Study Scheme & Syllabus
(Choice Based Credit System)

For

B.TECH (EE)

(First to 8th Semester)

Program Code: BOT-301

(w.e.f Session 2017-18)

DEPARTMENT OF ELECTRICAL ENGINEERING

SCHOOL OF ENGINEERING

RIMT UNIVERSITY

MANDI GOBINDGARH, PUNJAB

TABLE OF CONTENTS

SECTION 1

Vision & Mission of the University

VISION

To become one of the most preferred learning places a centre of excellence to promote and nurture future leaders who would facilitate in desired change in the society

MISSION

- To impart teaching and learning through cutting edge technologies supported by the world class infrastructure

- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values

SECTION 2

Vision and Mission of the Department

VISION

The Department of Electrical Engineering will provide programs of the high quality to produce world class competent engineers who can address challenges and are successfully involved in innovative research . It commits itself to impart the skills, knowledge and attitudes to create, interpret, apply and disseminate engineering to build better future for humankind.

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MISSION

- To create the environment that facilitates learning fundamentals of Electrical Engineering
- To impart the knowledge in Electrical Circuits, Power Systems electrical machines, power electronics non conventional energy
- Providing better understanding of the domain of study, including wider social issues, corporate social responsibility and ethical decision making.
- To ensure continuous interaction of the students through MOU's and collaborative research projects.

SECTION 3

About the Program

B. Tech. (Electrical Engineering) or Bachelor of Technology in Electrical Engineering is an Under-Graduate Electrical Engineering course. Electrical engineering is a field of engineering that generally deals with the study and application of electricity, electronics, and electromagnetism.

Our B. Tech. Program is an Outcome Based Education model which is a 4 year, 8 Semester Full time Program of 133* credit hours with a Choice Based Credit System (CBCS) and Grading Evaluation System. B.TECH EE course is structured semester wise and includes theory and Practical to impart the students a holistic understanding of B. Tech. EE subjects. After successfully completing the course, B. Tech. Electrical Engineering job scope includes Electrical engineer, Application Engineer and many more.

B.Tech Electrical Engineering Department

SECTION 4

Program Educational Objectives, Program Outcomes and Program Specific Outcomes

Programme Education Objectives

PEO1	Establish their careers in the field of Electrical Engineering and related areas, providing innovative and effective solutions.
PEO2	To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems and also to pursue higher studies.
PEO3	To train students with good scientific and engineering breadth so as to understand, analyze, design, and create novel products and solutions for the real-life problems
PEO4	To provide students with an academic environment aware of excellence, leadership, ethical code and guidelines, and the life-long learning needed for a successful professional career.

PROGRAMME OUTCOMES

PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO 9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO 1	Apply principles of engineering, electronics and computer science; physics, chemistry, environmental science, mathematics (including differential equations, discrete mathematics, linear algebra and complex variables) and laboratory skills for building, testing, operation and maintenance of high currents electrical systems, such as, electrical machines, power and energy systems.
PSO 2	Model, analyse, design, and realize physical systems, components or processes related to high current electrical engineering systems.

SECTION 5

Curriculum / Scheme with Examination Scheme

Semester Wise Summary of the program: B.TECH.

(ELECTRICAL ENGINEERING)

S.no.	Semester	No. of ContactHours	Marks	Credits
1.	I	31	900	25
2.	II	22	800	23
3.	III	31	900	25
4.	IV	31	800	23
5.	V	31	900	25
6.	VI	31	900	23
7	VII	29	700	21
8	VII	00	500	16
	Total	206	6400	133

EXAMINATION GRADING SCHEME

Marks Percentage Range	Grade	Grade Point	Qualitative Meaning
80-100	O	10	Outstanding
70-79	A^+	9	Excellent
60-69	A	8	Very Good
55-59	B^+	7	Good
50-54	B	6	Above Average
45-49	C	5	Average
40-44	P	4	Fail
0-39	F	0	Fail
ABSENT	AB	0	Fail

Percentage Calculation: CGPA *10

FIRST SEMESTER

Subject		Contact Hours/Week			Credit	Contact Hrs.	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P			Internal	External	Total	
Core Courses										
BTPH-1101	**Applied Physics**	3	1	0	4	4	40	60	100	3Hrs
BTMA-1101	**Applied Mathematics-I**	4	1	0	5	5	40	60	100	3Hrs
BTHU-1101	**Communicative English**	3	0	0	3	3	40	60	100	3Hrs
BTEE-1101	**Basics of Electrical & Electronics Engg.**	4	0	0	4	4	40	60	100	3Hrs
BTES-1101	**Environmental Science**	2	0	0	2	2	40	60	100	3Hrs
BTPH-1102	**Applied Physics Lab**	0	0	2	1	2	60	40	100	3Hrs
BTHU-1102	**Communicative English Lab**	0	0	2	1	2	60	40	100	3Hrs
BEEE-1102	**Basics of Electrical & Electronics Engg. Lab**	0	0	2	1	2	60	40	100	3Hrs
BTMP-1101	**Manufacturing Practice**	1	0	6	4	7	40	60	100	3Hrs
Total		17	2	12	25	31				

SECOND SEMESTER

Subject		Contact Hours/ Week			Credit	Contact Hrs.	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L		P			Internal	External	Total	
Core Courses										
BTCH-1101	**Applied Chemistry**	3	1	0	4	4	40	60	100	3Hrs
BTMA-1201	**Applied Mathematics-II**	4	1	0	5	5	40	60	100	3Hrs
BTCS-1101	**Basics of Computer Prog.**	3	0	0	3	3	40	60	100	3Hrs
BTME-1101	**Elements of Mechanical Engg.**	3	1	0	4	4	40	60	100	3Hrs
BTME-1102	**Engineering Drawing**	1	0	6	4	7	40	60	100	3Hrs
BTCH-1102	**Applied Chemistry Lab**	0	0	2	1	2	60	40	100	3Hrs
BTCS-1102	**Basics of Computer Prog. Lab**	0	0	2	1	2	60	40	100	3Hrs
BTPD-1101	**Professional Communication in Practice**	0	0	2	1	2	60	40	100	3Hrs
Total		14	3	12	23	29				

THIRD SEMESTER

COURSE			Contact Hours/Week			Exam Duration (Hours)	Credit	Relative Weight					
S.No	Code	Course Title	L	T	P			CWA	LWA	MTE	ETE	ETP	Total
1	BTEE-2301	Mathematics-III	3	2	0	3	4	16	-	24	60	-	100
2	BTEE-2302	Transformers and DC Machine	3	2	0	3	4	16	-	24	60	-	100
3	BTEE-2303	Network Analysis and Synthesis	3	2	0	3	4	16	-	24	60	-	100
4	BTEE-2304	Electronic Devices & Circuits	3	2	0	3	4	16	-	24	60	-	100
5	BTEE-2305	Electrical Measurement & Instrumentation	3	2	0	3	4	16	-	24	60	-	100
6	BTEE-2306	Measurement & Instrumentation Lab.	0	0	2	-	1	-	60	-	-	40	100
7	BTEE-2307	Electronic Devices & Circuit Lab.	0	0	2	-	1	-	60	-	-	40	100
8	BTEE-2308	Electrical Machine - I Lab.	0	0	2	-	1	-	60	-	-	40	100
9	BTEE-2309	Training #	0	0	0	-	2	-	60	-	-	40	100
	Total		**15**	**10**	**6**		**25**					**900**	

#Institutional training will be imparted in the institution at the end of 2nd semester for four- week duration (Minimum 36 hrs. per week) industrialTour will also from the part of this training

FOURTH SEMESTER

COURSE			Contact Hours/Week			Exam Duration (Hours)	Credit	Relative Weight					
S.No.	Code	Course Title	L	T	P			CWA	LWA	MTE	ETE	ETP	Total
1	BTEE-2401	Asynchronous Machines	3	2	0	3	4	16	-	24	60	-	100
2	BTEE-2402	Digital Electronics	3	2	0	3	4	16	-	24	60	-	100
3	BTEE-2403	Power System-I (Transmission and Distribution)	3	2	0	3	4	16	-	24	60	-	100
4	BTEE-2404	Linear Control System	3	2	0	3	4	16	-	24	60	-	100
5	BTEE-2405	Power Plant Engineering	3	2	0	3	4	16	-	24	60	-	100
6	BTEE-2406	Programming in MATLAB	0	0	2	-	1	-	60	-	-	40	100
7	BTEE-2407	Control System Lab.	0	0	2	-	1	-	60	-	-	40	100
8	BTEE-2408	Digital Electronics Lab.	0	0	2	-	1	-	60	-	-	40	100
	Total		15	10	6		23						800

FIFTH SEMESTER

COURSE			Contact Hours/Week			Exam Duration (Hours)	Credit	Relative Weight					
S.No.	Code	Course Title	L	T	P			CWA	LWA	MTE	ETE	ETP	Total
1	BTEE-3501	Synchronous Machines	3	2	0	3	4	16	-	24	60	-	100
2	BTEE-3502	Power Electronics & Drives	3	2	0	3	4	16	-	24	60	-	100
3	BTEE-3503	Generation and Economics of Electric Power	3	2	0	3	4	16	-	24	60	-	100
4	BTEE-3504	Electromagnetic Field Theory	3	2	0	3	4	16	-	24	60	-	100
5	BTEE-3505	Microprocessors and Interfacing	3	2	0	3	4	16	-	24	60	-	100
6	BTPD-3521	Personality Development-I	0	0	2	-	1	-	100	-	-	-	100
7	BTEE-3506	Power Electronics Lab.	0	0	2	-	1	-	60	-		40	100
8	BTEE-3507	Electrical Machines-II Lab.	0	0	2	-	1	-	60	-		40	100
9	BTEE-3508	Training #	0	0	0	-	2	-	60	-		40	100
	Total		15	10	6		25						900

SIXTH SEMESTER

COURSE			Contact Hours/Week			Exam Duration (Hours)	Credit	Relative Weight					
S.No.	Code	Course Title	L	T	P			CWA	LWA	MTE	ETE	ETP	Total
1	BTEE-3601	Power System-II (Switchgear and Protection)	3	2	0	3	4	16	-	24	60	-	100
2	BTEE-3602	Electrical Power Utilization	3	2	0	3	4	16	-	24	60	-	100
3	BTEE-3603	Microcontroller and PLC	3	2	0	3	4	16	-	24	60	-	100
4	BTEE-3604	Numerical & Statistical Methods	3	2	0	3	4	16	-	24	60	-	100
5	BTEE-3605	Electrical: Estimation & Costing Lab.	0	0	2	-	1	-	60	-	-	40	100
6	BTEE-3606	Microcontroller and PLC Lab	0	0	2	-	1	-	60	-	-	40	100
7	BTPD-3621	Personality Development-I	0	0	2	-	1	-	60	-	-	40	100
8	BTEE-3607	Pre-Synopsis Major Project (Seminar)	0	0	2	-	1	-	100	-	-	-	100
	Department Elective – I (Select any one)					-							
9	BTEE-3611	Signals and Systems	3	0	0	3	3	16	-	24	60		100
10	BTEE-3612	Flexible AC Transmission System Devices											
11	BTEE-3613	Instrumentation in Power System											
	Total		**15**	**8**	**8**		**23**						**900**

