relays, their design, constructional details & operations.
[CO5] Evaluate PSM & TSM for different relays.
[CO6] Modify the operating time of relay for different time-current characteristics.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	Name of Experiment
1	To study characteristics of MCB & HRC Fuse.
2	To test breakdown strength of a transformer oil.
3	To study the performance of under voltage relay.
4	To study the performance of over voltage relay.
5	To study of different characteristics of over current relay.
6	To study of different characteristics of Earth fault relay.
7	To study of the characteristics of on load time delay relay and off load time delay relay.
8	To test & find out polarity, ratio and magnetization characteristics of CT and PT.

E. TEXT BOOKS

T1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.

T2. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.

F. REFERENCE BOOKS

R1. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
R2. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
R3. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems",Wiley, 2012.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Identify the different types of faults.		**3**			**1**								**2**			
[CO2]	Understand basic protection schemes.		**1**	**1**		**1**								**2**			
[CO3]	Apply the protection schemes for different power system components.	**2**			**1**	**3**										**3**	
[CO4]	Distinguish various types of existing relays, their design, constructional details & operations.		**1**		**2**									**2**		**2**	
[CO5]	Evaluate PSM & TSM for different relays.			**2**	**2**											**2**	
[CO6]	Modify the operating time of relay for different time-current characteristics.			**1**	**1**										**2**	**1**	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Control Systems Lab

Code:BTE25292

1Credits | Semester V

A. Introduction:

- To understand the various design specifications.
- To know how to design controllers using the state-space approach.
- To learn various design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators)

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Characterize a system and find its state behavior.
[CO2]Illustrate type & order of different kind of systems.
[CO3] Investigate stability of a system using different tests.
[CO4] Discover different controller responses.
[CO5] Estimate response for different signal inputs for various systems.
[CO6] Design a Lead compensator and to obtain the characteristics by experiment and simulation using MATLAB

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	**Name of Experiment**
1	Determination of Step response for first order & Second order system with unity feedback & calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response
2	Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback.
3	Obtain Transfer Function of a given system from State Variable model and vice versa. State variable analysis of a physical system - obtain step response for the system by simulation.
4	To obtain step response and initial condition response for a single input, two-output system in SV form by simulation
5	Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for 2nd order system & determination of different control system specification from the plot
6	Determination of PI, PD and PID controller action of first order simulated process.
7	Determination of approximate transfer functions experimentally from Bode plot.

8	Evaluation of steady state error, settling time, percentage peak overshoot, gain margin, phase margin with addition of Lead compensator.

E. Text Book:

T1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
T2. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

F. Reference Books:

R1. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
R2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Identify the different types of faults.					**2**								**1**			
[CO2]	Understand basic protection schemes.		**1**		**2**									**2**			**1**
[CO3]	Apply the protection schemes for different power system components.	**2**				**1**										**2**	
[CO4]	Distinguish various types of existing relays, their design, constructional details & operations.		**1**	**2**										**1**		**2**	
[CO5]	Evaluate PSM & TSM for different relays.			**2**	**1**											**2**	
[CO6]	Modify the operating time of relay for different time-current characteristics.		**3**		**3**										**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Microprocessors Lab

Code:BTE25293

1Credits | Semester V

A. Introduction:

- To understand & maintain microprocessor & microcontroller based systems.
- To get acquainted with usage of Proteus &Keil Simulator Softwares.
- To know basic assembly language & C-language programming.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify features in Proteus &KeilSoftwares.
[CO2] Explain the program features of the Microcontroller based application.
[CO3] Develop C- language program & assembly language program.
[CO4] Compile and debug a Program.
[CO5] Justify different peripherals used in digital systems.
[CO6] Generate an executable file and use it.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	Name of Experiment
1	Interpret details of Hardware kit for Microcontroller and practice to write and execute programs
2	Develop and execute Assembly language programs using Arithmetic Instructions and demonstrate outcome for a given input data.
3	Develop and execute Assembly language programs using Logical Instructions and demonstrate outcome for a given input.
4	Develop and execute Assembly language program for subtraction of two 8 bit nos. and demonstrate outcome for a given input data
5	Develop and execute Assembly language program for subtraction of two 8 bit nos. and demonstrate outcome for a given input data.
6	Develop and execute Assembly language program for addition of two 16 bit nos. and demonstrate outcome for a given input data.
7	Develop and execute Assembly language program for subtraction of two 16 bit nos. and demonstrate outcome for a given input data

8	Introduction to PROTEUS Simulator & identify different menus available in a simulator software RIDE/KEIL and demonstrate their use

E. Text Book:

T1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, “The8051Microcontroller and Embedded Systems: Using Assembly and C”,Pearson Education, 2007.
T2. K. J. Ayala, “8051 Microcontroller”, Delmar Cengage Learning, 2004.

F. Reference Books:

R1. R. Kamal, “Embedded System”, McGraw Hill Education, 2009.
R2. R. S. Gaonkar, “, Microprocessor Architecture: Programming and Applications with the 8085”, Penram International Publishing, 1996

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify features in Proteus &KeilSoftwares.		3			2								3			
[CO2]	Explain the program features of the Microcontroller based application.		1			2								2			
[CO3]	Develop C- language program & assembly language program.	1		3											2	1	
[CO4]	Compile and debug a Program.		2		1									1		2	
[CO5]	Justify different peripherals used in digital systems.			2	1										1	2	
[CO6]	Generate an executable file and use it		1		1	2										3	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject:Summer Internship-1(3-4 Weeks)

Code:BTE25285

2 Credits | Semester V

A. Introduction:

- Following are the intended objectives of internship training:
- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' in classroom will be use in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job

GUIDELINES FOR INTERNSHIP

Summer Internship -1 should be undertaken in an industry/Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres/Institutes/Schemes.

S.No.	Suggested Schedule	Suggested Duration (In weeks)	Activities
1	Summer/winter vacation after 2nd/3rd Semester	3-4	Inter/Intra Institutional Activities

ARKA JAIN University Jharkhand

Syllabus of

B.Tech. in Electrical & Electronics Engineering

Semester-VI

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE
Scheme of Study (w.e.f Batch 2020-21)

SCHEME OF THE STUDY
SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SCHEME OF THE STUDY
SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Circuit Analysis	PCC	3	3	100	70	20	5	5
2	Electromagnetic Fields	PCC	4	4	100	70	20	5	5
3	Analog Electronic	PCC	3	3	100	70	20	5	5
4	Engineering Mathematics – III	BSC	4	4	100	70	20	5	5
5	Electrical Machines-I	PCC	4	4	100	70	20	5	5
6	Environmental Sciences	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Circuit Analysis Lab	PCC	1	2	50	35	5	5	5
8	Electrical Machines-I Lab	PCC	1	2	50	35	5	5	5
9	Analog Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**21**	**26**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Machines-II	PCC	4	4	100	70	20	5	5
2	Digital Electronics	PCC	3	3	100	70	20	5	5
3	Power Electronics	PCC	4	4	100	70	20	5	5
4	Signals and Systems	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
6	Essence of Indian Knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Machines II Lab	PCC	1	2	50	35	5	5	5
8	Digital Electronics Lab	PCC	1	2	50	35	5	5	5
9	Power Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**25**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Power Systems–I	PCC	3	3	100	70	20	5	5
2	Control Systems	PCC	3	3	100	70	20	5	5
3	Microprocessors	PCC	3	3	100	70	20	5	5
4	Program Elective – I Electrical Energy Conservation and Auditing Electrical Machine Design Industrial Electrical Systems	PEC	3	3	100	70	20	5	5
5	Open elective-I Electronic Devices Strength of Materials Data Structures and Algorithms	OEC	3	3	100	70	20	5	5
6	Professional practice law & ethics	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
7	Power Systems I Lab	PCC	1	2	50	35	5	5	5
8	Control Systems Lab	PCC	1	2	50	35	5	5	5
9	Microprocessors Lab	PCC	1	2	50	35	5	5	5
10	Summer Internship-1(3-4 Weeks)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**24**	**800**	**560**	**150**	**45**	**45**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Power Systems – II	PCC	3	3	100	70	20	5	5
2	Measurements and Instrumentation	PCC	3	3	100	70	20	5	5
3	Program Elective – II Digital Signal Processing Control Systems Design	PEC	3	3	100	70	20	5	5
4	Program Elective – III Line Commutated and Active Rectifiers High Voltage Engineering Electromagnetic Waves	PEC	3	3	100	70	20	5	5
5	Open Elective –II Wavelet Transforms Internet of Things Thermal and Fluid Engineering	OEC	3	3	100	70	20	5	5
6	IPR	HSMC	3	3	100	70	20	5	5
	Practical								
7	Power Systems II Lab	PCC	1	2	50	35	5	5	5
8	Measurements and Instrumentation Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**22**	**700**	**490**	**130**	**40**	**40**

SEMESTER VII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Professional Elective -IV Power System Protection Electrical and Hybrid Vehicles Computational Electromagnetic	PEC	3	3	100	70	20	5	5
2	Professional Elective - V Power System Dynamics andControl Power Quality and FACTS Electrical Drives	PEC	3	3	100	70	20	5	5
3	Open Elective - III Analog and Digital Communication Embedded Systems Fluid Machinery	OEC	3	3	100	70	20	5	5
4	Open Elective - IV Power Plant Engineering Image Processing Automobile Engineering	OEC	3	3	100	70	20	5	5
5	Project Management	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
9	Summer Internship-II(4-6 Weeks)	PROJ	3	0	100	70	30	0	0
10	Minor Project(Project to be carried over to next semester)	PROJ	3	6	100	70	30	0	0
	TOTAL		**21**	**21**	**600**	**490**	**160**	**25**	**25**

SEMESTER VIII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA	Attendance
1	Professional Elective - VI HVDC Transmission Systems Wind and Solar Energy Systems Advanced Electric Drives	PEC	3	3	100	70	20	5	5
2	Open Elective- V VLSI circuits Modern Manufacturing Processes Computer Networks	OEC	3	3	100	70	20	5	5
3	Open Elective - VI Electrical Materials Big Data Analysis	OEC	3	3	100	70	20	5	5
	PRACTICAL								
4	Major Project	PROJ	8	16	200	140	60	0	0
5	Extra-Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**17**	**25**	**600**	**420**	**150**	**15**	**15**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	4	12
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	8	18
4	Professional core courses (**PCC)**	24	54
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	6	18
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	64	160

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1].Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3].Design/Development of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion.

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.
[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Specify& analyze: An ability to identify, specify and analyze systems that inefficiently deliver technological solution in electrical & electronics engineering

[PSO.2]. Design/development of solutions: Design solutions for complex electronics engineering problem & design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, & the cultural, society & environmental considerations.

[PSO.3]. Modern tool usage: Create, select, & apply appropriate electrical techniques, resources & modern engineering including prediction & modeling to complex electrical systems with an understanding of the limitations & short comes.

[PSO.4]. Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Electrical systems & processes & communicate effectively with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions.

Power Systems – II

Code: BTE26383

3 Credits | Semester VI

A. Introduction:

- To understand the methods of Power System Analysis.
- To understand the economics of power system.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recognize the basics of power system economics.

[CO2] Understand the monitoring and control of a power system.

[CO3] Apply the methods to control the voltage, frequency and power flow.

[CO4] Analyze the stability constraints in a synchronous grid.

[CO5] Estimate the steady state parameters of power system usingvarious numerical methods.

[CO6] Formulate load flow & short circuit calculations.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

POWER FLOW ANALYSIS: Review of the structure of a Power System and its components, Analysis of Power Flows- Formation of Bus Admittance Matrix, Real and reactive power balance equations at a node, Load and Generator Specifications. Application of numerical methods for solution of non-linear algebraic equations- Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations, Computational Issues in Large-scale Power Systems.

STABILITY CONSTRAINTS IN SYNCHRONOUS GRIDS: Swing Equations of a synchronous machine connected to an infinite bus, Power angle curve, Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion, Impact of stability constraints on Power System Operation, Effect of generation rescheduling and series compensation of transmission lines on stability.

CONTROL OF FREQUENCY AND VOLTAGE: Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing, Automatic Generation Control, Generation and absorption of reactive power by various components of a Power System, Excitation System

Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs, Tap Changing Transformers, Power flow control using embedded dc links, phase shifters and

MONITORING AND CONTROL: Overview of Energy Control Centre Functions: SCADA systems, Phasor Measurement Units and Wide-Area Measurement Systems, State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System, Contingency Analysis. Preventive Control and Emergency Control.

POWER SYSTEM ECONOMICS AND MANAGEMENT: Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing, Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition),
Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.

E. TEXT BOOKS

T1.D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education.
T2.J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education.