SEVENTH SEMESTER

	COURSE		Contact Hours/Week			Exam Duration (Hours)	Credit	Relative Weight					
S.NO.	Code	Course Title	L	T	P			CWA	LWA	MTE	ETE	ETP	Total
1	BTEE-4701	Power System Analysis and Design	3	2	0	3	4	16	-	24	60		100
2	BTEE-4702	Non-linear and Digital Control System	3	2	0	3	4	16	-	24	60		100
3	BTEE-4703	Non-conventional Energy Sources	3	2	0	3	3	16	-	24	60		100
4	BTEE-4704	Power System Analysis Lab.	0	0	2	-	1	-	60	-	40		100
5	BTEE-4705	Major Project	0	0	6	-	3	-	60	-	40		100
	Department Elective – II (Select any one)												
6	BTEE-4711	Power System Operation and Control	3	0	0	3	3	16	-	24	60		100
7	BTEE-4712	Power Quality Monitoring and Conditioning											
8	BTEE-4713	High Voltage Engineering											
9	**Open Elective (List given below)**		3	0	0	-	3	16	-	24	60		100
	Total		**15**	**6**	**8**		**21**						**700**

List of Open Electives From Other Departments				
Sr. No.	**Subject Title**	**Subject Code**	**Semester**	**Name of Offering Department**
1	Agricultural Heritage	AEXT 1101	1	School of Agriculture Sciences
2	Environmental Studies and Disaster Management	AENV 2101	3	School of Agriculture Sciences
3	Intellectual Property Rights	APBG 3105	3	School of Agriculture Sciences
4	Agricultural Marketing, Trade and Prices	AECN 3103	5	School of Agriculture Sciences
5	Object Oriented Programming language using C++	BTCS-2303	3	Computer Science &Engg.
6	Artificial Intelligence	BTCS-4701	7	Computer Science &Engg.
7	Simulation & Modelling	BTCS-3601	6	Computer Science &Engg.
8	Manufacturing process	BTME-2305	3	Mechanical Engineering
9	Mechanical measurement & metrology	BTME-3503	5	Mechanical Engineering
10	Industrial automation and robotics	BTME-3505	5	Mechanical Engineering
11	International Relations	BLB-3505	5	School of Legal Studies
12	Principles of Taxation Law (Direct Taxation)	LLB-2304	3	School of Legal Studies
13	Gender Justice	LLB-3505A	5	School of Legal Studies
14	Electronic Measurements & Instrumentation	BTEC-2305	3	Electronics & Communication Engg
15	Neural Network and Fuzzy logic	BTEC-2309	3	Electronics & Communication Engg
16	Antenna and Wave Propagation	BTEC-3503	5	Electronics & Communication Engg
17	Cognitive Radio	BTEC-3510	5	Electronics & Communication Engg
18	Advanced Communication Systems	BTEC-4710	7	Electronics & Communication Engg
19	Mobile Computing	BTEC-4711	7	Electronics & Communication Engg

20	Non-conventional Energy Sources	BTEE-4703	7	Electrical Engineering
21	Generation and Economics of Electric Power	BTEE-3503	5	Electrical Engineering
22	Electrical Measurement & Instrumentation	BTEE-2305	3	Electrical Engineering
23	Selection of Research Problem & preparation of Dissertation Research			School of Education
24	Life Skills Education			School of Education
25	Inclusion Education			School of Education
26	Engagement with community (Experiences fort Social and Environmental Sensitivity).			School of Education
27	Fashion Styling (Practical)		1	Fashion Design
28	Fashion Illustration and Design (Practical)		2	Fashion Design
29	Concept Making		1	Interior Design
30	Research and Planning		2	Interior Design
31	History of Art –I		1	Fine Arts
32	Creative Painting –I		1	Fine Arts
33	History of Art –II		2	Fine Arts
34	Creative Painting –II		2	Fine Arts
35	Optics & Laser	BPHY-1151	1	Department of Physics
36	Modern Physics	BPHY-1252	2	Department of Physics
37	Nuclear Physics	BPHY-3511	5	Department of Physics
38	Calculus	BMAT-1101	1	Department of Mathematics
39	Algebra	BMAT-1102	1	Department of Mathematics
40	Numerical Analysis	MMAT-2305	3	Department of Mathematics
41	Organization Behavior	BB-2303	4	Management
42	Consumer Behavior	BB-2402	4	Management
43	Corporate Strategic	BB-3601	6	Management
44	Rock Mechanics	BTCE-2305	3	Civil Engineering

45	Construction Machinery & Works Management	BTCE-2311	3	Civil Engineering
46	Numerical Methods & Statistics in Civil Engineering	BTCE-3512	5	Civil Engineering
47	Remote Sensing & GIS	BTCE-3513	5	Civil Engineering
48	Disaster Management	BTCE-4716	7	Civil Engineering
49	Airport &Harbor Engineering	BTCE-4719	7	Civil Engineering
50	Theory and Practices of GST	BCM-2305	3	Commerce
51	Foreign Trade Practices	BCM-3502	5	Commerce
52	Managerial Skills	BCM-2306	3	Commerce
53	Basic Cellular Pathology	BMLT-2304	3	M.L.T
54	Blood Bank	BMLT-3504	5	M.L.T
55	SPCL2	MZOO-2305	3	Zoology
56	Wildlife and its management	MZOO-2402	4	Zoology
57	Apiculture	BZOO-2305	3	Zoology
58	Environment and Public Health	BZOO-3503	5	Zoology
59	Plant Resource Utilization	MBOT-2303	3	Botony
60	Forestry	MBTO-2404	4	Botony
61	Food Microbiology	MMB-2304	3	Microbiology
62	Industrial production of biofertilizers	MMB-2401	4	Microbiology
63	EnviromentalMicrobilogy	BMB-2302	3	Microbiology
64	Biofertilizers&Biopesticides	BMB-3501	5	Microbiology
65	Exercise Therapy	BPT-2305	3	Physiotherapy
66	Community Medicine and Rehabilitation	BPT-3503	5	Physiotherapy
67	Enviornmental Studies	BEVS-1101	2	Chemistry
68	Applied Chemistry	BTCH-1101	½	Chemistry
69	Foundation Course in Food Production -I	HM-1101	1	Hotel Management
70	Foundation Course in Front Office	HM-1103	1	Hotel Management

EIGHT SEMESTER

Program: B. Tech

Contact Hours: 00

Department: Department of Electrical Engineering

Credits: 16

COURSE			Subject Area	Contact Hours/Week			Exam Duration (Hours)	Credit	Relative Weight					
S.NO.	Code	Course Title		L	T	P			CWA	LWA	MTE	ETE	ETP	Total
1	BTEE-4801	Industrial Training		0	0	0	-	16	0	250	0	0	250	500
	Total			0	0	0		16						500

Year: 4thYear / 8thSemester

CWA: Class Work Assessment

LWA: Lab Work Assessment

MTE: Mid Term Examination

ETE: End Term Examination

EPE: End Practical Examination

Total Credits and Contact Hours3rd to 8th semester

Semester	Credits	Contact Hours
III	25	31
IV	23	31
V	25	31
VI	23	31
VII	21	29
VIII	16	00
Total	**133**	**153**

SECTION 6

Detailed Syllabus with Course Outcomes

TITLE: APPLIED MATHEMATICS-I
SUBJECT CODE: BTMA-1101
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	1	0	5

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objectives: To introduce the concepts and to develop working knowledge on matrix theory, Complex numbers, Convergence of infinite series and concepts of differential equations.

Outcomes: On completion of this course, the students will be able to:

- Learn methods to solve first and higher order differential equations and apply it to engineering problems.
- Use essential tools of matrices and linear algebra including linear transformations, eigenvalues, and diagonalization.
- Acquire the knowledge of convergence of sequence and series and different tests of convergence
- Learn the tools of functions of a complex variable that are used in various engineering problems.

Sr. No.	Contents	Contact Hours
UNIT-I	**Linear Algebra** Elementary transformations, Rank of a matrix, Row reduced echelon form, Reduction to normal form, Linear independence and dependence of vectors, Gauss- Jordan method to find inverse of a matrix, Solution of simultaneously linear algebraic equations, Linear transformations, Orthogonal transformations, Eigen values and Eigen vectors, Cayley-Hamilton theorem, Reduction to diagonal form, Orthogonal, Unitary, Hermitian matrices	15

UNIT-II	**Complex Numbers and Elementary Functions of Complex Variable** De-Moivre's theorem and its applications, Real and imaginary parts of exponential, Logarithmic, circular, Inverse circular, Hyperbolic, Inverse hyperbolic functions of complex variables, Summation of trigonometric series (C+iS method)	**15**
UNIT-III	**Sequence and Series** Introduction to sequence and series, Convergence and divergence of series, Tests of convergence (without proofs), Comparison test, Integral test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test and Gauss test. Alternating series- Absolute and conditional convergence, Leibnitz test. Power series-Weirstrass M-test	**15**
UNIT-IV	**Differential Equations and its Applications** Leibnitz's linear and Bernoulli's equation, Exact differential equations, Equations reducible to exact form by integrating factors, Equations of the first order and higher degree, Clairaut's equation. Solution of linear ordinary differential equations of second and higher order; Methods of finding complementary functions and particular integral, Special methods for finding particular integrals- Method of variation of parameters. Cauchy's homogeneous and Legendre's linear equation. Simultaneous linear equations with constant coefficients Applications to electric R-L-C circuits, Deflection of beams, Simple harmonic motion, Simple pendulum	**20**

Recommended Books

1. E. Kreyszig, 'Advanced Engineering Mathematics', 9th Edn., John Wiley, **2006.**
2. R.K. Jain and S.R.K. Iyengar, 'Advanced Engineering Mathematics', 4th Edn.,Narosa, **2014**.
3. B.S. Grewal, 'Higher Engineering Mathematics', 40th Edn., Khanna Publishers, New Delhi, **2007**.
4. H.C. Taneja, 'Engineering Mathematics, Volume-I & Volume-II', 2nd Edn., I.K. Publishers, **2010.**
5. Babu Ram, 'Advanced Engineering Mathematics', Pearson Education, **2009**.
6. J.S. Bindra, 'Applied Mathematics', Volume II, 9th Edn., Kataria Publications, **2012**.

Instructions to Question Paper Setter*: The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3*

questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks.

COURSE TITLE: COMMUNICATIVE ENGLISH
SUBJECT CODE: BTHU-1101
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objectives: Students will acquire the necessary academic vocabulary as well as develop the processes and strategies to produce academic writings. Working with key vocabulary in texts regarding legal issues will assist in consolidating their language skills in the production of an effective researched report.

Outcomes: On completion of this course, the students will be able to:

- Understand the basic concept of phonetics.
- Attain good reading skills.
- Review communication as a process with greater awareness.
- Use appropriate communication skills in specific contexts and for specific purposes.
- Write well organized self-introduction, Resume, CV etc.

Sr. No.	Contents	Contact Hours
UNIT-I	**unication**: Meaning, Types of Communication, Elements of Communication, Process of Communication, Channels of Communication, Barriers to Communication	**8**
UNIT-II	**Phonetics:** Introduction to Phonetic Symbols for Consonants & Vowels with examples. **Business Office Practices**: Group Discussion; Conducting a Meeting; Agenda and Minutes of meeting; Oral Presentation.	**10**
UNIT-III	**Business Correspondence**: • Elements of Business Writing, Business Letters: Components of a	

	Business Letter; Letter Formats and Punctuation style Used in Them: Complete Block Style, Block Style, Semi Block Style, Indented Style; Kinds of Business Letters – Inquiry, Order, Complaint, Complaint Redress, Credit Request, Acceptance and Denial of Credit Request, Quotations, Auction Notice, Tender Notice • Report Writing – Elements of a report; front matter , main body, back matter, four parts of the main body • Memorandum writing • Job Application Letter and Resume Writing	**12**
UNIT-IV	**Vocabulary** : One Word Substitution , Antonyms & synonyms , Idioms & Phrases, Pairs of words **Grammar:** Types of Sentences**,** Sentence Elements, Seven Basic Sentence Patterns of English, Formation and Use of Tenses, Identification & Use of Active and Passive and Change of Voice Change of Narration, Translation (Tense Based).	**10**

RECOMMENDED BOOKS

1. English for Effective Communication by Sanjay Kumar and PushpLata , OXFORD University Press
2. Technical Communication Principles and Practice by Meenakshi Raman And Sangeeta Sharma, OXFORD University Press
3. A Course in Phonetics And Spoken English by J. Sethi and P.V. Dhamija
4. English Pronouncing Dictionary by Daniel Jones , Cambridge
5. English Dictionary, OXFORD
6. English Grammar, Composition and Usage by NK Aggarwal and FT Wood; Published by Macmillan Publishers India Ltd; New Delhi
7. Soft Skills by Gajendra S. Chauhan and Sangeeta Sharma , Wiley Publications

Instructions to Question Paper Setter*: The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks*

COURSE TITLE: COMMUNICATIVE ENGLISH LAB
SUBJECT CODE: BTHU-1102

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)

SEMESTER: I/II CONTACT HOURS/WEEK:	0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Duration of Exam; 3 Hrs

Objectives: Students will acquire the necessary academic vocabulary as well as develop the processes and strategies to produce academic writings. Working with key vocabulary in texts regarding legal issues will assist in consolidating their language skills in the production of an effective researched report.

Course Outcome:

The student will acquire basic proficiency in English with special emphasis on listening and speaking skills both at social and professional platforms.

a) Introduction to IPA Symbols, Word Accent, Sentence Stress, Contrastive Stress, Intonation

b) Group discussion

c) Monk Interview

d) Paper reading using Voice Modulation (Reading a paragraph from a newspaper, article, etc.)

e) Employable Skills

f) Situational Conversation

g) Describing people, objects and situations

h) Just a minute sessions

i) Taking telephonic messages and passing them on to the intended receiver

Note :*For lab. work, each section should be divided into two groups (with the maximum strength not exceeding 30 students) and each group should have 1 lab class of 2 lectures per week.*

COURSE TITLE: BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING

SUBJECT CODE: BEEE-1101
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objectives: This course provides comprehensive idea about circuit analysis, working principles of machines and common measuring instruments.

Outcomes:

- Students will gain knowledge regarding the various laws and principles of Electrical Engineering
- Students will gain knowledge regarding working of electronic devices
- Student will gain knowledge digital electronics.

Sr. No.	Contents	Contact Hours
UNIT-I	**Review of Direct Current (DC) Circuits:** Review of circuit elements and connected terminology, Kirchhoff's Laws- Statement and Illustrations, Star-Delta Conversion, Ohm's Law- Statement, Illustration and Limitation, Effect of Temperature on Resistance **Alternating Current (AC) Fundamentals:** Generation of alternating electro-motive force (EMF), Peak, Root Mean Square and average value of alternating current, Pharos representation of alternating quantities, Alternating Quantities in Rectangular and polar forms. Introduction of Resistive, Inductive & Capacitive circuits and their series and parallel combinations, Concept of resonance in series and parallel circuits	12
UNIT-II	**Three Phase Balanced Systems.** Concept of 3-phase EMF Generation, Numbering of phases, phase sequence, Types of connections: star and delta connections, relationship between line voltages/currents and phase voltages/currents, Pharos diagrams. **Magnetic Circuits and Transformer:** Comparison between magnetic and electric circuits, Electromagnetic Induction and its law, Self-	12

	Inductance, Mutual Inductance, Coupling Coefficient between two magnetically coupled circuits. Single Phase Transformer: Construction, Working principle, Losses & Efficiency.	
UNIT-III	**Diodes:** PN Junction diode, LED, Photodiode, Zener diode, Avalanche &Zener phenomenon. **Diode Applications:** Rectification: Half Wave & Full Wave, Bridge vs. Centre Tapped Rectifiers; switching: ideal vs. Practical; Regulation, Power supply design **Transistors:** Bipolar Junction Transistors: NPN, PNP types; Terminology: Biasing, Q-Point; JFET **Transistor Applications:** Common Emitter, Common Base, Common Collector configurations; Transistor as Amplifier and Switch.	**15**
UNIT-IV	**Digital Electronics Fundamentals** Analog vs. Digital Signals, Digital Signal Representations with Binary and Timing diagrams, Multi-input Basic and Composite Gates working with symbolic representation, Universal Gates, ICs, Performance Characteristics terminology, Boolean Expression simplification with K-maps up to 4-variables	**10**

Recommended Books

1. Vincent Deltoro, 'Electrical Engineering fundamentals', 2nd Edition, Prentice Hall, New Delhi, 2007.

2. Mittle and Mittle, 'Basic Electrical Engineering', 3rdEdn.,Tata McGraw Hill, New Delhi, 2006.

3. Ashfaq Husain, 'Fundamentals of Electrical Engineering' DanpatRai Publications, 2002.

4. Robert Boylestad and Louis Nashelsky, 'Electronic Devices and Circuits', Prentice Hall of India 10thEdn,, 2009.

5. R.P. Jain, 'Modern Digital Electronics', Tata McGraw Hill, 2003.

6. M.S. Sukhija and T.K. Nagsarkar, 'Basic of Electrical and Electronics Engineering' Oxford University Press, 2012.

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COURSE TITLE: ENVIRONMENTAL SCIENCE

SUBJECT CODE: BTES-1101
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objectives:

- To identify global environmental problems arising due to various engineering/industrial/ and technological activities and the science behind these problems
- To realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- To identify the major pollutants and abatement devices for environmental management and sustainable development.
- To estimate the current world population scenario and thus calculating the economic growth, energy requirement and demand.
- To understand the conceptual process related with the various climatologically associated problems and their plausible solutions.

Outcomes: The Environmental Studies major prepares students for careers as leaders in understanding and addressing complex environmental issues from a problem-oriented, interdisciplinary perspective. Students:

- Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Sr.No	Contents	Contact

		Hours
UNIT I	**The Multidisciplinary Nature of Environmental Studies** Definition, scope and importance, Need for public awareness **Natural Resources and associated problems.** a. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. **b.** Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems c. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d. Food resources: World food problems, changes caused by agriculture and Overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. **e.** Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies **f.** Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. g. Role of an individual in conservation of natural resources. **h.** Equitable use of resources for sustainable lifestyles	**7**
UNIT II	**Ecosystems** (a) Concept of an ecosystem. (b) Structure and function of an ecosystem. (c) Producers, consumers and decomposers. (d) Energy flow in the ecosystem. (e) Ecological succession. (f) Food chains, food webs and ecological pyramids. (g) Introduction, types, characteristic features, structure and function of the following ecosystem:	**7**

	i) Forest ecosystem. ii) Grassland ecosystem. iii) Desert ecosystem. iv) Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries). **Biodiversity and its Conservation** (a) Introduction - Definition: genetic, species and ecosystem diversity. (b) Biogeographically classification of India. (c) Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and (d) Option values. (e) Biodiversity at global, national and local levels. (f) India as a mega-diversity nation. (g) Hot-spots of biodiversity. (h) Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. (i) Endangered and endemic species of India. (j) Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	
UNIT III	**Environmental Pollution: Definition** **(a) Causes, effects and control measures of**: (i) Air pollution (ii) Water pollution (iii) Soil pollution (iv) Marine pollution (v) Noise pollution (vi) Thermal Pollution (vii) Nuclear pollution (b) Solid Waste Management: Causes, effects and control measures of urban and industrial wastes. (c) Role of an individual in prevention of pollution. (d) Pollution Case Studies.	**7**

	(e) Disaster management: floods, earthquake, cyclone and landslides **6. Social Issues and the Environment** (a) From unsustainable to sustainable development (b) Urban problems and related to energy (c) Water conservation, rain water harvesting, Watershed Management (d) Resettlement and rehabilitation of people; its problems and concerns. Case studies. (e) Environmental ethics: Issues and possible solutions (f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. (g) Wasteland reclamation (h) Consumerism and waste products (i) Environmental Protection Act (j) Air (Prevention and Control of Pollution) Act (k) Water (Prevention and control of Pollution) Act (l) Wildlife Protection Act (m) Forest Conservation Act (n) Issues involved in enforcement of environmental legislation (o) Public awareness	
UNIT IV	**Human Population and the Environment** (a) Population growth, variation among nations (b) Population explosion - Family Welfare Programmed (c) Environment and human health (d) Human Rights	**8**

	(e) Value Education (f) HIV/AIDS (g) Women and Child Welfare (h) Role of Information Technology in Environment and Human Health (i) Case Studies **Field Work** (a) Visit to a local area to document environmental assets river/ (b) forest/grassland/hill/mountain (c) Visit to a local polluted site - Urban / Rural / Industrial / Agricultural (d) Study of common plants, insects, birds (e) Study of simple ecosystems-pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)	

Recommended Books

1. J.G. Henry and G.W. Heinke, 'Environmental Sc. & Engineering', Pearson Education, 2004.

2. G.B. Masters, 'Introduction to Environmental Engg. & Science', Pearson Education, 2004.

3. Erach Bharuch, 'Textbook for Environmental Studies', UGC, New Delhi.

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COURSE TITLE: APPLIED PHYSICS LAB

SUBJECT CODE: BTPH-1102
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Duration of Exam; 3 Hrs

Objectives: The aim and objective of the Lab course on Applied Physics is to introduce the students of B. Tech to the formal structure of experiments in physics so that they can use these in Engineering as per their requirement

Note: At least 10 experiments should be performed in one semester

LIST OF PRACTICALS

1. To study the magnetic field of a circular coil carrying current.
2. To find out polarizability of a dielectric substance.
3. To study the laser beam characteristics like; wave length using diffraction grating element.
4. Study of diffraction using Laser beam and thus to determine the grating element.
5. To study the angular divergence of laser beam.
6. To study laser interference using double slit or Michelson's Interferometer.
7. To determine numerical aperture of an optical fibers
8. To determine attenuation and propagation losses in optical fibers.
9. To find out the frequency of AC mains using electric-vibrator.
10. To find the refractive index of a material (solid or liquid) using spectrometer.
11. To study the B-H curve using CRO.
12. To determine the grain size of a material using optical microscope.
13. To find the velocity of ultrasound in liquid.

Recommended Books

1. C.L. Arora, 'Practical Physics', S. Chand & Co., 1997.

2. R.S. Sirohi, 'Practical Physics', Wiley Eastern.

COURSE TITLE: BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB

SUBJECT CODE: BEEE-1102
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Duration of Exam; 3 Hrs

Objectives:

- The objective of Basic electrical and electronics engineering laboratory is to learn the practical experience with operation and applications of electrical concept.
- To enhance the knowledge of electrical and electronic equipments
- It also aims to get the knowledge of the different electronic devices like diodes, rectifiers, transistors and how these devices are used in real time applications.
- It also makes the students to learn how to measure the electrical quantities with different measuring devices.

Outcomes:

- Explain the concept of circuit laws and network theorems and apply them to laboratory measurements.