F. REFERENCE BOOKS

R1.O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education.
R2.A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc.
R3.B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize the basics of power system economics.					2								1			
[CO2]	Understand the monitoring and control of a power system.		1		2									2			
[CO3]	Apply the methods to control the voltage, frequency and power flow.	1		2		3										3	
[CO4]	Analyze the stability constraints in a synchronous grid.		2		3									3			
[CO5]	Estimate the steady state parameters of power system using various numerical methods.			1	2	1										1	
[CO6]	Formulate load flow & short circuit calculations.		3	2		1									1		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Measurements and Instrumentation

Code:BTE26303

3 Credits | Semester VI

A. Introduction:

- To Study the various kinds of bridges and Electronic Instruments.
- To understand the concept of measurement of unknown resistance, inductance and capacitance

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understanding the working of various electrical bridges.

[CO2] Understanding the construction and working of various measuring instruments.

[CO3] Apply the energy conversion techniques.

[CO4] Analyze the different types of errors in measurement, calibration process and standards.

[CO5] Interpret the methods for measurement of non-electrical quantities like temperature, Pressure, Force, Torque, Density, Liquid level, Viscosity, Flow, Displacement etc.

[CO6] Improve the existing technology in the field of measurements in terms of accuracy, cost, and durability and user friendliness.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

MEASUREMENTS: Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments. Analog Meters- General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments. Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.

INSTRUMENT TRANSFORMER: Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current& Potential transformer, errors. Measurement of Power-

Principle of operation of Electrodynamic& Induction type wattmeter. Wattmeter errors. Measurement of Resistance- Measurement of medium, low and high resistances, Megger.

MEASUREMENT OF ENERGY: Construction, theory and application of AC energy meter, testing of energy meters. Potentiometer- Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer. Application. AC Bridges- Measurement of Inductance, Capacitance and frequency by AC bridges.

ELECTRONIC INSTRUMENTS: Cathode Ray Oscilloscope- Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO. Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator. Sensors & Transducers- Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.

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E. TEXT BOOKS

T1. A.K. Sawhney , A course in Electrical & Electronic Measurements & Instrumentation, , DhanpatRai& sons.

T2. A.J. Bouwens, Digital Instrumentation, Tata Mc-Graw hill.

F. REFERENCE BOOKS

R1. A.D. Heltric& W.C. Copper, Modern Electronic instrumentation & Measuring instruments, Wheeler Publication.

R2.D. Patranabis Sensors & Transducers, PHI, 2nd edition.

R3. E.W. Golding & F.C. Wides, Electrical Measurement & Measuring Instruments, Wheeler Publishing.

R4. H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill, 2nd Edition.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Understanding the working of various electrical bridges.					1								2			
[CO2]	Understanding the construction and working of various measuring instruments.		2		2									2			
[CO3]	Apply the energy conversion techniques.	1				3										3	
[CO4]	Analyze the different types of errors in measurement, calibration process and standards.			1	3									3			
[CO5]	Interpret the methods for measurement of non-electrical quantities like temperature, Pressure, Force, Torque, Density, Liquid level, Viscosity, Flow, Displacement etc.				3											2	
[CO6]	Improve the existing technology in the field of measurements in terms of accuracy, cost, durability and user friendliness.			2		1									2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Digital Signal Processing

Code:BTE26155

3 Credits | Semester VI

A. Introduction:

- To understand the discrete-time systems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Represent signals mathematically in continuous and discrete-time, and in the frequency domain.

[CO2] Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.

[CO3] Apply digital signal processing for the analysis of real-life signals.

[CO4] Analyze discrete-time systems using z-transform.

[CO5] Estimate the response parameters for digital filters.

[CO6] Design digital filters for various applications.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DISCRETE-TIME SIGNALS AND SYSTEMS: Introduction, Sequences, representation of signals on orthogonal basis, Representation of discrete systems using difference equations. Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-TRANSFORM: z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals. Interpretation of stability in z-domain, Inverse z-transforms.

DISCRETE FOURIER TRANSFORM: Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals. Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

DESIGNOF DIGITAL FILTERS: Design of FIR Digital filters, Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.

APPLICATIONS OF DIGITAL SIGNAL PROCESSING: Correlation Functions and Power Spectra, Stationary Processes. Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

E. TEXT BOOKS

T1.S. K. Mitra, “Digital Signal Processing: A computer based approach”, McGraw Hill.
T2.A.V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, Prentice Hall.

F. REFERENCE BOOKS

R1.J. G. Proakis and D.G. Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Prentice Hall.
R2.L. R. Rabiner and B. Gold, “Theory and Application of Digital Signal Processing”, Prentice Hall.
R3.J. R. Johnson, “Introduction to Digital Signal Processing”, Prentice Hall.
R4.D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, “Digital Signal Processing”, John Wiley & Sons.

G. Course Articulation Matrix: (Mapping of COs with POs) .

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Represent signals mathematically in continuous and discrete-time, and in the frequency domain.						1							2			
[CO2]	Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.		2				2							2			
[CO3]	Apply digital signal processing for the analysis of real-life signals.	2				3										3	
[CO4]	Analyze discrete-time systems using z-transform.			2	3									3			
[CO5]	Estimate the response parameters for digital filters.			1	2											2	
[CO6]	Design digital filters for various applications.			2	3										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Control Systems Design

Code:BTE26304

3 Credits | Semester VI

A. Introduction:

- To understand the design Specifications.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Identify the different controllers.

[CO2] Understand various design specifications.

[CO3] Apply the controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).

[CO4] Analyse the response of nonlinear systems.

[CO5] Evaluate the response parameters of a given linear system.

[CO6]Design controllers using the state-space approach.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DESIGN SPECIFICATIONS: Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

DESIGN OF CLASSICAL CONTROL SYSTEM IN THE TIME DOMAIN: Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

DESIGN OF CLASSICAL CONTROL SYSTEM IN FREQUENCY DOMAIN: Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

DESIGN OF PID CONTROLLERS: Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

CONTROL SYSTEM DESIGN IN STATE SPACE: Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability &observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

NONLINEARITIES AND ITS EFFECT ON SYSTEM PERFORMANCE: Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.

E. TEXT BOOKS

T1.N. Nise, "Control system Engineering", John Wiley.
T2.I. J. Nagrath and M. Gopal, "Control system engineering", Wiley.
T3.M. Gopal, "Digital Control Engineering", Wiley Eastern.

F. REFERENCE BOOKS

R1.K. Ogata, "Modern Control Engineering", Prentice Hall.
R2.B. C. Kuo, "Automatic Control system", Prentice Hall.
R3.J. J. D'Azzo and C. H. Houpis, "Linear control system analysis and design (conventional and modern)", McGraw Hill.
R4.R.T. Stefani and G.H. Hostetter, "Design of feedback Control Systems", Saunders College Pub.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the different controllers.		3											3			
[CO2]	Understand various design specifications.		1			1								2			
[CO3]	Apply the controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).	2				2										3	
[CO4]	Analyse the response of nonlinear systems.		1		2									3			
[CO5]	Evaluate the response parameters of a given linear system.		2		1										1		
[CO6]	Design controllers using the state-space approach.			3	2										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlat

Line-Commutated and Active Rectifiers

Code:BTE26305

3 Credits | Semester VI

A. Introduction:

- To analyze the different rectifiers.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Identify different types of semiconductor devices available & their characteristics.

[CO2] Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.

[CO3]Apply the required strategy for commutation of semiconductor devices.

[CO4] Analyze the working of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

[CO5]Evaluate the ripple factor for controlled rectifiers.

[CO6]Design a multi pulse converter.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DIODE RECTIFIERS WITH PASSIVE FILTERING: Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC Filter. 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current waveshape, effect of source inductance; commutation overlap.

THYRISTOR RECTIFIERS WITH PASSIVE FILTERING: Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter. 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current wave shape.

MULTI-PULSE CONVERTER: Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac. 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

SINGLE-PHASE AC-DC SINGLE-SWITCH BOOST CONVERTER: Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed-loop control structure.

AC-DC BIDIRECTIONAL BOOST CONVERTER: Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dc boost converter, Steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

ISOLATED SINGLE-PHASE AC-DC FLYBACK CONVERTER: Dc-dc fly back converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc fly back converter, steady state analysis, unity power factor operation, closed loop control structure.

E. TEXT BOOKS

T1.G. De, "Principles of Thyristorised Converters", Oxford & IBH Publishing Co.

F. REFERENCE BOOKS

R1.J.G. Kassakian, M. F. Schlecht and G. C. Verghese, "Principles of Power Electronics", Addison-Wesley.
R2.L. Umanand, "Power Electronics: Essentials and Applications", Wiley India.
R3.N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Son.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	**STATEMENT**	**CORRELATION WITH PROGRAM OUTCOMES**												**CORRELATION WITH PROGRAM SPECIFIC OUTCOMES**			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Identify different types of semiconductor devices available & their characteristics.		**2**			**1**								**3**			
[CO2]	Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.		**1**		**2**									**2**			
[CO3]	Apply the required strategy for commutation of semiconductor devices.	**1**				**3**										**2**	
[CO4]	Analyze the working of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.				**2**									**3**			
[CO5]	Evaluate the ripple factor for controlled rectifiers.				**1**											**2**	
[CO6]	Design a multi pulse converter.			**2**	**3**										**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

High Voltage Engineering

Code:BTE26153

3 Credits | Semester VI

A. Introduction:

- To understand the physics of different breakdown processes.

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Identify the tests on H. V. equipment and on insulating materials, as per the standards.
[CO2] Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
[CO3] Utilize the concept of generation and measurement of D. C., A.C., & Impulse voltages.
[CO4] Analyze the causes for rise of over-voltages in a power system, and protection against these over voltages.
[CO5] Evaluate the system parameters for over voltages due to lightning.
[CO6] Design of insulation levels of various parts of power system.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BREAKDOWN IN GASES: Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials. Breakdown in Uniform gap, non-uniform gaps, Townsend’s theory, Streamer mechanism, Corona discharge.

BREAKDOWN IN LIQUID AND SOLID INSULATING MATERIALS: Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown. Partial discharge, applications of insulating materials.

GENERATION OF HIGH VOLTAGES: Generation of high voltages, generation of high D. C. and A.C. voltages. Generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS: Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement,

LIGHTNING AND SWITCHING OVER-VOLTAGES: Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching over-voltages, Protection against over-voltages, Surge diverters, Surge modifiers.

HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS AND HIGH VOLTAGE LABORATORIES: Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables. Power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

E. TEXT BOOKS

T1. M. S. Naidu and V. Kamaraju, “High Voltage Engineering”, McGraw Hill Education.
T2. C. L. Wadhwa, “High Voltage Engineering”, New Age International Publishers.

F. REFERENCE BOOKS

R1.D. V. Razevig (Translated by Dr. M. P. Chourasia), “High Voltage Engineering Fundamentals”,Khanna Publishers, 1993.
R2. E. Kuffel, W. S. Zaengl and J. Kuffel, “High Voltage Engineering Fundamentals”, Newnes Publication, 2000.
R3. R. Arora and W. Mosch “High Voltage and Electrical Insulation Engineering”, John Wiley & Sons.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the tests on H. V. equipment and on insulating materials, as per the standards.		3			1								3			
[CO2]	Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.		1		2									2			
[CO3]	Utilize the concept of generation and measurement of D. C., A.C., & Impulse voltages.	1		2		1										2	
[CO4]	Analyze the causes for rise of over-voltages in a power system, and protection against these over voltages.		1		2									3			
[CO5]	Evaluate the system parameters for over voltages due to lightning.			2	1											2	
[CO6]	Design of insulation levels of various parts of power system.			3	3										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electromagnetic Waves

Code:BTE26306

3Credits | Semester VI

A. Introduction:

- To understand the transmission lines for evaluation of voltage and current.
- To understand the concept radiations.
- To understand the equations of the field.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide.

[CO2] Understandthe concept of radiation by antennas.

[CO3] Provide solution to real life plane wave problems for various boundary conditions.

[CO4] Analyze the field equations for the wave propagation in special cases such as lossy and low loss dielectric media.

[CO5] Estimate voltage and current at any point on transmission line for different load conditions.

[CO6] Formulate the problems involving lossy media with planar boundaries using uniform plane waves.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

TRANSMISSION LINES: Introduction, Concept of distributed elements, Equations of voltage andcurrent, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line,Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines.

BMAXWELL'S EQUATIONS:Basic quantities of Electromagnetic, Basic laws of Electromagnetic: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction.Maxwell's equations, Surface charge and surface current, Boundary conditions at media interface.

UNIFORM PLANE WAVE: Homogeneous unbound medium, Wave equation for time harmonic fields. Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector.