- Be able to systematically obtain the equations that characterize the performance of an electric circuit as well as solving both DC Machines and single phase transformer.
- Acknowledge the principles of operation and the main features of electric machines and their applications.
- Acquire skills in using electrical measuring devices

NOTE: Students are required to perform 12 experiments (7 From Group-I and 5 From Group-II)

List of Experiments

GROUP-I

1. To verify Ohm's law and its limitations
2. To Verify Kirchoff's Laws (KVL and KCL)
3. To find voltage-current relationship in a R-L series circuit and to determine the power
   factor of the circuit.
4. To verify the voltage and current relations in star and delta connected system
5. To measure power and power factor in a single- phase AC circuit
6. To study the principle of fluorescent lamp
7. To Study the home power supply system
8. To perform open- and short circuit tests on a single phase transformer and calculate its efficiency
9. To start and reverse the direction of rotation of a (i) DC Motor (ii) Induction Motor

GROUP-II

10. To measure amplitude and frequency of various signals (Sine, Triangular & Square) with
    CRO
11. To plot and analyze fully labeled V-I characteristics of P-N junction diode and compare
results with the data sheets
12. To obtain and plot input-output characteristics of Zener diode and compare results with the
    data sheets
13. To plot V-I characteristics of BJT in CE configuration and calculate static transistor
    parameters and compare results with the data sheets
14. To plot and evaluate V-I characteristic of FET and evaluate static parameters and compare
    results with the data sheets

15. To verify truth tables of various logic gates and realize various gates using universal gates

Recommended Books

1. S.K. Bhattacharya, 'Experiments in Basic Electrical Engineering', New Age International, New Delhi, 2007
2. Paul B. Zbar, Albert Paul Malvino, Michael A. Miller, 'Basic Electronics', 7th Edn., Glenco, 1994.
3. R.P. Jain, 'Modern Digital Electronics', Tata McGraw Hill.
4. L.K. Maheshwari, M.M.S. Anand, 'Laboratory Manual for Introductory Electronics Experiments', New Age International, 1997.

COURSE TITLE: MANUFACTURING PRACTICES

SUBJECT CODE: BTMP-1101
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
1	0	6	3

Internal Assessment: 60

End Term Exam: 40

Duration of Exam; 3 Hrs

Objectives: Introduction of various manufacturing practices, tools and equipment used, Hand on experience by making different jobs

Outcomes: At the end of course student will be able to

- Prepare basic joints used in carpentry
- Prepare edges for better joint for fitting
- Prepare single and double patterns for casting
- Prepare various shapes and objects by using Tin smithy, foundry and black smithy

List of Workshops

1. Machine Shop
2. Sheet Metal Shop
3. Fitting Shop
4. Welding Shop
5. Carpentry and Pattern Making Shop
6. Forging Shop
7. Foundry Shop
8. Electrical and Electronics Shop

Safety Awareness in workshop: it is very important to know & understand to keep the safety in workshop during working. The concerned shop in-charge must ensure the safe practice sessions. The student must be aware of and follow safety norms and rules during practice in Workshop.

COURSE TITLE: APPLIED CHEMISTRY

SUBJECT CODE: BTCH-1101
SEMESTER: I
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	1	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objectives: To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

Outcomes:

- Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic and Physical Chemistries. Majors to be certified by the American Chemical Society will have extensive laboratory work and knowledge of Biological Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.
- Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
- Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.
- Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.

Sr. No.	Contents	Contact Hours
UNIT-I	**Molecular Spectroscopy:** UV/Visible Spectroscopy: Selection rule, Principle and instrumentation, Electronic Transitions, Chromophores&Auxochromes, Factors affecting λmax intensity of spectral lines, Types of absorption bands, Frank Condon Principle, Applications. IR Spectroscopy: Principle and instrumentation; Force Constant, Anharmonic Oscillator Model, Finger Print region, Fundamental modes of vibrations, Factors affecting vibrational frequency, Applications. **NMR Spectroscopy:** Principle & instrumentation; Chemical shift; Factors affecting Chemical Shift; Spin-Spin Splitting; Coupling Constant, High resolution NMR spectrum, NMR spectrum of EtOH, Relaxation process, Applications.	
UNIT-II	**Polymers:** Introduction; Functionality; Classifications of Polymers, Types of polymerization; Specific features of polymers; Structures - regularity and irregularity; Tacticity of polymers; Average molecular weights and size; Effect of molecular weight on the properties of polymers; Glass Transition Temperature, Crystallinity of polymers, Introduction to polymer reinforced composite. **Petrochemicals:** Introduction; First, second & third generation petrochemicals; Primary Raw Materials for Petrochemicals, Natural gas and its treatment processes; Properties of natural gas; Crude oil: Composition of and classification of crude oil; Physical separation processes; Conversion processes.	
UNIT-III	**Water and its Treatment:** Specifications of water, Hardness of water, Treatment and problems of Boiler feed water, Different methods of the water softening, domestic water treatment of water, Desalination of	

	water. **Coordination and Organometallic Chemistry:** Coordination number and structures of coordination complexes, Nomenclature of Coordination Compounds, Werner, co-ordination theory, Theory of bonding-crystal field and molecule orbital theory for Tetrahedral and octahedral complexes	
UNIT-IV	**Green Chemistry and its Applications:** Introductory overview-Definition and concepts of Green chemistry; Twelve Principles of Green chemistry, Use of alternative feedstock (bio-fuels); Use of innocuous reagents in natural processes; Alternative solvents; Design of the safer chemicals; Designing alternative reaction methodology. Microwave and ultrasonic radiation in Green synthesis-Minimizing energy consumption **Corrosion and its Prevention:** Introduction; Wet and Dry corrosion; Different types of surface films; Mechanisms of wet corrosion; Galvanic corrosion; Galvanic Series; Concentration cell corrosion and differential aeration corrosion; Soil and microbial corrosion; Factors affecting corrosion; Various methods of corrosion control.	

Recommended Books

1. William Kemp, 'Organic Spectroscopy', Palgrave Foundations, 1991.

2. D. A. Skoog, F. J. Holler and A. N. Timothy, 'Principle of Instrumental Analysis', 5thEdn., Saunders College Publishing, Philadelphia, 1998.

3. G. W. Castellan, 'Physical Chemistry', 3rdEdn, 1995, Narosa, reprint 2004.

4. C. P. Poole, Jr., F. J. Owens, 'Introduction to Nanotechnology', Wiley Interscience, 2003.

5. M. Lancaster, 'Green Chemistry- An Introductory Text', 1stEdn,,Royal Society of Chemistry, Cambridge, UK, 2010.

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COURSE TITLE: APPLIED MATHEMATICS-II

SUBJECT CODE: BTMA-1201
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	1	0	5

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objectives: To introduce the concepts and to develop working knowledge on curve tracing, Partial differentiation and its applications, Multiple integration and vector calculus.

Outcomes:

After completion of this course, the students will be able to:

- Analyze functions of more than two variables and their applications.
- Apply Partial differentiation on functions of more than two variables.
- Evaluate multiple integrals and apply them to practical problems.
- Apply vector calculus to engineering problems.
- Sketch and identify the curves in various coordinate systems.
- Apply integral calculus to engineering problems.

Sr. No.	Contents	Contact Hours
UNIT-I	**Differential & Integral Calculus and its Applications:** Curve tracing- Tracing of standard Cartesian, Parametric and polar curves, Curvature of Cartesian, Parametric and polar curves. Rectification of standard curves, Areas bounded by standard curves, Volumes and surfaces of revolution of curves, Applications of integral calculus to find center of gravity and moment of inertia.	15
UNIT-II	**Partial Differentiation and its Applications:** Functions of several variables, Limit and continuity, Change of variable, Chain rule, Partial differentiation, Homogeneous functions and Euler's theorem, Composite functions, Total derivative, Derivative of an implicit function; Change of variable, Jacobeans. Tangent and normal to surface, Taylor's and Maclaurin's series for functions of two variables, Errors and approximations, Maxima and minima of function of several variables, Lagrange's method of undetermined multipliers.	20
UNIT-III	**Multiple Integrals and its Applications:** Double and triple integrals and their evaluation, Change of order of integration, Change of variables, Applications of double and triple integral to find area and volumes.	15
UNIT-IV	**Vector Calculus and its Applications:** Scalar and vector fields, Differentiation of vectors, Velocity and acceleration, Vector differential operators: Del, Gradient, Divergence and curl and their physical interpretations, Formulae involving del applied to point function and their products, Line, surface and volume integrals, Solenoidal and irrotational vectors, Gauss divergence theorem, Green's theorem in	15

	plane, Stoke's theorem (without proofs) and their applications.	

Recommended Books

1. E. Kreyszig, 'Advanced Engineering Mathematics', 9thEdn.,John Wiley, 2006.

3. B.S. Grewal, 'Higher Engineering Mathematics', 40thEdn.,Khanna Publishers, New Delhi, 2007.

4. .Babu Ram, 'Advanced Engineering Mathematics', Peaeson Education, 2009.

5. J.S. Bindra, 'Applied Mathematics', Volume-I, 9thEdn.,Kataria Publications, 2009.

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COURSE TITLE: ELEMENTS OF MECHANICAL ENGINEERING

SUBJECT CODE: BTME-1101
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	1	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Course Objectives:

In this course students will learn a process for analysis of static objects; concepts of force, moment, and mechanical equilibrium; how to analyses forces and moments in two and three dimensions; and how to analyse distributed forces and internal loads. They will be able to analyse forces in various systems such as frames, machines, trusses, beams and cables. The tools learned in this course will provide the basis for later courses and a career in engineering.

Outcomes:

- Use a standard process for analysing static objects.
- Define a force and a moment.
- Add forces and moments in two and three dimensions, and find a component of a force or moment in a given direction.
- Construct free body diagrams of an object or a system of connected objects.
- Describe conditions of equilibrium and their associated component equations.
- Use conditions of equilibrium and known forces and moments to solve for unknown external and internal forces and moments present in an object of system of connected objects.
- Define statically determinate, statically indeterminate, and under-constrained systems, and identify systems having these characteristics.
- Calculate the center of gravity, center of mass, and centroid for simple and composite volumes.
- Represent a distributed line or area load by an equivalent point force, and use the equivalent point force in static analysis.
- Define, identify, and carry out equilibrium analysis of frames, machines, trusses, beams and cables.