PLANE WAVES AT MEDIA INTERFACE: Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface.Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

WAVEGUIDES: Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion.Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, Rectangular waveguides.

ANTENNAS: Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole, Near field, Far field, Total power radiated by a dipole.Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.

E. TEXT BOOKS

T1. R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill.
T2. D. K. Cheng, "Field and Wave Electromagnetics", Addison-Wesley.

F. REFERENCE BOOKS

R1. M. N.O. Sadiku, "Elements of Electromagnetics", Oxford University Press.
R2. C. A. Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons.
R3. C. A. Balanis, "Antenna Theory: Analysis and Design", John Wiley & Sons.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide.					1								2			
[CO2]	Understand the concept of radiation by antennas.		1		2	1								2			
[CO3]	Provide solution to real life plane wave problems for various boundary conditions.	2		1												2	
[CO4]	Analyze the field equations for the wave propagation in special cases such as lossy and low loss dielectric media.		1		3									3			
[CO5]	Estimate voltage and current at any point on transmission line for different load conditions.			1	1											2	
[CO6]	Formulate the problems involving lossy media with planar boundaries using uniform plane waves.		3	1											2	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Wavelet Transforms

Code:BTE26307

3 Credits | Semester VI

A. Introduction:

- To build different solutions in various sectors.
- To learn the fundamentals of the emerging technology.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand about wavelet packets
[CO2] Classify wavelet basis and characterize continuous and discrete wavelet transforms
[CO3] implement discrete wavelet transforms with multirate digital filters.
[CO4]Analyzemulti resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.
[CO5] Evaluate a signal using windowed Fourier transform and differentiate between windowed Fourier transform and wavelet transform.
[CO6] Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

CONTINUOUS WAVELET TRANSFORM: Introduction, C-T wavelets, Definition of CWT, The CWT as a correlation. Constant Q-Factor Filtering Interpolation and time frequency resolution, the CWT as an operator, inverse CWT.

INTRODUCTION TO DISCRETE WAVELET TRANSFORM AND ORTHOGONAL WAVELET DECOMPOSITION: Introduction, Approximation of vectors in nested linear vector spaces, (i) example of approximating vectors in nested subspaces of a finite dimensional liner vector space, (ii) Example of approximating vectors in nested subspaces of an infinite dimensional linear vector space. Example MRA. (i) Bases for the approximations subspaces and Harr scaling function, (ii) Bases for detail subspaces and Haar wavelet.

MRA, ORTHO NORMAL WAVELETS AND THEIR RELATIONSHIP TO FILTER BANKS: Introduction, Formal definition of an MRA.Construction of a general orthonormal MRA, (i) scaling function and subspaces, (ii) Implication of dilation equation and orthogonality, a wavelet basis for MRA. (i) Two scale relations for (t), (ii) Basis for the detail subspace (iii) Direct sum decomposition, Digital filtering interpolation (i)Decomposition filters, (ii) reconstruction, the signal.

EXAMPLES OF WAVELETS: Examples of orthogonal basis generating wavelets, (i) Daubechies D4 scaling function and wavelet. (ii) Band limited wavelets; interpreting orthonormal, MRAs for Discrete time MRA, (iii) Basis functions for DTWT.

ALTERNATIVE WAVELET REPRESENTATIONS & CONSTRUCTION OF SIMPLE WAVELETS:
Introduction, Bi-orthogonal wavelet bases, Filtering relationship for bi-orthogonal filters, Examples of bi-orthogonal scaling functions and wavelets. 2-D wavelets. Construction of simple wavelets like Harr and DB1. Other Applications of Wavelet Transforms: Introduction, wavelet de-noising, speckle removal, edge detection and object isolation, Image fusions, Object detection by wavelet transforms of projections.

E. TEXT BOOKS

T1.Lokenath Debnath, “Wavelet Transforms & Time-Frequency Signal Analysis”, Birkhauser publication.

T2. Ajit S. Bopardikar, Raghuveer M. Rao, “Wavelet Transforms: Introduction to Theory and Applications, Pearson Education.

F. REFERENCE BOOKS

R1.D. Sundararajan, “Discrete Wavelet Transformer”, John Wiley & Sons Pubilcation.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Understand about wavelet packets	2				1								2			
[CO2]	Classify wavelet basis and characterize continuous and discrete wavelet transforms					1								2			
[CO3]	Implement discrete wavelet transforms with multirate digital filters.	2														2	
[CO4]	Analyzemulti resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.			3										3			
[CO5]	Evaluate a signal using windowed Fourier transform and differentiate between windowed Fourier transform and wavelet transform.		1		2											2	
[CO6]	Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.			2		3									2	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Internet of Things

Code:BTE27323

3 Credits | Semester VI

A. Introduction:

- To build different solutions in various sectors.
- To learn the fundamentals of the emerging technology.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify various tools and have basic implementation skills.
[CO2]Understand of various aspect of Internet of Things (IoT)
[CO3] Use real IoT protocols for communication.
[CO4] Analyze the working of an IoT device with a Cloud Computing infrastructure.
[CO5] Evaluate & verify the IoT data in the cloud and in between cloud providers.
[CO6]Design and program IoT devices.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO INTERNET OF THINGS: Sensing**,** Actuation

BASICS OF IoT NETWORKING: Communication Protocols**,** Sensor networks

INTRODUCTION TO ARDUINO PROGRAMMING: Integration of Sensors, Actuators to Arduino

IMPLEMENTATION OF IoT: With Raspberry Pi**,** Data Handling Analytics

CASE STUDIES DIFFERENT SECTORS: Agriculture, Healthcare, Activity Monitoring

E. TEXT BOOKS

T1. Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.
T2. Dr. JeevaJose , Internet of Things, Khanna Publishing House.

F. REFERENCE BOOKS

R1. ArshdeepBahga and Vijay Madisetti, Internet of Things: A Hands-on Approach, Universities Press.
R2.Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw Hill.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify various tools and have basic implementation skills.		3			1								3			
[CO2]	Understand of various aspect of Internet of Things (IoT)		1		1									2			
[CO3]	Use real IoT protocols for communication.	2		1		1										2	
[CO4]	Analyze the working of an IoT device with a Cloud Computing infrastructure.		1		3									3			
[CO5]	Evaluate & verify the IoT data in the cloud and in between cloud providers.			1	2											2	
[CO6]	Design and program IoT devices.			3	2										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Thermal and Fluid Engineering

Code:BTE26308

3Credits | Semester VI

A. Introduction:

- To learn about of I law for reacting systems and heating value of fuels
- To learn about gas and vapor cycles and their first law and second law efficiencies
- To understand about the properties of dry and wet air and the principles of psychometric
- To learn about the application of mass and momentum conservation laws for fluid flows
- To understand the importance of dimensional analysis

B. Course Outcomes: At the end of the course, students will be able to

[CO1]List various thermodynamics concepts and approach real life engineering problems like engines compressor etc.
[CO2] Understand various practical power cycles.
[CO3]Apply mathematical analysis simple flow situations.
[CO4]Analyze energy conversion in various thermal devices.
[CO5]Compute force of buoyancy on a partially or fully submerged body.
[CO6] Predict pressure drop in pipe flow for laminar flow in a pipe.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, energy analysis. Super- critical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.

Properties of dry and wet air, use of pschyrometric chart, processesinvolving heating/cooling and humidification/dehumidification, dew point.

Definition of fluid, Newton's law of viscosity, Units and dimensions, Properties of fluids, mass ,density, specific volume, specific gravity, viscosity, surface tension and capillarity, vapor pressure, compressibility and bulk modulus.

Control volume and control surface, application of continuity equation and momentum equation,Bernoulli's equation and its applications.Concept of boundary layer, boundary layer thickness, is placement thickness, momentum thickness, energy thickness

E. TEXT BOOKS

T1.Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.

T2.Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

F. REFERENCE BOOKS

R1.Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

R2.Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

R3.Frank M. White, Fluid Mechanics (Sixth Edition), Tata McGraw-Hill, New Delhi (2008).

R4.J. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall (1999).

R5.Som and Biswas; Fluid Mechnics and machinery; TMH

R6.Cengal; Fluid Mechanics; TMH

R7.Modi& Seth; Fluid Mechanics; Standard Book House, Delhi

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	List various thermodynamics concepts and approach real life engineering problems like engines compressor etc.					1								2		1	
[CO2]	Understand various practical power cycles.		2		1	2								2			
[CO3]	Apply mathematical analysis simple flow situations.	1		2		3										3	
[CO4]	Analyze energy conversion in various thermal devices.		1		3									3			
[CO5]	Compute force of buoyancy on a partially or fully submerged body.			2	1											2	
[CO6]	Predict pressure drop in pipe flow for laminar flow in a pipe.				2	1									1	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Intellectual Property Rights

Code: BTE26385

Credits- 3 | Semester IV

A. Introduction:

- To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
- To disseminate knowledge onpatents, patent regime in India and abroad and registration aspects.
- To disseminateknowledge on copyrights and its related rights and registration aspects.
- To disseminate knowledge on trademarks and registration aspects
- To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects
- To aware about current trends in IPR and Govt. steps in fostering IPR

B. Course Outcomes: At the end of the course, students will be able

[CO1] Identify activities, constitute IP infringements and the remedies available to the IP owner, and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.

[CO2] Understand the knowledge on patent and copyright for their innovative research works.

[CO3] Apply information in patent documents provide useful insight on novelty of their idea from state of-the art search. This provide further way for developing their idea or innovations.

[CO4] Apply the activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.

[CO5] Anticipate the critical analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.

[CO6] Formulate the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

OVERVIEW OF INTELLECTUAL PROPERTY: Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge. Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994.

PATENTS: Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

COPYRIGHTS: Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

TRADEMARKS: Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

OTHER FORMS OF IP: Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical Indication (GI) Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection, Plant Variety Protection Plant variety protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection Layout Design. Protection Layout Design protection: meaning – Procedure for registration, effect of registration and term of protection

CURRENT CONTOUR: India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies

E. TEXT BOOKS

T1. Nithyananda, K V, Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.

F. REFERENCE BOOKS

R1. Neeraj, P., &Khusdeep, D, Intellectual Property Rights. India, IN: PHI learning Private Limited.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify activities, constitute IP infringements and the remedies available to the IP owner, and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.						2							2			2
[CO2]	Understand the knowledge on patent and copyright for their innovative research works.								2				2		1		1
[CO3]	Apply information in patent documents provide useful insight on novelty of their idea from state of-the art search. This provide further way for developing their idea or innovations.									1	2					2	
[CO4]	Apply the activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products										2	1				2	

	and technology development.																
[CO5]	Anticipate the critical analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.							**1**					**1**				**2**
[CO6]	Formulate the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing.						**2**								**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Power Systems II Lab

Code:BTE26310

1 Credits | Semester VI

A. Introduction:

- To understand the power angle for electrical machines.
- To know the formation of parameters for network.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recall the various types of methods for load flow.
[CO2] Understand the Economic Load Dispatch.
[CO3] Model the required system.
[CO4] Analyse the power system stability, security and reliability.
[CO5] Estimate the network parameters with load flow analysis.
[CO6] Formulate required parameters for various kind of power system networks.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	Name of Experiment
1	Formulation of Y-Bus.
2	Study on DC load flow.
3	Study on AC load flow using Gauss-Seidel method.
4	Study on AC load flow using Newton-Raphson method.
5	Study on Economic load dispatch.
6	Formation of Abcd parameters for t-network.
7	Determination of power angle curve for non- salient pole synchronous machines
8	Determination of power angle curve salient pole synchronous machines

E. Text Book:

T1.D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education.
T2.J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education.

F. Reference Books:

R1.O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education.
R2.A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc.
R3.B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall the various types of methods for load flow.					2								2		1	
[CO2]	Understand the Economic Load Dispatch.		1		2	1								2			
[CO3]	Model the required system.	2			2	1										2	
[CO4]	Analyse the power system stability, security and reliability.		1		3									3			
[CO5]	Estimate the network parameters with load flow analysis.			2	1											1	
[CO6]	Formulate required parameters for various kind of power system networks.		3	1											2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Measurements and Instrumentation Lab

Code:BTE26311
1 Credits | Semester VI

A. Introduction:

- To find the power using different instruments.
- To know the different types of bridges.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recognize the various types of instruments.
[CO2] Understand the various types of Energy Meter.
[CO3] Apply principle of calibration of a measuring instrument and plotting of calibration curves.
[CO4] Analyze the working of ammeter, voltmeter, wattmeter, Kelvin's double bridge and wheat stone's bridge.
[CO5] Evaluate the circuit parameters from measurement devices.
[CO6] Choose appropriate measurement device & connection to find the required parameter.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sr.No.	Name of Experiment
1	To observe the construction of PMMC & MI type instruments.
2	Measurement of small resistance using Kelvin double bridge.
3	Measurement of unknown resistance using Wheatstone bridge.
4	Measurement of three-phase power using single wattmeter method.
5	Measurement of three-phase power using two-wattmeter method.
6	Calibrate single-phase AC energy meter.
7	Calibrate three-phase AC energy meter.
8	Measurement of power using Instrument transformers.

D. Text Book:

T1. A.K. Sawhney , A course in Electrical & Electronic Measurements & Instrumentation, , DhanpatRai& sons.

T2. A.J. Bouwens, Digital Instrumentation, Tata Mc-Graw hill.

E. Reference Books:

R1. A.D. Heltric& W.C. Copper, Modern Electronic instrumentation & Measuring instruments, Wheeler Publication.

R2.D. Patranabis Sensors & Transducers, PHI, 2nd edition.

R3. E.W. Golding & F.C. Wides, Electrical Measurement & Measuring Instruments, Wheeler Publishing.

R4. H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill, 2nd Edition.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize the various types of instruments.					2								2			
[CO2]	Understand the various types of Energy Meter.		2		1	1								2			
[CO3]	Apply principle of calibration of a measuring instrument and plotting of calibration curves.	3				2										3	
[CO4]	Analyze the working of ammeter, voltmeter, wattmeter, Kelvin’s double bridge and wheat stone’s bridge.		1	3										3			
[CO5]	Evaluate the circuit parameters from measurement devices.			1	1											1	
[CO6]	Choose appropriate measurement device & connection to find the required parameter.				2	1									1		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University Jharkhand

Syllabus of

B.Tech in Electrical & Electronics Engineering

Semester-VII

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE
Scheme of Study (w.e.f Batch 2020-21)

SCHEME OF THE STUDY
SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SCHEME OF THE STUDY
SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Circuit Analysis	PCC	3	3	100	70	20	5	5
2	Electromagnetic Fields	PCC	4	4	100	70	20	5	5
3	Analog Electronic	PCC	3	3	100	70	20	5	5
4	Engineering Mathematics – III	BSC	4	4	100	70	20	5	5
5	Electrical Machines-I	PCC	4	4	100	70	20	5	5
6	Environmental Sciences	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Circuit Analysis Lab	PCC	1	2	50	35	5	5	5
8	Electrical Machines-I Lab	PCC	1	2	50	35	5	5	5
9	Analog Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**21**	**26**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Machines-II	PCC	4	4	100	70	20	5	5
2	Digital Electronics	PCC	3	3	100	70	20	5	5
3	Power Electronics	PCC	4	4	100	70	20	5	5
4	Signals and Systems	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
6	Essence of Indian Knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Machines II Lab	PCC	1	2	50	35	5	5	5
8	Digital Electronics Lab	PCC	1	2	50	35	5	5	5
9	Power Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**25**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Power Systems–I	PCC	3	3	100	70	20	5	5
2	Control Systems	PCC	3	3	100	70	20	5	5
3	Microprocessors	PCC	3	3	100	70	20	5	5
4	Program Elective – I Electrical Energy Conservation and Auditing Electrical Machine Design Industrial Electrical Systems	PEC	3	3	100	70	20	5	5
5	Open elective-I Electronic Devices Strength of Materials Data Structures and Algorithms	OEC	3	3	100	70	20	5	5
6	Professional practice law & ethics	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
7	Power Systems I Lab	PCC	1	2	50	35	5	5	5
8	Control Systems Lab	PCC	1	2	50	35	5	5	5
9	Microprocessors Lab	PCC	1	2	50	35	5	5	5
10	Summer Internship-1(3-4 Weeks)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**24**	**800**	**560**	**150**	**45**	**45**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Power Systems – II	PCC	3	3	100	70	20	5	5
2	Measurements and Instrumentation	PCC	3	3	100	70	20	5	5
3	Program Elective – II Digital Signal Processing Control Systems Design	PEC	3	3	100	70	20	5	5
4	Program Elective – III Line Commutated and Active Rectifiers High Voltage Engineering Electromagnetic Waves	PEC	3	3	100	70	20	5	5
5	Open Elective –II Wavelet Transforms Internet of Things Thermal and Fluid Engineering	OEC	3	3	100	70	20	5	5
6	IPR	HSMC	3	3	100	70	20	5	5
	Practical								
7	Power Systems II Lab	PCC	1	2	50	35	5	5	5
8	Measurements and Instrumentation Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**22**	**700**	**490**	**130**	**40**	**40**

SEMESTER VII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Professional Elective -IV Power System Protection Electrical and Hybrid Vehicles Computational Electromagnetic	PEC	3	3	100	70	20	5	5
2	Professional Elective - V Power System Dynamics andControl Power Quality and FACTS Electrical Drives	PEC	3	3	100	70	20	5	5
3	Open Elective - III Analog and Digital Communication Embedded Systems Fluid Machinery	OEC	3	3	100	70	20	5	5
4	Open Elective - IV Power Plant Engineering Image Processing Automobile Engineering	OEC	3	3	100	70	20	5	5
5	Project Management	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
9	Summer Internship-II(4-6 Weeks)	PROJ	3	0	100	70	30	0	0
10	Minor Project(Project to be carried over to next semester)	PROJ	3	6	100	70	30	0	0
	TOTAL		**21**	**21**	**600**	**490**	**160**	**25**	**25**

SEMESTER VIII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA	Attendance
1	Professional Elective - VI HVDC Transmission Systems Wind and Solar Energy Systems Advanced Electric Drives	PEC	3	3	100	70	20	5	5
2	Open Elective- V VLSI circuits Modern Manufacturing Processes Computer Networks	OEC	3	3	100	70	20	5	5
3	Open Elective - VI Electrical Materials Big Data Analysis	OEC	3	3	100	70	20	5	5
	PRACTICAL								
4	Major Project	PROJ	8	16	200	140	60	0	0
5	Extra-Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**17**	**25**	**600**	**420**	**150**	**15**	**15**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	5	15
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	8	18
4	Professional core courses (**PCC**)	24	54
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC**)	6	18
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	163

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1].Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3].Design/Development of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion.

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.
[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Specify& analyze: An ability to identify, specify and analyze systems that inefficiently deliver technological solution in electrical & electronics engineering

[PSO.2]. Design/development of solutions: Design solutions for complex electronics engineering problem & design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, & the cultural, society & environmental considerations.

[PSO.3]. Modern tool usage: Create, select, & apply appropriate electrical techniques, resources & modern engineering including prediction & modeling to complex electrical systems with an understanding of the limitations & short comes.

[PSO.4]. Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Electrical systems & processes & communicate effectively with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions.

Power System Protection

Code:BTE27200

3 Credits | Semester VII

A. Introduction:

- To understand parameters associated with faults and over current protection
- To know Equipment Protection Scheme and Digital Protection
- To learn Modelling and Simulation of Protection Schemes and system protection

B. Course Outcomes: At the end of the course, students will be able to

[CO 1] Identify the system protection schemes, and the use of wide-area measurements.
[CO 2] Understand & relate the different components of a protection system.
[CO 3] Provide standards and specifications related to switchgear and protection.
[CO 4] Analyze the basic principles of digital protection
[CO 5] Evaluate fault current due to different types of fault in a network.
[CO 6] Design the protection schemes for different power system components.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION AND COMPONENTS OF A PROTECTION SYSTEM AND FAULTS AND OVER-CURRENT PROTECTION: Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers, Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection andovercurrent relay co-ordination

EQUIPMENT PROTECTION SCHEMES: Directional, Distance, Differential protection. Transformer and Generator protection, Bus bar Protection, Bus Bar arrangement schemes.

DIGITAL PROTECTION: Computer-aided protection, Fourier analysis and estimation of Phasors from DFT. Sampling, aliasing issues.

MODELING AND SIMULATION OF PROTECTION :CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing.

SYSTEM PROTECTION: Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under voltage eand df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

E. TEXT BOOKS

T1. J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York,1987.

T2. Y. G.Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.

F. REFERENCE BOOKS

R1. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons 1988.

R2 .A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications",Springer, 2008.

R3.D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the system protection schemes, and the use of wide-area measurements.		3			1								3			
[CO2]	Understand & relate the different components of a protection system.		1			2										2	
[CO3]	Provide standards and specifications related to switchgear and protection.	2				1										3	
[CO4]	Analyze the basic principles of digital protection		1		3									2			
[CO5]	Evaluate fault current due to different types of fault in a network.			1	3											2	
[CO6]	Design the protection schemes for different power system components.			2	3										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical and Hybrid Vehicles

Code:BTE27325

3 Credits | Semester VII

A. Introduction:

- To learn about working principal of Conventional vehicle and Hybrid Vehicle
- To understand different types of hybrid –electric trains and electric trains
- To know about how to storage of energy and strategies related to energy storage systems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify power flow control in Hybrid drive –train and electric derive Topologies.
[CO2] Explain the Electric Propulsion Unit and use of its application.
[CO3] Utilize the different strategies related to energy storage systems.
[CO4] Inspect the different possible ways of energy storage.
[CO5] Rate the models to describe Conventional and hybrid vehicles and their performance.
[CO6] Design of a Hybrid Electric Vehicle (HEV).

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

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

HYBRID ELECTRIC DRIVE-TRAINS AND ELECTRIC TRAINS: Basic concept of hybrid traction, introduction to various hybrid drivetrain topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysisBasic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis

ELECTRIC PROPULSION UNIT: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drivesConfiguration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency

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, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. 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

ENERGY MANAGEMENT STRATEGIES: 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, implementation issues of energy management strategies, Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

E. TEXT BOOKS

T1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.

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F. REFERENCE BOOKS

R1. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies",Springer, 2015.
R2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
R3. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify power flow control in Hybrid drive –train and electric derive Topologies.		3			1								3			
[CO2]	Explain the Electric Propulsion Unit and use of its application.		1		2									2			
[CO3]	Utilize the different strategies related to energy storage systems.	2		1		1										3	
[CO4]	Inspect the different possible ways of energy storage.		2		2									2			
[CO5]	Rate the models to describe Conventional and hybrid vehicles and their performance.			1	2									1		2	
[CO6]	Design of a Hybrid Electric Vehicle (HEV).			2	3										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Computational Electromagnetic

Code:BTE27326

3 Credits | Semester VII

A. Introduction:

- To know Principal and Working of Computational technologies.
- To learn use of FDM and FEM
- To Apply Application of of Computational technologies

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Identify power flow control in Hybrid drive –train and electric derive Topologies.
[CO2] Understand the basic concepts of electromagnetics.
[CO3] Apply different finite element method.
[CO4] Analyze computational techniques for computing fields.
[CO5] Justify the techniques to simple real-life problems.
[CO6] Create some innovative computational electromagnetics method.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION OF COMPUTATIONAL ELECTROMAGNETICS AND ANALYTICAL METHODS: Conventional design methodology, Computer aided design aspects – Advantages. Review of basicfundamentals of Electrostatics and Electromagnetics. Development of Helmhotz equation, energy transformer vectors- Poynting and Slepian, magnetic Diffusion-transients and time-harmonic, Analytical methods of solving field equations, method of separation of variables, Roth's method,integral methods- Green's function, method of images

FINITE DIFFERENCE METHOD (FDM): Finite Difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions, Finite-Difference Time-Domain (FDTD) method- Uniqueness and convergence.

FINITE ELEMENT METHOD (FEM): Overview of FEM, Variational and Galerkin Methods, shape functions, lower and higher orderelements, vector elements, 2D and 3D finite elements, efficient finite element computations

SPECIAL TOPICS: Background of experimental methods-electrolytic tank, R-C network solution, Field plotting(graphical method)}, hybrid methods, coupled circuit - field computations, electromagnetic – thermal and electromagnetic - structural coupled computations, solution of equations, method of moments,Poisson's fields

APPLICATIONS: Low frequency electrical devices, static / time-harmonic / transient problems in transformers, Rotating machines, actuators. CAD packages

E. TEXT BOOKS

T1. P. P. Silvester and R. L. Ferrari "Finite Element for Electrical Engineers", Cambridge University press, 1996.

F. REFERENCE BOOKS

R1. M. N. O. Sadiku, "Numerical Techniques in Electromagnetics", CRC press, 2801

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify power flow control in Hybrid drive –train and electric derive Topologies.		2			1								3			
[CO2]	Understand the basic concepts of electromagnetics.		1		1									2			
[CO3]	Apply different finite element method.	2				2										3	
[CO4]	Analyze computational techniques for computing fields.		1		3									2			1
[CO5]	Justify the techniques to simple real-life problems.			2	1										1	2	
[CO6]	Create some innovative computational electromagnetics method.				1	3										3	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Power System Dynamics and Control

Code:BTE27327

3 Credits | Semester VII

A. Introduction:

- To study power system stability, numerical methods for linear dynamical system.
- To learn about enhancement power system stability.
- To study modeling of power system component.