Sr. No.	Contents	Contact Hours
UNIT-I	**Basic Concepts of Thermodynamics and various laws:** Thermodynamic System, Boundary and Surroundings, Thermodynamic System types, basic definitions, reversible and irreversible process, Temperature, pressure, heat, work, internal energy, enthalpy and specific heat, Zero law of Thermodynamics, first law of Thermodynamics, its corollaries and applications on various cyclic processes (constant volume, constant pressure, constant temperature, adiabatic and polytrophic, Free Expansion Process), Steady State energy flow process and its engineering applications Second Law of Thermodynamics, its corollaries and applications. Heat Engine, Heat Pump and Refrigerator, Clauses Inequality, concept and	

	philosophy of entropy, entropy changes during various Processes, and third law of thermodynamics **Basics of Automobiles:** IC engines and its classification, petrol and diesel engines, two and four stroke engines, basic components of IC engines, BHP, IHP, FHP, Mechanical efficiency, gears and its types, power transmission in automobiles, basic function of clutch, brake, differential, axle, tyres	
UNIT-II	**Fluids and Fluid Mechanics:** Fluids, types of fluids, properties of Fluids, Pascal law, Archimedes law, buoyancy and buoyant force, Continuity equation and Bernoulli's equation	
UNIT-III	**Laws of forces:** Two dimensional force system, basic concepts, rigid body, free body diagram, resolution of forces into components, triangle law of forces, parallelogram law of forces, polygon law of forces, Lama's equation. Verizon's theorem, Application, **Friction: Introduction:** Laws of Coulomb's friction, equilibrium of bodies involving dry friction, Applications.	
UNIT-IV	**Centroid, Centre of Gravity and Moment of Inertia:** Difference between center of gravity and centroid, determination of position of centroid of plane geometric figures of I, T, Circular and Triangular Sections. Determination of position of Centre of Gravity (CG) of simple solid figures, Parallel axis theorem, Perpendicular axes Theorem, Radius of gyration, determination of area Moment of Inertia of I, T, Circular and Triangular Sections	

Recommended Books

1. A. YunusCengel and Mishal A. Boles, 'Thermodynamics & Engineering Approach', 4th Edn., Tata McGraw Hill, 2011.

2. K.U. Siddiqui, 'A Text Book of Automobile Engineering', 1stEdn., New Age, 2011.

3. K.L. Kumar, 'Engineering Fluid Mechanics', S. Chand, 2015.

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COURSE TITLE: BASICS OF COMPUTER PROGRAMMING

SUBJECT CODE: BTCS-1101
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective: This course is designed to explore computing and to show students the art of computer programming. Students will learn some of the design principles for writing good programs.

Outcomes:

- Understand, analyze and implement software development tools like algorithm, pseudo codes and programming structure
- Study, analyze and understand logical structure of a computer program, and different construct to develop a program in 'C' language
- Write small programs related to simple/ moderate mathematical and logical problems in 'C'.
- Study, analyze and understand simple data structures, use of pointers, memory allocation and data handling through files in 'C'.

S.No.	Content	Contact Hours
1.	**Introduction to Problem Solving and Programming Languages:** Problem Solving Aspects, Program Development Steps, Introduction to Programming Languages, Types and Categories of Programming Languages, Program Development Environments **Logic development and Algorithms:**Types of Problem: Data Centric and Process Centric, Problem Solving Strategies, Problem Analysis, formal definition of problem, Top- Down design and Bottom –Up design, Algorithms, Flow charts, Flow chart symbols, Pseudo codes, illustrative examples	10
2.	**Introduction to C Programming Language:** Introduction to C Language, Evolution and Characteristics of C Language, Compilation Model, Character Set, Keywords, Identifiers, Data Types, Variables, Constants, Operators, Expressions, Type conversion and Type Casting, Overview of Pre-processors,	10

	Structure of a C Program, Input and Output Statements **Control Statements:** Basic Programming Constructs, Sequence, Selection Statements 'if' Statement, Conditional / Ternary /?: Operator, Switch Statement, Iteration Statements, 'for' statement, 'while' statement, 'do - while' statement, break, continue Statement	
3	**Arrays and Strings:** Need for an Array, Memory Organization of an Array, Declaration and Initialization, Basic Operation on Arrays, Multi-dimensional Array and strings **Pointers:** Introduction, Declaration and Initialization, Pointer Arithmetic, Pointers and Arrays, Dynamic Memory Allocation **Functions and Storage Classes:** Need for Functions, Function Prototype, Function Definition, Function Call Passing Arguments, Functions and Arrays, Functions and Pointers, Command Line Arguments, Recursive Functions, String Functions, Automatic Storage Class, Register Storage Class, Static Storage Class, External Storage Class	12
4	**Structures:** Declaration and Initialization, Structures and Arrays, Structures and Pointers, Structures and Functions, Introduction to Unions, Enumeration, Type of statement. **Files:** Introduction, File Operations, Character I/O, String I/O, Numeric I/O, Formatted I/O, Block I/O	8

Suggested Books:

1. R.S. Salaria, 'Problem Solving and Programming in C'
2. Cognizant, 'Problem Solving and C Programming".
3. Yashwant P. Kanetkar, 'Let us C', BPB Publications
4. JitenderChhabra, 'Programming with C', Schaum's Series
5. ReemaThareja, 'Computer Fundamentals & Programming in C", OXFORD
6. Peter Nortan, 'Computing Fundamentals', Tata McRaw Hill.

Instructions to Question Paper Setter*: The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks.*

COURSE TITLE: ENGINEERING DRAWING

SUBJECT CODE: BTME-1102
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
1	0	6	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Objective: The main objective of engineering drawing is to familiarize the students with the art of presentation of solid bodies on drawing sheet in accordance with general rules of Engineering Drawing so that they can understand drafting language and convey their ideas via drafting.

Outcomes: After learning the course the students should be able to

- To learn and use tools for engineering drawing
- Drawing Letters using engineering drawing standards
- Methods of Dimensioning
- Representation of solid bodies with Scales
- Draw& visualize different shapes
- Learn about BIS and ISO standards
- To Learn development of surfaces
- Draw and understand Pictorial view
- To learn about the construction of Isometric Projections and conversion of Isometric views to Orthographic views and vice-versa.
- To learn about the sectional views.

Sr. No.	Contents	Contact Hours
UNIT-I	**Introduction:** Introduction to drawing equipment and use of instruments, Symbols and conventions in drawing Practice. Types of lines and their use, BIS codes for lines, Technical lettering as per BIS codes, Introduction to Dimensioning, Concepts of scale in drawing, Types of scales. **Projection of Points and Lines:** Projection of points in quadrants,	**15**

	projection of lines parallel to H P and V P, Parallel to one and inclined to other, inclined to both. True length and angle orientation of straight line: rotation method and trapezoidal method and trace of line	
UNIT-II	**Projection of Planes:** Difference between plane and lamina. Projection of lamina Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes and trace of planes. **Projection of Solids:** Definition of solids, types of solids. Projection of solids in first or third quadrant, with axis parallel to one and perpendicular to other, axis parallel to one inclined to other, axis inclined to both the principle plane, Visible and invisible details in the projection.	**15**
UNIT-III	**Section of Solids:** Definition of Sectioning and its purpose.Procedure of Sectioning, Types of sectional planes.Illustration through examples. **Development of Surface:** Purpose of development, Parallel line, radial line and triangulation method. Development of prism, cylinder, cone and pyramid surface for both right angled.	**15**
UNIT-IV	**Isometric Projection:** Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder **Orthographic Projection:** Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.	**15**

Recommended Books

1. P.S. Gill, 'Engineering Drawing', 4thEdn.,S.K. Kataria.

2. N.S. Parthasarthy Vela Murli, 'Engineering Drawing', 3rdEdn.,Oxford University Press.

3. BasantAggarwal and C.M. Aggarwal, 'Engineering Drawing', 3rdEdn.,McGraw Hill Education (India) Pvt., Ltd.

Instructions to Question Paper Setter*: The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks.*

COURSE TITLE: APPLIED CHEMISTRY LAB

SUBJECT CODE: BTCH-1102
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Duration of Exam; 3 Hrs

Note: Each student is required to perform two experiments from each of the 5 titles (presented bold) depending on his/her Branch and Aptitude.

Objectives:

- To encourage students to take an active part in class.
- To encourage students to develop curiosity and a spirit of enterprise.
- To teach good laboratory practice and skills.
- To teach students to be aware of the safety of oneself and others in the laboratory and be committed to safe practices in daily life.
- To teach students to analyze data from experiments or from other sources.
- To acquire students a readiness in becoming responsible citizens in a changing world.
- To provide students with some insight into future career prospect in the fields related to Chemistry.

Outcomes: Students in chemistry are able to understand

- Demonstration of foundation knowledge in the five areas of chemistry (analytical, biochemistry, inorganic, organic and physical).
- Integrate knowledge learned in discipline specific courses.

- Able to access, search and use the chemical literature.
- Knowledgeable in classical laboratory techniques and be able to use modern instrumentation.
- Design and conduct scientific experiments and analyze the resulting data.
- Be able to work as a member of a team.
- Proper procedures and regulations in handling and disposal of chemicals.
- To communicate (written and oral) scientific information to chemists and non--chemists.
- Be knowledgeable of ethical practices in science.

List of Experiments

1. Analysis of Effluents
a. Determination of Residual Chlorine. b. Determination of water by EDTA method. c. Determination of COD in a given water sample. d. Determination of H_2O by dissolved oxygen analyser e. Determination of turbidity by Nephelometer
2. Analysis of Fuels and Lubricants
a. Determination of Iodine value of oil. b. Determination of Flash & Fire point by Abel's Apparatus c. Determination of the viscosity of oil. d. Determination of Acid Value of and Aniline point of oil e. Determination of refractive index for oils
3. Synthesis & analysis of metal complexes
a. Preparation of Ni-DMG complex. b. Preparation of Tetra minecopper(II)sulphatemonohydrate [Cu(NH3)4]SO4.H2O] c. Determination of copper & nickel in the given solution by audiometric method d. Determination of amount of Cu in the copper ore. e. Estimation of ferrous & ferric ions in the given solution
4. Instrumental Analysis
a. Determination of the surface tension by stalagmometer b. Determination λ-max by spectrophotometer and determination of unknown conc. of binary mixture of two liquids

c. Determination of the strength of a solution pH metrically. d. Determination of the concentration of a solution conductometrically. e. Distinction between acid, ester, ketone using IR spectrophotometer
5. Synthesis & Green Chemistry experiments
a. Preparation of aspirin b. Preparation of a polymer phenol/urea formaldehyde resin c. Preparation of Nylon 66 polymer d. Preparation of ethyl-2-cyano-3-(4-methoxyphenyl)-propeonate (Microwave assisted reaction) e. Base catalysedaldol condensation by Green Methodology Acetylation of primary amines using eco-friendly method.

Recommended Books.

1. Vogel A-I, 'Quantitative Inorganic Analysis', 4th Edn., LongmanSc& Tech, 1980.
2. Vogel A-I, Quantitative Organic Analysis, Oxford ELBS

COURSE TITLE: BASICS OF COMPUTER PROGRAMMING LAB

SUBJECT CODE: BTCS-1102
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Duration of Exam; 3 Hrs

Objective: Basics of Computer and C programming language.

Outcomes:

- Student will develop a vocabulary of key terms related to the computer and to software program
- Student will be able to identify the components of a personal computer system
- Student will be able to demonstrate mouse and keyboard functions
- Student will be able to demonstrate window and menu commands and how they are used
- Student will be able to demonstrate how to organize files and documents on a USB/hard drive
- Student will be able to compose, format and edit a word document
- Student will be able to send email messages (with or without attachments)
- Student will be able to navigate and search through the internet 9. Student will be able to navigate through WebCT.

List of Programmes: At least 10 Programmes to be performed

S. No	CONTENTS
1	Getting used to with the Computer System: Hardware and Software.
2	Working with Files & Folders: Create, Delete, Move files and folders.
3	Setting the Environment: create new user accounts, install new hardware and configuring existing hardware, install new software.
4	Exploring the Internet : Understand the working of the internet that include the use of protocols, domains, IP addresses, URLs, web browsers, web servers, mail-servers, etc.
5	Documentation Tool : MS WORD , MS EXCEL , MS POWERPOINT
6	Introduction to Various C Compilers: Turbo C, GCC, Borland etc.
7	Practical exercises to use various data types.
8	Practical exercises using Conditional statements: if statements, if else statements, and nested statements
9	Practical exercises using for loop, while loop, do while loop, Nested looping
10	Practical exercises using switch statements
11	Practical exercises using arrays
12	Practical exercises using strings and is functions.
13	Practical exercises using structures, unions, enumerations
14	Practical exercises using functions
15	Practical exercises using pointers
16	Practical exercises to read and write the file content.