B. Course Outcomes: At the end of the course, students will be able to

[CO 1] Recognize different model components of power system.
[CO2] Understand the problem of power system stability and Analyze linear dynamical systems by use of numerical integration methods.
[CO 3] Develop Measurement stability analysis of different power system.
[CO 4] Distinguish different methods to improve stability.
[CO 5] Estimatemodeling of Synchronous Machines and use of associated Controllers.
[CO 6] Modelling ofpower system components - generators, transmission lines, excitation and prime mover controllers.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO POWER SYSTEM OPERATIONS AND ANALYSIS OF LINEAR DYNAMICAL SYSTEM AND NUMERICAL METHODS: Introduction to power system stability. Power System Operations and Control. Stability problems in Power System. Impact on Power System Operations and control. Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability. Modal Analysis of Linear System. Analysis using Numerical Integration Techniques. Issues in Modeling: Slow and Fast Transients, Stiff System

MODELING OF SYNCHRONOUS MACHINES AND ASSOCIATED CONTROLLERS: Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. D-Q Transformation. Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine. Synchronization of Synchronous Machine to an Infinite Bus. Modeling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control. Automatic Voltage Regulator. Prime Mover Control Systems. Speed Governors.

MODELING OF OTHER POWER SYSTEM COMPONENTS: Modeling of Transmission Lines and Loads. Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency and Voltage, Dependence of Loads. Other Subsystems – HVDC and FACTS controllers, Wind Energy System.

STABILITY ANALYSIS: Angular stability analysis in Single Machine Infinite Bus System. Angular Stability in multi-machine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre of Inertia Motion. Load Sharing: Governor Droop. Single Machine Load Bus System: Voltage Stability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability Analysis Tools: Transient Stability Programs, Small Signal Analysis Programs

ENHANCING SYSTEM STABILITY: Planning Measures. Stabilizing Controllers (Power System Stabilizers), Operational Measures- Preventive Control. Emergency Control

E. TEXT BOOKS

T1. K.R. Padiyar, "Power System Dynamics, Stability and Control", B. S. Publications, 2002.

F. REFERENCE BOOKS

R1. P. M. Anderson & A. A. Fouad, "Power System Control and stability", second Edition, IEEE Press

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize different model components of power system.					2								2			
[CO2]	Understand the problem of power system stability and Analyze linear dynamical systems by use of numerical integration methods.		2		1	1								2			
[CO3]	Develop Measurement stability analysis of different power system.	2		3		1										1	
[CO4]	Distinguish different methods to improve stability.		1		2									2			
[CO5]	Estimate modeling of Synchronous Machines and use of associated Controllers.			1	2										1	2	
[CO6]	Modelling of power system components - generators, transmission lines, excitation and prime mover controllers.			2	1	1										3	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Power Quality and Facts

Code:BTE27329

3 Credits | Semester VII

A. Introduction:

- To study analysis of AC transmission lines controllers.
- To study properties and application of voltage Source Converter based (FACTS) controllers
- To understand unified power compensation Quality Conditioner

B. Course Outcomes: At the end of the course, students will be able to

[CO 1] Recognize the working of AC transmission lines and FACTS
[CO 2] Learn modeling and operation of Voltage source converter
[CO 3] Select the application of FACTS and Power Quality Problems in Distribution Systems.
[CO 4] Inspect the work of Power Quality Conditioner.
[CO 5]Estimate the reactive power compensation.
[CO 6] Create special purpose FACTS controllers and custom power.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

TRANSMISSION LINES AND SERIES/SHUNT REACTIVE POWER COMPENSATION AND THYRISTOR-BASED FLEXIBLE AC TRANSMISSION CONTROLLERS (FACTS Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation. Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter

VOLTAGE SOURCE CONVERTER BASED (FACTS) CONTROLLERS: Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control.

Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter

APPLICATION OF FACTS AND POWER QUALITY PROBLEMS IN DISTRIBUTION SYSTEMS: Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM. Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve

DSTATCOM: Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters ATCOM, Synchronous Reference Frame Extraction of Reference Current Control Techniques in for DST

DYNAMIC VOLTAGE RESTORER AND UNIFIED POWER QUALITY CONDITIONER: Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering. Unified Power Quality Conditioner (UPQC): Working Principle. Capabilities and Control Strategies

E. TEXT BOOKS

T1. N. G. Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of FACTS Systems”, Wiley-IEEE Press, 1999.
T2. K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd. 2007.

F. REFERENCE BOOKS

R1.T. J. E. Miller, “Reactive Power Control in Electric Systems”, John Wiley and Sons, New York, 1983.
R2.R. C. Dugan, “Electrical Power Systems Quality”, McGraw Hill Education, 2012.
R3.G. T. Heydt, “Electric Power Quality”, Stars in a Circle Publications, 1991

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G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize the working of AC transmission lines and FACTS					**1**								**2**			
[CO2]	Learn modeling and operation of Voltage source converter		**1**		**2**									**2**			
[CO3]	Select the application of FACTS and Power Quality Problems in Distribution Systems.	**1**				**3**										**3**	
[CO4]	Inspect the work of Power Quality Conditioner.		**2**	**2**										**1**	**2**		
[CO5]	Estimate the reactive power compensation.			**1**	**1**										**2**		**1**
[CO6]	Create special purpose FACTS controllers and custom power.		**1**			**3**									**2**	**3**	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical Drives

Code:BTE27330

3 Credits | Semester VII

A. Introduction:

- To study characteristics of different types dc motors and properties chopper fed DC derive
- To learn the power electronic converters used for dc motor and induction motor speed control

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Select a suitable DC Motor and Power Electronic Converter package from description of drive requirement – involving load estimation, load cycle considerations, thermal aspects and motor converter matching.

[CO2] Understand the characteristics of dc motors and properties chopper fed DC derive.

[CO3] Apply the principles of speed-control of dc motors.

[CO4] Analyze the characteristics of Induction motor and Scalar control or constant V/f control of induction motor.

[CO5]Examine& describe Operation of multi –quadrant dc machines and choppers.

[CO6]Design the power electronic converters used for dc motor and induction motor speed control.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DC MOTOR CHARACTERISTICS AND CHOPPER FED DC DRIVE: Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high-speed operation. Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.

MULTI-QUADRANT DC DRIVE: Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking

CLOSED-LOOP CONTROL OF DC DRIVE : Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, Plant transfer function, for controller design, current controller specification and design, speed controller specification and design

INDUCTION MOTOR CHARACTERISTICS AND SCALAR CONTROL OR CONSTANT V/F CONTROL OF INDUCTION MOTOR: Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation. Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation.

CONTROL OF SLIP RING INDUCTION MOTOR: Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, Power electronic based rotor side control of slip ring motor, slip power recovery

E. TEXT BOOKS

T1. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
T2. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control",Prentice Hall, 2001.

F.REFERENCE BOOKS

R1. G. K. Dubey, "Fundamentals of Electrical Drives", CRC Press, 2002.
R2. W. Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001
R3. G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Select a suitable DC Motor and Power Electronic Converter package from a description of drive requirement – involving load estimation, load cycle considerations, thermal aspects and motor converter matching.	1				3										3	
[CO2]	Understand the characteristics of dc motors and properties chopper fed DC derive.		2											2			
[CO3]	Apply the principles of speed-control of dc motors.	2				3										3	
[CO4]	Analyze the characteristics of Induction motor and Scalar control or constant V/f control of induction motor.				3									3			1
[CO5]	Examine& describe Operation of multi –quadrant dc machines and choppers.		1	2											2		1
[CO6]	Design the power electronic converters used for dc motor and induction motor speed control.		2		3										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Analog and Digital Communication

Code:BTE27331

3 Credits | Semester VII

A. Introduction:

- To know different parameters Analog modulation and Behavior of associated communication system.
- To study about characteristics of detection of pulse modulation.
- To learn different types digital modulation and bit error performance

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recall the behavior of a communication system in presence of noise.
[CO2] Compare different analog modulation schemes for their efficiency and bandwidth.
[CO3] Apply different digital modulation schemes and compute the bit error performance.
[CO4] Explain different Analysis and Detection of Characteristics of PMS
[CO5]Interpret pulsed modulation system and analyze their system performance.
[CO6] Build an innovative technique for Carrier Recovery for Digital modulation.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

ANALOG MODULATION SYSTEM: Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals

BEHAVIOR OF A COMMUNICATION SYSTEM: Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

PULSED MODULATION SYSTEM: Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

ANALYSIS AND DETECTION OF CHARACTERISTICS OF PMS: Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms Probability of

Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion, Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying

DIGITAL MODULATION AND BIT ERROR PERFORMANCE: Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation

E. TEXT BOOKS

T1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
T2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.

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F. REFERENCE BOOKS

R1. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill,2001.
R2. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering", John Wiley,1965.
R3. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
R4. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall the behavior of a communication system in presence of noise.					2								2		1	
[CO2]	Compare different analog modulation schemes for their efficiency and bandwidth.		2			1								2			
[CO3]	Apply different digital modulation schemes and compute the bit error performance.	2				3										3	
[CO4]	Explain different Analysis and Detection of Characteristics of PMS		2	1										2			
[CO5]	Interpret pulsed modulation system and analyze their system performance.				3										2		
[CO6]	Build an innovative technique for Carrier Recovery for Digital modulation.				2										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Embedded Systems

Code:BTE26106

3 Credits | Semester VII

A. Introduction:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recognize the differences between the general computing system and the embedded system.

[CO2] Understand hardware and software design requirements of embedded systems.

[CO3] Apply interfacing design for peripherals like I/O, A/D, D/A, timer etc.

[CO4] Analyze the embedded systems' specification and develop software programs.

[CO5]Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.

[CO6] Design real time embedded systems using the concepts of RTOS.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO EMBEDDED SYSTEMS: Introduction, Structural units in Embedded processor, selection of processor & memory devices, challenges in embedded system design, DMA – Memory management methods- Timer and Countingdevices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

EMBEDDED NETWORKING: Introduction, I/O Device Ports & Buses– Serial Bus communicationprotocols RS232 standard – RS422 – RS 485 – CAN. Bus -Serial Peripheral Interface (SPI) – InterIntegrated Circuits (I2C) –need for device drivers.

EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT: Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling ofEDLC; issues in Hardware-software Co-design, Data Flow Graph.State machine model, Sequential Program Model, concurrent Model, object oriented Model.

RTOS BASED EMBEDDED SYSTEM DESIGN: Introduction to basic concepts of RTOS-Task, process & threads, interrupt routines in RTOS,Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Taskcommunication shared memory, message passing-, Inter process Communication –synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priorityinheritance

EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT: Case Study of Washing Machine**-** Automotive Application**-** Smart card System Application-ATMmachine –Digital camera**.** Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

E. TEXT BOOKS

T1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.

T2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.

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F. REFERENCE BOOKS

R1. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.

R2. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.

R3. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize the differences between the general computing system and the embedded system.					2								1		2	
[CO2]	Understand hardware and software design requirements of embedded systems.		2			1								2		1	
[CO3]	Apply interfacing design for peripherals like I/O, A/D, D/A, timer etc.	2				3										3	
[CO4]	Analyze the embedded systems' specification and develop software programs.		1		3									2			
[CO5]	Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.				1	1									1		
[CO6]	Design real time embedded systems using the concepts of RTOS.			3	2										2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Fluid Machinery

Code:BTE26163

3 Credits | Semester VII

A. Introduction:

- To Study of flow measuring devices.
- To Use pumps & turbine under specified conditions.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Label the impact on JET.

[CO2] Explain flow of fluid through different pipes.

[CO3] Apply fluid mechanics concepts and its applications to various real life-engineering problems like notches, flow-measuring devices etc.

[CO4] Analyze the construction and working of turbines and pumps and test the performance of turbines and pumps.

[CO5]Evaluate different parameters such as co-efficient of friction, power, efficiency etc. of various systems.

[CO6] Improve characteristics curves of turbines and pumps.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

PROPERTIES OF FLUID AND FLUID PRESSURE & PRESSURE MEASUREMENT: Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility, Fluid pressure ,Pressure head, Pressure intensity, Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure, Simple and differential manometers, Bourdon pressure gauge. Total pressure, centre of pressure of plane, regular surfaces immersed in liquid. Horizontally, vertically and inclined.