COURSE TITLE: PROFESSIONAL COMMUNICATION IN PRACTICE

SUBJECT CODE: BTPD-1201
SEMESTER: I/II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Duration of Exam; 3 Hrs

Objectives:

- To enhance the students' communication skills by giving adequate exposure in reading, writing, listening and speaking skills and the related sub-skills
- To enable students to use English in day-to-day communication
- To encourage the students to speak English
- To built up their confidence in the usage of English

Outcome:

The student will acquire basic proficiency in English with special emphasis on listening and speaking skills both at social and professional platforms.

A. **Listening Skills :**

Listening of pre recordedtracks for details and answering questions, choosing or matching the best response, identifying central ideas, understanding accent, pronunciation and stress.

B. Speaking Skills :

Self introduction and introduction of another person; Speeches for special occasion at workplace – Welcome speech ,Introduction speech, Felicitation speech, Farewell Speech, Commemorative Speech); Telephonic skills; Group discussion on social issues and current affairs.

C. Reading Skills :

Comprehension ; Skimming and Scanning for particular information ; Matching statements with paragraphs ; Locating the main idea and understanding main points of given passage

D. **Writing Skills :**

Elements of Effective Business Writing, Group exercise on writing a Paragraph on given topic ;Precis Writing;Resume Writing; Business e-mail writing.

(Note : For lab work, each section should be divided into two groups (with the maximum strength not exceeding 30 students) and each group should have 1 lab class of 2 lectures per week.)

3RD Semester

SUBJECT TITLE: TRANSFORMERS AND DIRECT CURRENT MACHINES
SUBJECT CODE: BTEE-2302
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks.

Course Objectives

1. To prepare students to perform the analysis of any electromechanical system.
2. To empower students to understand the working of electrical equipment used in everyday life

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Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Transformers:** Working principle, construction of single phase transformer, EMF equation, phasor diagrams on no-load and on loaded conditions, open circuit and short circuit tests, equivalent circuit parameters estimation, voltage regulation and efficiency, back to back test. Effect of saturation on exciting current and in-rush current phenomenon. Parallel operation of single phase transformers.
UNIT-II	**Auto Transformers:** Principle of operation, equivalent circuit and phasor diagrams, comparison with two winding transformer.
UNIT-III	**Three-Phase Transformers**: Different types of winding connections, Voltage and current ratios, Parallel operation of three phase transformers. Three winding transformer's equivalent circuit, off-load and on-load tap changing transformer, Scott connections. Testing of transformers.
UNIT-IV	**DCGenerator:** Working principle, construction of DC Machines, Armature windings, single and double layer winding diagrams, EMF and torqueequations, armature reaction,effect of brushshift,compensatingwinding,commutation,causesofbadcommutation,methodsofimp

	rovingcommutation,methods of excitation ofDC generators and their characteristics
UNIT-V	**DCMotor:**Workingprinciplecharacteristics,startingofshuntandseriesmotor,starters,speedcontrolmethods:fieldandarmaturecontrol.Braking:plugging,dynamicandregenerativebraking,Testing:Swinburn's test,Hopkinson test,Field test. Estimation of losses andefficiency.

COURSE OUTCOMES

On successful completion of this course, the learner will be able to

CO1	**BTEE-2302.1**	Outline the principle of operation, construction and testing of single phase transformer
CO2	**BTEE-2302.2**	Demonstrate the working principle of different types of dc machines
CO3	**BTEE-2302.3**	Analyze the losses in dc machines to improve the efficiency by conducting various tests.
C04	**BTEE-2302.4**	The skill to analyze the response of any electrical machine.

Recommended Books:

1. Bimbhra P.S., *ElectricalMachinery*,*KhannaPublishers*
2. Fitzgerald A.E.,KingsleyC. and UmansS.D.,*ElectricMachinery*,McGraw Hill
3. LangsdorffE.H.,*PrinciplesofD.C.machines*,McGraw Hill
4. NagrathI.J.andKothariD.P.,*ElectricalMachines*,TataMcGraw Hill.

SUBJECT TITLE: NETWORK ANALYSIS AND SYNTHESIS
SUBJECT CODE: BTEE-2303
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives

1. To aware the students about the basics of networks.
2. To provide them basic concepts of different types of network theorems and their applications.
3. To impart knowledge about different circuits, analysing and synthesizing the circuits.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Circuits Concepts:** Independent and dependent sources, Standard test signals: Step, ramp, impulse, and doublet. Mesh and nodal analysis. Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, Millman's, Tellegen's and Reciprocity
UNIT-II	**Time and Frequency Domain Analysis:** Representation of basic circuits in terms of generalized frequency and their response, Laplace transform, transient and steady response, transfer function, poles and zeros, pole zero diagram, time domain behaviors from poles and zeros, Convolution Theorem.
UNIT-III	**Network Synthesis:** Network functions, Impedance and admittance function, Transfer functions. Network function for two port network, Sinusoidal network in terms of poles and zeros, Real liability condition for impedance synthesis of RL, LCand RC circuits, network synthesis techniques for 2-terminal network, foster and cauer forms

UNIT-IV	**Filters Synthesis:** Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, pass bands and stop bands, Design of Constant-K, m-derived filters, Composite filters.

Course Outcomes : On successful completion of this course, the student will be able to

CO1	**BTEE-2303.1**	Apply network topology concepts in the formulation and simulation of electrical network problem.
CO2	**BTEE-2303.2**	Apply two-port network analysis in the design and analysis of filter and attenuator network.
CO3	**BTEE-2303.3**	Knowledge of mathematical forms such as Laplace transforms and designing of filters circuits.
C04	**BTEE-2303.4**	Synthesis passive one-port networks using standard Foster and cauer forms.

Recommended Books:

1. Bird John, 'Electrical Circuit Theory and Technology', Newnes,.
2. AbhijitChakraborty, 'Circuit Theory', DhanpatRai,.
3. D. Roy Chaudhury, 'Networks and Synthesis', New Age International.
4. T.S.K. VIyer, 'Circuit Theory', Tata McGraw Hill,
5. Mohan, Sudhakar Sham, 'Circuits and Networks Analysis and Synthesis', TMH.
6. Van Valkenberg, 'Network Analysis and Synthesis', PHI Course.

SUBJECT TITLE: ELECTRONICS DEVICES AND CIRCUITS
SUBJECT CODE: BTEE-2304
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives

1. To aware the students about basic electronic components.
2. To update the knowledge about amplification circuits to amplify the signal.
3. Various types of circuits to generate signals.
4. How electronic components are specified and selected for industrial applications.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introduction:** Introduction to semiconductors theory, P type and N-Type semiconductors, different types of diodes, Drift current, diffusion current. Rectifiers.
UNIT-II	**Bipolar Junction Transistor:** Working action of NPN and PNP. CE, CB and CC configurations, Current components, Concept of D.C. and A.C. load line and operating point, Q point selection, bias stability, various biasing circuits- fixed bias, collector to base bias, emitter bias, voltage divider, Stability factors.
UNIT-III	**Power Amplifiers**: Classifications according to mode of operation and driving output, Class A direct coupled with resistive load, operation of class- B power amplifier, Push-Pull Amplifiers, Concept of feedback in amplifiers: Positive and negative feedback, effect of negative feedback. **Oscillators:** Principle of operation of different oscillator circuits-RC Phase shift,

	Wien Bridge, Hartley Bridge, Colpits and Crystal oscillators
UNIT-IV	**Field Effect Transistors**: FET construction and working, P-channel and N-channel JFETs. Comparison with BJT, Characteristics of JFET, JFET parameters-AC drain resistance, trans-conductance, amplification factor, dc drain resistance. Construction, working and characteristics of MOSFET. Comparison of BJT, JFET and MOSFET.

Course Outcomes : On successful completion of this course, the student will be able

CO1	**BTEE-2304.1**	skills about the basic electronic circuits, their operational characteristics and their applications
CO2	**BTEE-2304.2**	Examine PN junction in semiconductors devices under various conditions.
CO3	**BTEE-2304.3**	Describe the behavior of special purpose diodes..
C04	**BTEE-2304.4**	Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Recommended Books:

1. Boylstad and Nashelsky, 'Electronic Devices and Circuits', Prentice Hall.
2. Millman and Halkias, 'Integrated Electronics', McGraw Hill.
3. Malvino, 'Electronic Principles', McGraw Hill.
4. V.K. Mehta, 'Principles of Electronics', S. Chand.
5. Donald L. Shilling and Charles Below, 'Electronic Circuits', TMH.

SUBJECT TITLE: ELECTRICAL MEASUREMENT & INSTRUMENTATION
SUBJECT CODE: BTEE-2305
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

IInternal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives

1. To aware the students about the basics of measurements and instrumentation systems.
2. To impart knowledge about different instruments for electrical measurements.
3. To provide them basic concepts of different types of sensors and transducers.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Measuring Instruments:** Introduction to measuring techniques, necessity of measurements, block diagram of measurement system, types of instruments, classification of standards, fundamental and derived units. Instrument characteristics; accuracy, precision, repeatability and sensitivity. Different types of errors in measurement. Principle of operation and constructional features; D'Arsonval galvanometer, Moving Coil PMMC and Moving Iron instrument (Repulsion and Attraction type), Electrodynamics instruments
UNIT-II	**Measurement of Resistance**: Low, Medium and High resistance measurement using Kelvin Double Bridge, Ammeter-Voltmeter method,

	Wheat Stone Bridge, Loss of Charge and Megger. **Measurement of Inductance and Capacitance**: Maxwell Inductance, Hay's, Anderson and Schering Bridges, Measurement of frequency by Wein bridge method.
UNIT-III	**Oscilloscope:** Basic principle and construction of Analog CRO, sweep modes, applications in measurement of voltage, frequency (Lissajous pattern), Introduction to Dual Trace Oscilloscope, Digital Storage Oscilloscope, sampling oscilloscope. Comparison between analog and digital oscilloscope.
UNIT-IV	**Transducers:** Transducer and its classifications, basic requirements of Transducer/Sensors. Displacement Transducers: LVDT, RVDT and Piezo Electric. Resistance Thermometer, Thermistors, Thermocouples and Strain Gauge Transducer: Basic principle of operation of Resistance strain gauge.

Course Outcomes

On successful completion of this course, the student will able to .

CO1	**BTEE-2305.1**	Design, analyse various instruments.
CO2	**BTEE-2305.2**	Classify various errors present in measuring instruments.
CO3	**BTEE-2305.3**	Understand construction, working principle and types of oscilloscopes.
C04	**BTEE-2305.4**	Application of various transducers used in measurement system.

Recommended Books:

1. H. Cooper, 'Modern Electronic Instrumentation and Measurement Techniques', PHI,.
2. A.K. Sawhney, Electronic Instrumentation and Measurement', DhanpatRai& Sons.
3. Jones and Chin, 'Electronic Instruments and Measurement.
4. J. Toppin, 'Theory of Errors', Wessely Publishing,.