Note: Numerical on Manometers, Total Pressure & Centre of pressure

FLUID FLOW AND FLOW THROUGH PIPES: Types of fluid flows, Continuity equation Bernoulli's theorem, Venturimeter– Construction, principle of working, Coefficient of discharge, Derivation for discharge through venturimeter. Orifice meter– Construction, Principle of working, hydraulic coefficients ,Derivation for discharge through Orifice meter Pilottube– Construction, Principle of Working Note:-Numerical son Venturimeter, orifice meter ,pilottube, Laws of fluid friction (Laminar and turbulent. Darcy's equation and Chezy's equation for frictional losses. Minor losses in pipes, Hydraulic gradient and total gradient line. Hydraulic power transmission through pipe, Note: Numerical to estimate major and minor losses

IMPACT OF JET: Impact of jet on fixed vertical, moving vertical, flatplates. Impact of jet on curved vanes with special reference to turbines &pumps

Note-Simple Numerical on work done and efficiency

HYDRAULIC TURBINES: Layout of hydro- electric power plant. Features of Hydro - electric power plant, Classification of hydraulic turbines. Selection of turbine on the basis of head and discharge available, Construction and working principle of Pelton-wheel, Francis and Kaplan turbine. Draft tubes – types and construction, Concept of cavitation in turbines Calculation of Work done, Power, efficiency of turbine.

CENTRIFUGAL PUMPS: Construction, principle of working and applications. Types of casings and impellers. Concept of multistage, Priming and its methods, Manometrichead, Work done, Manometricefficiency, Overall efficiency, NPSH. Performance Characteristics of Centrifugal pumps. Trouble Shooting. Construction, working and applications of submersible, jet pump

Note: Numericals on calculations of overall efficiency and power required to drive pumps**.** Reciprocating Pump, Construction, working principle and applications of single and double acting reciprocating pumps. Concept of Slip, Negative slip, Cavitation and separation. Use of Air Vessel. Indicator diagram with effect of acceleration head &Frictional head.
Note:-No Derivations and Numerical on reciprocating Pumps.

E. TEXT BOOKS

T1. Modi,P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
T2. S.S. Rattan, Fluid Mechanics and Hydraulic Machines, Khanna Publishing House, Delhi
.

F-REFERENCE BOOKS

R1.Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, DhanpatRai Publishing Company, New Delhi.
R2.Khurmi,R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S Chand Publishers, New Delhi.

R3.Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
R4.Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize the differences between the general computing system and the embedded system.					2										2	
[CO2]	Understand hardware and software design requirements of embedded systems.		2											2			1
[CO3]	Apply interfacing design for peripherals like I/O, A/D, D/A, timer etc.	2				2										3	
[CO4]	Analyze the embedded systems' specification and develop software programs.				2									2			
[CO5]	Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.			1	1										1		
[CO6]	Design real time embedded systems using the concepts of RTOS.			2	1										2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Power Plant Engineering

Code:BTE27211

3 Credits | Semester VII

A. Introduction:

- To study coal based thermal power plant and Hydro-power plant.
- To study nuclear Energy and use of different Reactors
- To provide an overview of power plants and the associated energy conversion issues

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Define the working principle of Gas turbine power plant, its layout, safety principles and compare it with plants of other types.
[CO2] Understand the working principle and basic components of the nuclear power plant and the economic and safety principles involved with it.
[CO3] Utilize economics of power plants and list factors affecting the power plants.
[CO4] Analyse the working and operation of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts.
[CO5]Determine performance of different power plants based on load variations.
[CO6] Choose different types of sources and mathematical expressions related to thermodynamics and improve factors involved with power plant operation.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

COAL BASED THERMAL POWER PLANT: Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates**.** Subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems

GAS TURBINE: Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants Combined cycle power plants; Integrated Gasifier based Combined Cycle (IGCC) systems.

NUCLEAR ENERGY AND REACTOR: Basics of nuclear energy conversion, Layout and subsyst ems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety ,Measures for nuclear power plants.

HYDROELECTRIC POWER PLANT: Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal. Solar PV and solar thermal, geothermal, biogas and fuel cell power systems.

ENVIRONMENTAL ECONOMY AND COSTING: Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating. Cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants

E. TEXT BOOKS

T1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.

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F. REFERENCE BOOKS

R1. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.

R2. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998

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G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Define the working principle of Gas turbine power plant, its layout, safety principles and compare it with plants of other types.					**2**										**2**	**1**
[CO2]	Understand the working principle and basic components of the nuclear power plant and the economic and safety principles involved with it.		**1**			**2**								**2**			
[CO3]	Utilize economics of power plants and list factors affecting the power plants.	**1**			**2**											**3**	
[CO4]	Analyse the working and operation of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts.		**1**		**3**									**2**			**2**
[CO5]	Determine performance of different power plants based on load variations.		**2**		**1**										**1**	**1**	
[CO6]	Choose different types of sources and mathematical expressions related to thermodynamics and improve factors involved with power plant operation.			**1**	**1**										**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Image Processing

Code:BTE27332

3 Credits | Semester VII

A. Introduction:

- To develop an overview of the field of image processing.
- To understand the fundamental algorithms and how to implement them.
- To prepare to read the current image processing research literature.
- To gain experience in applying image processing algorithms to real problems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Tell fundamental of digital image.
[CO2] Explain different process of image enhancement and image restoration.
[CO3] Carry out process of color imaging.
[CO4] Discover the basic principles of wavelets and multi-resolution processing
[CO5] Interpret different causes for image degradation and overview of image restoration techniques.
[CO6] Design application software of image compression and principal of object recognition.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DIGITAL IMAGE FUNDAMENTALS: Introduction, Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures. Subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems.

IMAGE ENHANCEMENT AND IMAGE RESTORATION: Image enhancement in the spatial domain: Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing and sharpening spatial filters, combining the spatial enhancement methods. A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms; Introduction to the Fourier transform and the frequency domain, estimating the degradation function

COLOR IMAGE PROCESSING: Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation. Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding–global and adaptive, region-based segmentation.

WAVELETS AND MULTI-RESOLUTION PROCESSING: Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphologic algorithms**.** Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time frequency localization, Continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Sub band filter banks, wavelet packets

IMAGE COMPRESSION AND OBJECT RECOGNITION: Image Compression- Redundancy–inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards–JPEG and JPEG-2000. Object Recognition : Patterns and patterns classes, recognition based on decision–theoretic methods, matching, optimum statistical classifiers, neural networks, structural methods – matching shape numbers, string matching

E. TEXT BOOKS

T1. Digital Image Processing, RafealC.Gonzalez, Richard E.Woods, Second Edition, PearsonEducation/PHI.

T2. Al Bovik (ed.), “Handbook of Image and Video Processing”, Academic Press, 2000.

T3. A.K. Jain, “Fundamentals of Digital Image Processing”, Prentice-Hall, Addison-Wesley, 1989.

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F-REFERENCE BOOKS

R1. Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning

R2.Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology

R3.Computer Vision and Image Processing, Adrian Low, Second Edition, B.S.Publications

R4.Digital Image Processing using Matlab, RafealC.Gonzalez, Richard E.Woods, Steven L. Eddins, Pearson Education

R5. M. Petrou, P. Bosdogianni, “Image Processing, The Fundamentals“, Wiley, 1999.
R6.P.RameshBabu, Digital Image Processing. Scitech Publications., 2003 5. Bernd Jähne,
R7.Digital Image Processing, Springer-Verlag Berlin Heidelberg 2005. 6.
R8.B. Jähne, “Practical Handbook on Image Processing for Scientific Applications“, CRC Press, 1997.
R9. J. C. Russ. The Image Processing Handbook. CRC, Boca Raton, FL, 4th edn., 2002.
R10. J. S. Lim, “Two-dimensional Signal and Image Processing” Prentice-Hall, 1990.
R11. W. K. Pratt. Digital image processing, PIKS Inside. Wiley, New York, 3rd, edn., 2001.
R12. StephaneMarchand-Maillet, Yazid M. Sharaiha, Binary Digital Image Processing, A Discrete Approach, Academic Press, 2000

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Tell fundamental of digital image.					1										2	
[CO2]	Explain different process of image enhancement and image restoration.		1		2									2			1
[CO3]	Carry out process of color imaging.	1		2	2											3	
[CO4]	Discover the basic principles of wavelets and multi-resolution processing		1	1										2			
[CO5]	Interpret different causes for image degradation and overview of image restoration techniques.				3										1	1	
[CO6]	Design application software of image compression and principal of object recognition.			3	2										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Automobile Engineering

Code:BTE28249

3 Credits | Semester VII

A. Introduction:

- To Study the construction and working principle of various parts of an automobile.
- To Study the function of each automobile componentand also have a clear idea about the overall vehicle performance.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recall the working and principle of engines.
[CO2] Understand the types and function of automobile.
[CO3] Apply the knowledge of EVs, HEVs & solar vehicles.
[CO4] Compare & select the proper automotive system for the vehicle.
[CO5] Explain use alternative energy sources in automobile
[CO6] Design a new concept of work process component of automobile.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

TYPES OF AUTOMOBILE: Types of automobiles, vehicle construction and layouts, chassis, frame and body, vehicle aerodynamics, IC engines-components, function and materials, variable valve timing (VVT).

ENGINES: Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotary distributor type and common rail direct injection system. Transistor based coil ignition & capacitive discharge ignition systems, turbo chargers (WGT, VGT), engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).

MECHANISM OF AUTOMOBILE: Transmission systems, clutch types & construction, gear boxes-manual and automatic gearshift mechanisms, over drive, transfer box, flywheel, torque converter, propeller shaft, slip joints, universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive.

STEERING AND BRAKING SYSTEM: Steering geometry and types of steering gear box, power steering, types of front axle, types of suspension systems, pneumatic and hydraulic braking systems, antilock braking system (ABS), electronic brake force distribution (EBD) and traction control.

ALTERNATIVE ENERGY SOURCES: Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels inautomobiles, modifications needed, performance, combustion & emission characteristics of alternative fuels in SI and CI engines, Electric and Hybrid vehicles, application of Fuel Cells

E. TEXT BOOKS

T1. Kirpal Singh, Automobile Engineering, 7th ed., Standard Publishers, New Delhi, 1997.

F-REFERENCE BOOKS

R1. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.
R2. Heitner J., Automotive Mechanics, 2nd ed., East-West Press, 1999
R3. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recall the working and principle of engines.		2			1										2	
[CO2]	Understand the types and function of automobile.		2											2			
[CO3]	Apply the knowledge of EVs, HEVs & solar vehicles.	2				3										3	
[CO4]	Compare & select the proper automotive system for the vehicle.		2	1										2			
[CO5]	Explain use alternative energy sources in automobile			1											1		1
[CO6]	Design a new concept of work process component of automobile.			2	3										3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Project Management

Code:BTE28352

3 Credits | Semester VII

A. Introduction:

- To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.
  To develop an understanding of key project management skills

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recognize functions of management and practice in real world.
[CO2] Understand the importance of projects and its phases.
[CO3] Apply crashing procedures for time and cost optimization.
[CO4] Analyze projects from marketing, operational and financial perspectives.
[CO5] Evaluate projects based on discount and non-discount methods
[CO6] Develop network diagrams for planning and execution of a given project.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

CONCEPT OF A PROJECT: Classification of projects- importance of project management- The project life cycle- establishing project priorities (scope-cost-time) project priority matrix- work break down structure. Subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems

CAPITAL BUDGETING PROCESS: Planning-Analysis-Selection-Financing-Implementation Review. Generation and screening of project ideas- market and demand analysis- Demand forecasting techniques. Market planning and marketing research process- Technical analysis

FINANCIAL ESTIMATES AND PROJECTIONS: Cost of projects-means of financing-estimates of sales and production-cost of production-Working capital requirement and its financing-profitability projected cash flow statement and balance sheet. Break even analysis

BASIC TECHNIQUES IN CAPITAL BUDGETING: Non discounting and discounting methods- paybackperiod- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return.

Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of projects**.**

PROGRESS PAYMENTS: Progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress, time-cost trade off. Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management softwares

E. TEXT BOOKS

T1. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill

T2. Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson – McGraw Hill

F-REFERENCE BOOKS

R1. Project management - David I Cleland - Mcgraw Hill International Edition, 1999

R2Project Management – Gopalakrishnan – Mcmillan India Ltd.

R3Project Management-Harry-Maylor-Peason Publication

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize functions of management and practice in real world.							1	2								2
[CO2]	Understand the importance of projects and its phases.										1			2			
[CO3]	Apply crashing procedures for time and cost optimization.											3				2	1
[CO4]	Analyze projects from marketing, operational and financial perspectives.											3		3			
[CO5]	Evaluate projects based on discount and non-discount methods											3				1	2
[CO6]	Develop network diagrams for planning and execution of a given project.									2			2		2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject:Summer Internship-II

Code:BTE27349

3 Credits | Semester VII

A. Introduction:

- Following are the intended objectives of internship training:
- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' in classroom will be use in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job

B. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	30
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

GUIDELINES FOR INTERNSHIP

Summer Internship –II should be undertaken in an industry only

S.No.	Suggested Schedule	Suggested Duration (In weeks)	Activities
1	Summer/winter vacation after 4th Semester	4-6	Inter/Intra Institutional Activities

Subject:Minor Project

Code:BTE27348

3 Credits | Semester VII

A. Introduction: The objective of this course is to prepare students to use applications of the theory and practical learned during the course. It will also help students to develop an industry or research oriented project. This course helps students how to carry out project/studies in the field of interest of the student or as given by the industry.

B.Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	30
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

GUIDELINES FOR PROJECT

Minor Project should be based on real/ live problems of the Industry/Govt./NGO/ MSME/Rural Sector or an innovative idea having the potential of a Startup and this project to be carried over to next semester.

ARKA JAIN University Jharkhand

Syllabus of

B.Tech in Electrical & Electronics Engineering

Semester-VIII

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE
Scheme of Study (w.e.f Batch 2020-21)

SCHEME OF THE STUDY
SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SCHEME OF THE STUDY
SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Circuit Analysis	PCC	3	3	100	70	20	5	5
2	Electromagnetic Fields	PCC	4	4	100	70	20	5	5
3	Analog Electronic	PCC	3	3	100	70	20	5	5
4	Engineering Mathematics – III	BSC	4	4	100	70	20	5	5
5	Electrical Machines-I	PCC	4	4	100	70	20	5	5
6	Environmental Sciences	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Circuit Analysis Lab	PCC	1	2	50	35	5	5	5
8	Electrical Machines-I Lab	PCC	1	2	50	35	5	5	5
9	Analog Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**21**	**26**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Electrical Machines-II	PCC	4	4	100	70	20	5	5
2	Digital Electronics	PCC	3	3	100	70	20	5	5
3	Power Electronics	PCC	4	4	100	70	20	5	5
4	Signals and Systems	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
6	Essence of Indian Knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	PRACTICAL								
7	Electrical Machines II Lab	PCC	1	2	50	35	5	5	5
8	Digital Electronics Lab	PCC	1	2	50	35	5	5	5
9	Power Electronics Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**25**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Power Systems–I	PCC	3	3	100	70	20	5	5
2	Control Systems	PCC	3	3	100	70	20	5	5
3	Microprocessors	PCC	3	3	100	70	20	5	5
4	Program Elective – I Electrical Energy Conservation and Auditing Electrical Machine Design Industrial Electrical Systems	PEC	3	3	100	70	20	5	5
5	Open elective-I Electronic Devices Strength of Materials Data Structures and Algorithms	OEC	3	3	100	70	20	5	5
6	Professional practice law & ethics	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
7	Power Systems I Lab	PCC	1	2	50	35	5	5	5
8	Control Systems Lab	PCC	1	2	50	35	5	5	5
9	Microprocessors Lab	PCC	1	2	50	35	5	5	5
10	Summer Internship-1(3-4 Weeks)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**24**	**800**	**560**	**150**	**45**	**45**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Power Systems – II	PCC	3	3	100	70	20	5	5
2	Measurements and Instrumentation	PCC	3	3	100	70	20	5	5
3	Program Elective – II Digital Signal Processing Control Systems Design	PEC	3	3	100	70	20	5	5
4	Program Elective – III Line Commutated and Active Rectifiers High Voltage Engineering Electromagnetic Waves	PEC	3	3	100	70	20	5	5
5	Open Elective –II Wavelet Transforms Internet of Things Thermal and Fluid Engineering	OEC	3	3	100	70	20	5	5
6	IPR	HSMC	3	3	100	70	20	5	5
	Practical								
7	Power Systems II Lab	PCC	1	2	50	35	5	5	5
8	Measurements and Instrumentation Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**22**	**700**	**490**	**130**	**40**	**40**

SEMESTER VII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Professional Elective -IV Power System Protection Electrical and Hybrid Vehicles Computational Electromagnetic	PEC	3	3	100	70	20	5	5
2	Professional Elective - V Power System Dynamics andControl Power Quality and FACTS Electrical Drives	PEC	3	3	100	70	20	5	5
3	Open Elective - III Analog and Digital Communication Embedded Systems Fluid Machinery	OEC	3	3	100	70	20	5	5
4	Open Elective - IV Power Plant Engineering Image Processing Automobile Engineering	OEC	3	3	100	70	20	5	5
5	Project Management	HSMC	3	3	100	70	20	5	5
	PRACTICAL								
9	Summer Internship-II(4-6 Weeks)	PROJ	3	0	100	70	30	0	0
10	Minor Project(Project to be carried over to next semester)	PROJ	3	6	100	70	30	0	0
	TOTAL		**21**	**21**	**600**	**490**	**160**	**25**	**25**

SEMESTER VIII

Sl. No.	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA	Attendance
1	Professional Elective - VI HVDC Transmission Systems Wind and Solar Energy Systems Advanced Electric Drives	PEC	3	3	100	70	20	5	5
2	Open Elective- V VLSI circuits Modern Manufacturing Processes Computer Networks	OEC	3	3	100	70	20	5	5
3	Open Elective - VI Electrical Materials Big Data Analysis	OEC	3	3	100	70	20	5	5
	PRACTICAL								
4	Major Project	PROJ	8	16	200	140	60	0	0
5	Extra-Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**17**	**25**	**600**	**420**	**150**	**15**	**15**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	5	15
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	8	18
4	Professional core courses (**PCC)**	24	54
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	6	18
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	163

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - EEE

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1].Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3].Design/Development of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion.

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.
[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Specify& analyze: An ability to identify, specify and analyze systems that inefficiently deliver technological solution in electrical & electronics engineering

[PSO.2]. Design/development of solutions: Design solutions for complex electronics engineering problem & design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, & the cultural, society & environmental considerations.

[PSO.3]. Modern tool usage: Create, select, & apply appropriate electrical techniques, resources & modern engineering including prediction & modeling to complex electrical systems with an understanding of the limitations & short comes.

[PSO.4]. Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Electrical systems & processes & communicate effectively with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions.

HVDC Transmission Systems

Code:BTE28354

3 Credits | Semester VIII

A. Introduction:

- To understand the merits of DC transmission.
- To know how to improve the power system stability using an HVDC system.
- To learn the control strategies used in HVDC transmission system.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] List the advantages of dc transmission over ac transmission.
[CO2] Understand the operation of Line Commutated Converters and Voltage Source Converters.
[CO3] Develop the control strategies used in HVDC transmission system.
[CO4] Analyze the reactive & active power flow in HVDC transmission system.
[CO5] Evaluate the performance parameters for converters in HVDC transmission systems.
[CO6] Formulate methods for improvement of power system stability using an HVDC system.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DC TRANSMISSION TECHNOLOGY: Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission, Types of HVDC Systems, Components of a HVDC system. Line Commutated Converter and Voltage Source Converter based systems.

ANALYSIS OF LINE COMMUTATED AND VOLTAGE SOURCE CONVERTERS: Line Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonicsTwelve Pulse Converters, Inverter Operation, Effect of Commutation Overlap, Expressions for average dc voltage, AC current and reactive power absorbed by the converters, Effect of Commutation Failure, Misfire and Current Extinction in LCC links.Voltage Source Converters (VSCs): Two and Three-level VSCs.PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation.Analysis of a six-pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC.

CONTROL OF HVDC CONVERTERS: Principles of Link Control in a LCC-HVDC systemControl Hierarchy, Firing Angle Controls – Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link Higher level Controllers Power control, Frequency Control, Stability ControllersReactive Power Control, Principles of Link Control in a VSC HVDC system: Power flow and dc Voltage Control, AC voltage regulation.

COMPONENTS OF HVDC SYSTEMS: Smoothing Reactors, Reactive Power Sources and Filters in LCC HVDC systems DC lineCorona Effects, Insulators, Transient Over-voltages, DC line faults in LCC systems, DC line faults in VSC systems, DC breakers, Monopolar Operation, Ground Electrodes

STABILITY ENHANCEMENT USING HVDC CONTROL & MTDC LINKS: Basic Concepts: Power System Angular, Voltage and Frequency Stability, Power Modulation: basic principles – synchronous and asynchronous links, Voltage Stability Problem in AC/DC systems. Multi-Terminal and Multi-Infeed Systems. Series and Parallel MTDC systems using LCCs. MTDC systems using VSCs. Modern Trends in HVDC Technology. Introduction to Modular Multi-level Converter

E. TEXT BOOKS

T1. K. R. Padiyar, "HVDC Power Transmission Systems", New Age International Publishers, 2011.

F. REFERENCE BOOKS

R1. J. Arrillaga, "High Voltage Direct Current Transmission", Peter Peregrinus Ltd., 1983.
R2. E. W. Kimbark, "Direct Current Transmission", Vol.1, Wiley-Interscience, 1971.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	List the advantages of dc transmission over ac transmission.					**2**										**2**	
[CO2]	Understand the operation of Line Commutated Converters and Voltage Source Converters.		**2**											**2**			
[CO3]	Develop the control strategies used in HVDC transmission system.	**1**		**3**												**2**	
[CO4]	Analyze the reactive & active power flow in HVDC transmission system.				**3**									**3**			
[CO5]	Evaluate the performance parameters for converters in HVDC transmission systems.				**2**										**1**		
[CO6]	Formulate methods for improvement of power system stability using an HVDC system.		**3**		**1**										**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Wind and Solar Energy Systems

Code:BTE28355
3 Credits | Semester VIII

A. Introduction:

- To understand the major working components of wind & solar generating plants.
- To know how to tackle with issues related to the grid-integration of solar and wind energy systems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify the basic properties of different renewable sources of energy and technologies for their utilisation,
[CO2] Understand the basic physics of wind and solar power generation.
[CO3] Describe main elements of technical systems designed for utilisation of renewable sources of energy.
[CO4] Discover the issues related to the grid-integration of solar and wind energy systems.
[CO5] Interpret the energy scenario and the consequent growth of the power generation from renewable energy sources.
[CO6] Design a power electronic interface for wind and solar generation.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

PHYSICS OF WIND POWER: History of wind power, Indian and Global statistics,Wind physics, Betz limit, Tip speed ratio, stall and pitch control,Wind speed statistics-probability distributionsWind speed and power-cumulative distribution function

WIND GENERATOR TOPOLOGIES: Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control

THE SOLAR RESOURCE: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability, Technologies-Amorphous, monocrystalline, polycrystalline,, V-I characteristics of a PV cell, PV module, array.

Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms, Converter Control.

NETWORK INTEGRATION ISSUES: Overview of grid code technical requirements, Fault ride-through for wind farms - real and reactive, power regulation, voltage and frequency operating limits

Solar PV and wind farm behavior during grid disturbances, Power quality issues, Power system interconnection experiences in the world,Hybrid and isolated operations of solar PV and wind systems

SOLAR THERMAL POWER GENERATION: Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

E. TEXT BOOKS

T1. Mukund R. Patel, Wind and Solar Power Systems: Design, Analysis, and Operation, Second Edition, CRC Press, 2015.

T2. Kenneth, Wind Solar Hybrid Renewable Energy System, INTECHOPEN LIMITED, 2020

F. REFERENCE BOOKS

R1. David M. Buchla, Renewable Energy Systems, Pearson Publication, 2017

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the basic properties of different renewable sources of energy and technologies for their utilisation,		**3**			**1**								**2**			
[CO2]	Understand the basic physics of wind and solar power generation.	**2**				**1**								**1**			
[CO3]	Describe main elements of technical systems designed for utilisation of renewable sources of energy.	**1**	**2**													**2**	**1**
[CO4]	Discover the issues related to the grid-integration of solar and wind energy systems.			**2**										**1**		**2**	
[CO5]	Interpret the energy scenario and the consequent growth of the power generation from renewable energy sources.				**3**										**2**		
[CO6]	Design a power electronic interface for wind and solar generation.			**2**	**3**	**1**									**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Advanced Electric Drives

Code:BTE28356

3 Credits | Semester VIII

A. Introduction:

- To understand the operation of power electronic converters.
- To know how to implement the control strategies using digital signal processors.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recognize the operation of power electronic converters and their control strategies.
[CO2] Understand the vector control strategies for ac motor drives.
[CO3] Implement the control strategies using digital signal processors.
[CO4] Analyze the various drives for AC machines.
[CO5] Evaluate the performance parameters for AC drives.
[CO6] Improve the working and design details of frequency-controlled converters used in induction motor drives.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

POWER CONVERTERS FOR AC DRIVES: PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies. SVM for 3-level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.

INDUCTION MOTOR DRIVES: Different transformations and reference frame theory, Modeling of induction machines, Voltage fed inverter control-v/f control, Vector control, direct torque and flux control (DTC)

SYNCHRONOUS MOTOR DRIVES: Modeling of synchronous machines, Open loop v/f control, Vector control, direct torque control,CSI fed synchronous motor drives

PERMANENT MAGNET MOTOR & SWITCHED RELUCTANCE MOTOR DRIVES: Introduction to various PM motors,BLDC and PMSM drive configuration, comparison, block diagrams,Speed and torque control in BLDC and PMSM,Evolution of switched reluctance motors, various topologies for SRM drives, comparison,Closed loop speed and torque control of SRM.

DSP BASED MOTION CONTROL: Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.

E. TEXT BOOKS

T1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
T2. P.C. Krause, O. Wasynczuk and S.D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.

F. REFERENCE BOOKS

R1. H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.
R2. R. Krishnan, "Permanent MagnetSynchronous and Brushless DC motor Drives", CRC Press, 2009.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Recognize the operation of power electronic converters and their control strategies.					**1**										**3**	
[CO2]	Understand the vector control strategies for ac motor drives.		**2**			**2**								**1**			
[CO3]	Implement the control strategies using digital signal processors.	**2**		**1**												**3**	
[CO4]	Analyze the various drives for AC machines.				**3**									**2**			
[CO5]	Evaluate the performance parameters for AC drives.				**1**										**2**		
[CO6]	Improve the working and design details of frequency-controlled converters used in induction motor drives.			**2**	**2**	**1**									**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

VLSI Circuit

Code:BTE28357

3 Credits | Semester VIII

A. Introduction:

- To understand the concept of VLSI design.
- To know the micro-electronic processes for VLSI fabrication.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Recognize the scale of integration for VLSI design.
[CO2] Understanding the processes for VLSI fabrication.
[CO3] Solve the performance issues in circuit layout.
[CO4] Analyze circuits using both analytical and CAD tools.
[CO5] Interpret logic circuits with different design styles.
[CO6] Create appropriate automation algorithms for partitioning, floor planning, placement and routing.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO VLSI DESIGN: VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog& Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.

MOS STRUCTURE: E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat-band voltage, Potential balance & Charge balance, Inversion, MOS capacitances .Three Terminal MOS Structure: Body effect. Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation). Scaling in MOSFET: Short Channel Effects, General scaling, Constant Voltage & Field scaling.

CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate usingCMOS.

MICRO-ELECTRONIC PROCESSES FOR VLSI FABRICATION: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist, Basic CMOS

Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, Layout Design Rule: Stick diagram with examples, Layout rules.

HARDWARE DESCRIPTION LANGUAGE: VHDL or Verilog Combinational & Sequential Logic circuit Design.

E. TEXT BOOKS

T1. Modern VLSI Design, Wayne Wolf, Pearson Education.
T2. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.

F. REFERENCE BOOKS

R1. CMOS Digital Integrated Circuit, S.M.Kang &Y.Leblebici, TMH.
R2. VHDL, Bhaskar, PHI.
R3. Advance Digital Design Using Verilog, Michel D. Celliti, PHI

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Recognize the scale of integration for VLSI design.					2										2	
[CO2]	Understanding the processes for VLSI fabrication.		1			1								3			
[CO3]	Solve the performance issues in circuit layout.	1	2	1												2	
[CO4]	Analyze circuits using both analytical and CAD tools.				3									3			
[CO5]	Interpret logic circuits with different design styles.				3										2		
[CO6]	Create appropriate automation algorithms for partitioning, floor planning, placement and routing.			1		3									2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Modern Manufacturing Processes

Code:BTE28358

3 Credits | Semester VIII

A. Introduction:

- To understandthe different conventional and unconventional manufacturing methods.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify the appropriate process parameters, and possible defects of manufacturing processes to remove them.
[CO2] Understand the different conventional and unconventional manufacturing methods employed for making different products.
[CO3] Develop simplified manufacturing processes with the aim of reduction of cost & manpower.
[CO4] Compare basic manufacturing processes of Casting, Joining, Forming and machining.
[CO5] Choose suitable manufacturing processes to manufacture the products optimally.
[CO6] Plan sequential action in manufacturing through practice in various sections.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

CONVENTIONAL MANUFACTURING PROCESSES: Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses; Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming(forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

METAL CUTTING: Single and multi-point cutting; Orthogonal cutting, various force components: Chip, formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials,, Cutting fluids, Coating;

Turning, Drilling, Milling and finishing processes, Introduction to CNC machining, Additive manufacturing: Rapid prototyping and rapid tooling

JOINING/FASTENING PROCESSES: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding

UNCONVENTIONAL MACHINING PROCESSES: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters, Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining

MACHINING PROCESSES: Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear,dielectric, power and control circuits, wire EDMElectro-chemical machining (ECM), etchant &maskant, process parameters, MRR and surface finish

E. TEXT BOOKS

T1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014
T2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
T3. Degarmo, Black &Kohser, Materials and Processes in Manufacturing

F. REFERENCE BOOKS

R1. Kirpal Singh, Automobile Engineering, 7th ed., Standard Publishers, New Delhi, 1997.
R2. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.
R3. Heitner J., Automotive Mechanics, 2nd ed., East-West Press, 1999.
R4. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the appropriate process parameters, and possible defects of manufacturing processes to remove them.		3											3			
[CO2]	Understand the different conventional and unconventional manufacturing methods employed for making different products.		1											2			
[CO3]	Develop simplified manufacturing processes with the aim of reduction of cost & manpower.											2				2	
[CO4]	Compare basic manufacturing processes of Casting, Joining, Forming and machining.		2											2			
[CO5]	Choose suitable manufacturing processes to manufacture the products optimally.												2		1		
[CO6]	Plan sequential action in manufacturing through practice in various sections.				2	1									2		1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Computer Networks

Code:BTE26138
3 Credits | Semester VIII

A. Introduction:

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming.
- To provide a WLAN measurement ideas.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify the functional blocks of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) & describe the function of each block.
[CO2] Explain the functions of the different layer of the OSI Protocol.
[CO3] Apply the knowledge in some specific areas of networking such as the design and maintenance of individual networks.
[CO4] Analyze and evaluate a number of datalink, network, and transport layer protocols.
[CO5] Program network communication services for client/server and other application layouts.
[CO6] Design of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) based on the market available component.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DATA COMMUNICATION COMPONENTS: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards.OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN,Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRCFlow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access. Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

NETWORK LAYER: Switching, Logical addressing – IPV4, IPV6, Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

TRANSPORT LAYER: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control, Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm

APPLICATION LAYER: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP),HTTP, SNMP, Bluetooth, Firewalls, Basic concepts ofCryptography

E. TEXT BOOKS

T1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.

T2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

F. REFERENCE BOOKS

R1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

R2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice NHall of India.

R3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the functional blocks of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) & describe the function of each block.		3											1		2	
[CO2]	Explain the functions of the different layer of the OSI Protocol.		2	1										2			1
[CO3]	Apply the knowledge in some specific areas of networking such as the design and maintenance of individual networks.	2				3										2	
[CO4]	Analyze and evaluate a number of data link, network, and transport layer protocols.				3									2			
[CO5]	Program network communication services for client/server and other application layouts.				1										1		
[CO6]	Design of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) based on the market available component.			2	3										2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Electrical Materials

Code:BTE28359

3 Credits | Semester VIII

A. Introduction:

- To understand Electrical system, Materials are the building blocks.
- The present subject aims at giving the students a basic knowledge necessary for understanding of electric, magnetic materials.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Select insulating, conducting and magnetic materials used in electrical machines.
[CO2] Understand the properties of liquid, gaseous and solid insulating materials.
[CO3] Apply the physics behind the electrical engineering materials.
[CO4]Analyze the electrical properties and characteristics of various materials, used in the electrical appliances, devices & instruments.
[CO5]Evaluate breakdown strength of transformer oil by testing.
[CO6] Create innovative research in the field of electrical engineering material science.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DIELECTRIC MATERIALS: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, and curie point, anti-ferromagnetic materials, piezoelectric materials, pyro electric materials.

MAGNETIC MATERIALS: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy,Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis.

SEMI-CONDUCTOR MATERIALS: Crystal growth, zone refining, Degenerate and no degenerate semiconductors, Direct and indirect band gap semiconductors, Electronic properties of silicon, Germanium, Compound Semiconductor, Gallium Arsenide, gallium phosphide & Silicon carbide.

CONDUCTIVE & SUPERCONDUCTIVE MATERIALS: Electrical properties of conductive and resistive materials. Important characteristics and electronic applications of specific conductor & resistance materials. Superconductor phenomenon, Type I, Type II superconductors, and their applications

MATERIALS FOR ELECTRICAL APPLICATIONS AND SPECIAL PURPOSE MATERIALS: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses. Soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid Liquid and Gaseous insulating materials. Effect of moisture on insulation. Refractory Materials, Structural Materials, Radioactive Materials, Galvonization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI.

E. TEXT BOOKS

T1. S. O. Kasap, “Principle of Electrical Engineering materials and devices” , 3/e, TMH 2013

T2. B. D. Indu, “Electrical Engineering Materials”, Jain Brothers. 2006

T3. R K Rajput: A course in Electrical Engineering Materials, Laxmi Publications. 2009

F. REFERENCE BOOKS

R1. Robert M Rose, “Structures and Properties of Materials Volume IV”, Electronic Properties, Wiley.

R2. S. P. Seth and P. V. Gupta, “A Course of Electrical Engineering Materials”, DhanpatRai& Sons.

R3. C. S. Indulkar& S. Thiruvengadam, “An Introduction to Electrical Engineering Materials”, S.Chand. 1994

R4. A.J. Dekker, “Electrical Engineering Materials”, Prentice Hall of India. 2010

R5. C.S. Indulkar&S.Triruvagdan “An Introduction to Electrical Engg. Materials, S.Chand& Co. 2010

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
[CO1]	Select insulating, conducting and magnetic materials used in electrical machines.					**2**								**2**			
[CO2]	Understand the properties of liquid, gaseous and solid insulating materials.	**2**	**2**											**3**			
[CO3]	Apply the physics behind the electrical engineering materials.	**1**				**3**										**2**	
[CO4]	Analyze the electrical properties and characteristics of various materials, used in the electrical appliances, devices & instruments.				**3**									**2**			**1**
[CO5]	Evaluate breakdown strength of transformer oil by testing.				**2**										**1**		
[CO6]	Create innovative research in the field of electrical engineering material science.			**2**		**2**									**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Big Data Analysis

Code: BTE28360

3 Credits | Semester VIII

A. Introduction:

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map reduce.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- To enable students to have skills that will help them to solve complex real-world problems in for decision support.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify key issues in big data management and its associated applications in intelligent business and scientific computing.
[CO2] Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
[CO3] Apply the fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and No SQL in big data analytics.
[CO4] Analyze adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
[CO5] Choose machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.
[CO6] Create machine learning techniques and computing environment that are suitable for the applications under consideration.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BIG DATA PLATFORMS: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare applications. Advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence.

INTRODUCTION TO NOSQL: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication

BASICS OF HADOOP: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structure

MAP REDUCE APPLICATIONS: Map-Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, Map Reduce types.

HADOOP RELATED TOOLS: Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries

E. TEXT BOOKS

T1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

F. REFERENCE BOOKS

R1. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
R2. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
R3. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
R4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
R5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
R6. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
R7. Alan Gates, "Programming Pig", O'Reilley, 2011

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify key issues in big data management and its associated applications in intelligent business and scientific computing.		3			1										2	
[CO2]	Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.		2			1								2			
[CO3]	Apply the fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and No SQL in big data analytics.	2				3										2	
[CO4]	Analyze adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.			1	3									2			
[CO5]	Choose machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.			2											1		
[CO6]	Create machine learning techniques and computing environment that are suitable for the applications under consideration.				2	3									2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Major Project-II

Code:BTE28364

8 Credits | Semester VIII

The object of Project Work & Dissertation is to enable the student to extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In-depth study of the topic assigned in the light of the Report;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Extra-Curricular/Co-Curricular Activity

Code: BTE28390

0 Credits | Semester VIII

AICTE Activity Points to be earned by students admitted to Degree program **(For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**

Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.

The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.

Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.

Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.