SUBJECT TITLE: ELECTRICAL MEASUREMENT & INSTRUMENTATIONLABORATORY
SUBJECT CODE: BTEE-2306
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

IInternal Assessment: 60

End Term Exam: 40

Course Objectives

1. To understand the working principal and construction of the measuring instruments and recorders.
2. To measure various electrical parameters using meters and transducers.
3. To calibrate the measuring devices such as meters and transducers.

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LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	Study of principle of operation of various types of electromechanical measuring instruments.
EXP-2	To measure high value of DC current and voltage using shunt and multiplier.

EXP-3	To measure low resistance using wheat stone bridge.
EXP-4	To measure active and reactive power in 3-phase balanced load by one wattmeter method.
EXP-5	To measure the active power in 3-phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter readings.
EXP-6	To study and calibrate single phase energy meter.
EXP-7	Measurement of resistance using Kelvin's Bridge.
EXP-8	Measurement of self-inductance using Anderson's Bridge.
EXP-9	Measurement of capacitance using Schering Bridge.
EXP-10	Plotting of Hysteresis loop for a magnetic material using flux meter.
EXP-11	Measurement of frequency using Wein's Bridge.
EXP-12	To study the connections and use of Current and Potential transformers and to find out ratio error.
EXP-13	Determination of frequency and phase angle using CRO.
EXP-14	Measurement of unknown voltage using potentiometer.
EXP-15	To find 'Q' of an inductance coil and verify its value using Q-meter.

Note: At least ten experiments should be performed in semester.

Course Outcomes

CO1	**BTEE-2306.1**	Measurement of various electrical and non electrical parameters.

CO2	**BTEE-2306.2**	Compute the errors present in measuring instruments and calibrate them.
CO3	**BTEE-2306.3**	Ability to use the techniques and skills to operate CRO.
C04	**BTEE-2306.4**	Select various transducers for the measurement of physical quantities like temperature, pressure ,distance and displacement.

SUBJECT TITLE: ELECTRONICS DEVICES & CIRCUIT LABORATORY
SUBJECT CODE: BTEE-2307
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

IInternal Assessment: 60

End Term Exam: 40

Course Objectives

1. To understand the Characteristics of various semiconductor devices and construction of different electronic circuits using the above devices.
2. Tointroducevarietyofsourcestoobtainspecificationsofelectronicdevices&to impartknowledgeabouttechnicalreportsrelatedtobasicelectroniccircuits using correct technical vocabulary.
3. Able to understand identification and selection of various electronic components.

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	To analyse the response of Zener diode asregulator
EXP-2	To analyse the response of half wave, full wave and Bridgerectifiers.
EXP-3	To plot the input and output characteristics of CEconfiguration.
EXP-4	To plot the input and output characteristics of CBconfiguration.

EXP-5	To examine the characteristics of a Class-Aamplifier.
EXP-6	To examine the characteristics of Class-Bamplifier.
EXP-7	To analyse the characteristics of Class-B push-pullamplifier.
EXP-8	To analyse the characteristics of complementary symmetryamplifier.
EXP-9	To discuss the response of RC phase shift oscillator and determine frequency of oscillation.
EXP-10	To discuss the response of Hartley oscillator and determine frequency ofoscillation.
EXP-11	To analyse the response of Colpitt's oscillator and determine frequency ofoscillation.
EXP-12	To analyse the response of Wien Bridge oscillator and determine frequency of oscillation.
EXP-13	To study the characteristics and response of crystaloscillator.
EXP-14	To plot the characteristics ofFET.
EXP-15	To plot the characteristics ofMOSFET.

Note: At least ten experiments should be performed in semester.

Course Outcomes(CO) :On successful completion of this course, the learner will be able to

CO1	**BTEE-2307.1**	Understand all types of electronics devices and circuits.
CO2	**BTEE-2307.2**	Select various transducers for the measurement of physical quantities like temperature, pressure ,distance and displacement
CO3	**BTEE-2307.3**	Use the techniques and skills to operate CRO.
C04	**BTEE-2307.4**	Design and conduct experiments, as well as to analyze and interpret data.

SUBJECT TITLE: ELECTRICAL MACHINE-I LABORATORY
SUBJECT CODE: BTEE-2308
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Course Objectives

1. To understand the basics of D.C Machines.
2. To introduce variety of speed control of dc shunt motor.
3. To Study the universal motor .

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	To study various components/cut-section of DC machine

EXP-2	To perform starting techniques of various DC machines.
EXP-3	To obtain torque and speed characteristics of a D.C. Shunt motor
EXP-4	To obtain external characteristics of a D.C. shunt generator
EXP-5	To obtain external characteristics of a D.C. series generator.
EXP-6	To obtain external characteristics of DC compound generator.
EXP-7	Speed control of a dc shunt motor by varying armature circuit and field circuit method
EXP-8	To obtain performance characteristics of universal motor.
EXP-9	To perform Swinburne's Test
EXP-10	To perform Hopkinson's Test
EXP-11	To perform the Brake Load Test
EXP-12	Calculate the power rating of DC machines.
EXP-13	To determine losses and efficiency of DC machines

Note: At least ten experiments should be performed in semester.

Course Outcomes(CO): On successful completion of this course, the learner will be able to
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CO1	**BTEE-2308.1**	Acquire skills to understand all types of dc machines
CO2	**BTEE-2308.2**	Ability to analyse the speed control of machine
CO3	**BTEE-2308.3**	Determine the performance characteristics of DC shunt motor and DC compound motors.
C04	**BTEE-2308.4**	Determine the performance characteristics of DC machine by conducting direct and indirect tests

SUBJECT TITLE: ASYNCHRONOUS MACHINES
SUBJECT CODE: BTEE-2401
SEMESTER: 4
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

IInternal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To impart knowledge of the constructional features and principle of operation of three-phase and single-phase induction machines.

2. To impart knowledge about methods of starting and speed control of induction motors.
3. To make the students aware about construction, principle of operation and applications of special purpose motors.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Three Phase Induction Motors**: Constructional features, Production of rotating field in space distributed three-phase winding, Principle of operation, Concept of slip, rotor frequency, current, torque and power output, Types of induction motors, Analogy between induction motor and transformer, no load and blocked rotor test, Circle diagram, Equivalent circuit parameters, Phasor diagram, Torque-slip characteristics, Effect of rotor circuit resistance, Crawling and Cogging, Cage motors (double cage and deep bar motor).
UNIT-II	**Starting Methods and Speed Control:** Starting methods of squirrel cage and slip ring induction motor, Different speed control methods, effect of voltage injection in rotor circuit of slip ring induction motor. **Induction Generator:** Isolated and Grid mode operation, method of excitation, performance characteristics of three-phase self-excited induction generator, introduction to doubly fed induction generator.
UNIT-III	**Single Phase Motors**: Introduction, Double revolving field theory, types of single phase motors (Split phase, capacitor start, capacitor run, capacitor start and run) and their characteristics, shaded pole motor: working principle and characteristics. Reluctance motor: construction, principle of operation and applications.
UNIT-IV	**Special Purpose Motors:** Stepper Motor: construction, principle of operation and applications. Linear Induction Motor: construction, principle of operation and applications. Universal Motor: construction, principle of operation and applications.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-2401.1**	Identify alternator types ,and appreciate their performance
CO2	**BTEE-2401.2**	Skills to analyse the performance of the asynchronous machines

		using the phasor diagrams and equivalent circuits.
CO3	**BTEE-2401.3**	Gain knowledge of speed control and testing of asynchronous machines.
C04	**BTEE-2401.4**	Select appropriate asynchronous machine for any application and appraise its significance

Recommended Books:

1. A.E. Fitzgerald, C. Kingsley and S.D. Umans, 'Electric Machinery',McGrawHill.
2. E.H. Langsdorff, 'Principles of A.C. Machines', McGraw Hill.
3. I.J. Nagrath and D.P. Kothari, 'Electrical Machines',Tata McGraw Hill.
4. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers.
5. M.G. Say,' Alternating Current Machines', Sir Isaac Pitman and Sons Ltd.

SUBJECT TITLE: DIGITAL ELECTRONICS
SUBJECT CODE: BTEE-2402
SEMESTER: 4
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

IInternal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives

1. To provide knowledge about basics of digital electronics.
2. To impart knowledge about designing of digital circuits.
3. Students will use schematics and symbolic algebra to represent digital gates inthe creation of solutions to design problems

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Number System and Binary Code:** Introduction, Binary, decimal, Octal, hexadecimal, BCD number system, Signed and unsigned numbers, binary operations: Addition, Subtraction. Multiplication and division. Subtractions using 1's and 2's compliment. ASCII code. Excess 3 codes and Gray code. Logic gates: OR, AND, NOT, NOR, NAND, Ex-OR gates, Basic theorems of Boolean algebra, sum of products and product of sums. Minimisation using theorems, minimisation using K-map up to 4 variables.
UNIT-II	**Combinational logic circuits:** Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, adders, subtractors, code converters, parity checkers, BCD display drive, magnitude comparators.
UNIT-III	**Sequential circuits:** Flip Flop fundamentals, different flip flop configurations: SR, JK, D,T. Edge triggered and clocked flip flops, Registers: Types of Registers, series and parallel shift: circuit diagram, timing wave form and operations. Counters: synchronous and asynchronous, Johnson counter.
UNIT-IV	**D/A and A/D Converters:** Introduction, Weighted register D/A converter, binary ladder D/A converter, D/A accuracy and resolution, parallel A/D converter, Counter type A/D converter, Successive approximation A/D converter, Single and dual slope A/D converter, A/D accuracy and resolution.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-2402.1**	Became familiar with the digital signal, positive and negative logic, Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and their conversion from to others.
CO2	**BTEE-2402.2**	Learn the minimization techniques to simply the hardware requirements of digital circuits, implement it, design and apply for real time digital systems.
CO3	**BTEE-2402.3**	Understand all types of combinational & sequential digital circuits and their designing
C04	**BTEE-24024**	Know various types of components-ADC and DAC, memory elements and the timing circuits to generate different waveforms, and also the different logic families involved in the digital system

Recommended Books:

1. R.P. Jain, 'Modern Digital Electronics', Tata McGraw Hill**.**
2. Malvino& Leach, 'Digital Principals & Applications', Tata McGraw Hill**.**
3. Fletcher, 'An Engg. Approach to Digital Design', PHI, Indian Edn.**.**
4. Sanjay Sharma, 'Digital Electronics' Kataria Sons**.**

SUBJECT TITLE: POWER SYSTEM-I (TRANSMISSION AND DISTRIBUTION)
SUBJECT CODE: BTEE-2403
SEMESTER: 4
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

IInternal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions.

Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To introduce the students to the structure of power and distribution systems.
2. To introduce them to overhead transmission lines and underground cables and make them to understand their operating characteristics.
3. To make them familiar with the components and the mechanical design aspects of overhead transmission lines.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Structure of Power System:** Growth of power systems: Indian overview, Interconnectionsand their advantages, Electricity act 2003, Environmental and safety measures. **Distribution Systems:** DC 2-wire and 3-wire systems, AC single phase, three phase and 4-wire systems, and comparison of copper efficiency. Distribution Systems: primary and secondary distribution systems, concentrated and uniformly distributed loads on distributors; one and both ends, ring distribution, sub mains and tampered mains
UNIT-II	**Overhead Transmission Lines:** Materials and types of conductors, line parameters calculation of inductance and capacitance of single and double circuit transmission lines, three phase lines with stranded and bundle conductors, generalized ABCD constants and equivalent circuits of short, medium and long lines. Line performance: regulation and efficiency of short, medium and long lines, series and shunt compensation.
UNIT-III	**Overhead Line Insulators and Mechanical Design of Transmission Lines:** Type, string efficiency, voltage distribution in string of suspended insulators, grading ring, preventive maintenance. Different types of towers, sag-tension calculations, Corona-losses, radio and audio noise, transmission line–communication line interference, Comparison of EHVAC and HVDC transmission systems.
UNIT-IV	**Underground Cables:** classification of cables based upon voltage and dielectric material, insulation resistance and capacitance of single core cable, dielectric stress, capacitance of 3 core cables, methods of laying, heating effect, Maximum current carrying capacity, cause of failure, comparison with overhead transmission lines.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-24013.1**	Understand power distribution systems.
CO2	**BTEE-2403.2**	Analyse performance of transmission lines and underground cables.
CO3	**BTEE-2403.3**	Design and Select overhead line insulators and transmission lines
C04	**BTEE-2403.4**	Implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology.

Recommended Books:

1. D.P. Kothari and I. J. Nagrath, 'Power System Engineering', Tata McGraw Hill.
2. J.B. Gupta, 'Transmission and Distribution of Electrical Power', Katson Books.
3. C.L. Wadhwa, 'Electric Power Systems',New Age International Publishers.
4. J. Grainger John and Jr. W.D. Stevenson, 'Power System Analysis', McGraw Hill.

SUBJECT TITLE: LINEAR CONTROL SYSTEM
SUBJECT CODE: BTEE-2404
SEMESTER: 4
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

IInternal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives

1. To obtain transfer functions for electrical circuits, translational/rotational mechanical systems and electromechanical systems.
2. To learn basic goals of control systems in terms of transient/steady state time response behaviour.
3. To update the knowledge about control components.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introductory Concepts**: Plant, Systems, Servomechanism, regulating systems, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, Block diagrams, some illustrative examples
UNIT-II	**Modelling**: Force voltage analogy, force current analogy, Transfer function, Block diagram reduction technique, signal flow graphs and Mason's gain formula, characteristics equation. **Time Domain Analysis**: Transient response of the first and second order systems, Time domain specifications, Steady state error and coefficients, Absolute and relative stability, Routh-Hurwitz Criterion.
UNIT-III	**Stability Analysis:** Root locus technique, sketch of the root locus plot, Frequency domain analysis: Closed loop frequency response, bode plots, relative stability using bode plot. Frequency response specifications, relation between time and frequency response for second order systems.Nyquist criterion for stability.
UNIT-IV	**State Space Analysis: S**tate space representations, transfer function from state model, state transition matrix, controllability, observability. Control components: Error detectors- potentiometers and synchros, servo motors, A.C. and D.C. techno generators, Magnetic amplifiers.

Course Outcomes : On successful completion of this course, the learner will be able to

CO1	**BTEE-2404.1**	Identify a set of algebraic equations to represent and model a complicated system into a more simplified form.
CO2	**BTEE-2404.2**	Classify any Laplace domain system to illustrate different specification of the system using transfer function concept.
CO3	**BTEE-2404.3**	Various mechanical and physical systems in terms of electrical system to construct equivalent electrical models for analysis .
C04	**BTEE-2404.4**	Analyzed the designed systems'stability

Recommended Books

1. Dorf Richard C. and Bishop Robert H., 'Modern Control System', Addison–Wesley,Pearson New Delhi**.**
2. K. Ogata, 'Modern Control Engineering', Prentice Hall**.**
3. B.C. Kuo, 'Automatic Control System', Prentice Hall**.**
4. I.J. Nagrath and M. Gopal, 'Control System Engineering', Wiley Eastern Ltd.**.**
5. B.S. Manke, 'Linear Control Systems'

SUBJECT TITLE: POWER PLANT ENGINEERING
SUBJECT CODE: BTEE-2405
SEMESTER: 4
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To introduce the students to the classification of steam and hydro-electric power plants and make them familiar with the main equipment and machinery used in them.
2. To provide them basic concepts of nuclear, gas and diesel power plants.
3. To impart knowledge about pollution control and combined operation of different plants.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Steam Generators, Condensers and Turbines**: Classification of steam generators, Typesof condensers, effect of air in condensers, steam nozzles, types of steam turbine efficiencies. **Steam Power Plant:** Classification, Operation, Description of Rankin cycle, coal handlingsystem, combustion system, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.
UNIT-II	**Hydro-Electric Power Plants:** Hydrological cycle, Hydrograph, Flow duration curve,Classification of hydro plants, Selection of water turbines for hydro power plant. **Nuclear Power Plants:** Nuclear physics, Binding energy, Radioactive decay. Fertilematerial, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Safety measures, Future of nuclear power.

UNIT-III	**Gas Turbine:** Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Plant layout, applications. **Diesel Power Plants:** Classifications of IC Engines and their performance, four stroke andtwo stroke diesel engines, combustion phenomenon; Essential components, Cetane number, knocking, super charging, operation and layout of diesel power plant.
UNIT-IV	**Combined Operation of Different Power Plants**: Advantages of combined operation ofplants, load division between power stations, coordination of different types of Power Plants. **Pollution Control**: Pollution from thermal and nuclear plants, Particulate emission and control, electrostatic precipitator, solid waste disposal.

Course Outcomes:

On successful completion of this course, the learner will be able to

CO1	**BTEE-2405.1**	Acquire knowledge about various equipment used in thermal, hydro and nuclear power generation.
CO2	**BTEE-2405.2**	Become familiar with equipment used in gas and diesel power plants .
CO3	**BTEE-2405.3**	Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts
C04	**BTEE-2405.4**	Know about the importance of co-ordinated operation of different power plants and methods of pollution control

Recommended Books:

1. Chakrabarti, Soni, Gupta and Bhatanagar, ‘A Textbook on Power System Engineering’, DhanpatRai& Co.
2. M.M. EI-Wakil, ‘Power Plant Technology’, Tata McGraw Hill Edn..
3. R.K. Rajput, ‘Power Plant Engineering’, Luxmi Publications.
4. P.C. Sharma, ‘Power Plant Engineering’, Kataria and Sons.
5. B.G.A. Skrotzki and W.A. Vapot, ‘Power Station Engineering and Economy’, Tata McGraw Hill Education Pvt.Ltd..
6. P.K. Nag, ‘Power Plant Engineering’,McGraw Hill Education (India) Pvt. Ltd..

SUBJECT TITLE: PROGRAMMING IN MATLAB
SUBJECT CODE: BTEE-2406
SEMESTER: 4
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

IInternal Assessment: 60

End Term Exam: 40

Course Objectives:

1. To introduce to BASIC built in functions of MATLAB and blocks of SIMULINK.
2. To learn to do various programming operations in MATLAB and develop Simulink models in SIMULINK.
4. To learn to plot various types of graphs in MATLAB.

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	Introduction to Fundamentals of MATLAB Programming.
EXP-2	To perform Arithmetic and logic operations in MATLAB.
EXP-3	To perform branch and loop operations in MATLAB.
EXP-4	To use basic built-in function of Matrices in MATLAB.
EXP-5	To develop a user defined function file in MATLAB
EXP-6	To plot 2-D & 3-D graphs in MATLAB, such as plots, subplots, logarithmic plots and multiple plots etc.
EXP-7	To plot 3-phase AC supply voltage in MATLAB.

EXP-8	To develop MATLAB program to calculate ABCD parameters of transmission line.
EXP-9	To develop Simulink model to show series resonance phenomenon and to plot voltage & current waveforms and frequency vs impedance graph.
EXP-10	To develop Simulink model to show parallel resonance phenomenon and plot voltage & current waveforms and frequency vs admittance graph.
EXP-11	To develop a Simulink model of symmetrical three phase power system supplying a three phase balanced load and to display the three phase voltage, current, active and reactive power.
EXP-12	To develop a Simulink model of symmetrical three phase power system supplying a three phase balanced load and to display the three phase voltage, current, active and reactive power.
EXP-13	To develop Simulink model of three phase transformer and to display the primary and secondary voltages and currents.
EXP-14	To develop Simulink model for speed control of dc motors.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-2303.1**	Kow about BASIC built in functions of MATLAB and blocks of
CO2	**BTEE-2303.2**	Break a complex task into simple and smaller
CO3	**BTEE-2303.3**	They will learn to do various programming operations in MATLAB and develop Simulink models in SIMULINK.
C04	**BTEE-2303.4**	They will be able to draw 2-D and 3-D plots in MATLAB

 # Note: At least ten experiments should be performed in semester.

SUBJECT TITLE: CONTROL SYSTEM LABORATORY
SUBJECT CODE: BTEE-2407
SEMESTER: 4
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

IInternal Assessment: 60

End Term Exam: 40

Course Objectives

1. To understand the basics of MATLAB software.
2. To introduce variety of control system strategies.
3. To comment about t he stability of designed systems.

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox andPSPICE.
EXP-2	Determination of step response for first order and second order system with unity feedback and their display on CRO. Calculation and verification of time constant, peak overshoot, setting time etc. from theresponse.
EXP-3	Simulation of step response and impulseresponsefortype-0, type-1and type-

	2 systems with unity feedback using MATLAB andPSPICE.
EXP-4	Determination of Root Locus, Bode-Plot, Nyquist Plot using MATLAB-Control system toolbox for 2ndorder system. Determination of different control system performance indices from theplots.
EXP-5	Experimental determination of approximate transfer function from Bodeplot.
EXP-6	Evaluation of steady state error, settling time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator and by compensator in forward path transfer function for unity feedback control system usingPSPICE.
EXP-7	Design of a second order linear time invariant control system and study of system response with unit stepinput.
EXP-8	To study the characteristics of potentiometers and to use 2-potentiometers as an error detector in a control system.
EXP-9	To study the synchro Transmitter-Receiver set and to use it as an errordetector.
EXP-10	To study the Speed-Torque characteristics of an AC Servo Motor and to explore its applications.
EXP-11	To study the Speed-Torque characteristics of a DC Servo Motor and explore its applications.
EXP-12	To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers.
EXP-13	To study the speed control of an A.C. Servo Motor using a closed loop and an open loop system.
EXP-14	To study the operation of a position sensor and study the conversion of position in to correspondingvoltage

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-2407.1**	Demonstrate the response of first order and second order systems with various standard test signals.
CO2	**BTEE-2407.2**	Understand concepts of time domain analysis of series RLC Circuit

CO3	**BTEE-2407.3**	Examine the DC motors time response and determine the transfer function
C04	**BTEE-24074**	Evaluate the stability of control systems

#Note: At least ten experiments should be performed in semester.

SUBJECT TITLE: DIGITAL ELECTRONICS LABORATORY
SUBJECT CODE: BTEE-2408
SEMESTER: 4
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

IInternal Assessment: 60

End Term Exam: 40

Course objectives

1. To give students a practical knowledge about all types of digital circuits.
2. To give students a working knowledge to connect digital circuits and verify their truth tables.
3. To give students acknowledge about integrated circuits of different combinational and sequential circuits.

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	To Study Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and realization of OR, AND, NOT and XOR functions using universalgates.
EXP-2	To design Half Adder using Logic gates on breadboard.
EXP-3	To design Full Adder using Logic gates on breadboard.
EXP-4	To design Half Subtractor using Logic gates on breadboard.

EXP-5	To design Full Subtractor using Logic gates on breadboard.
EXP-6	To design 4-Bit Binary-to-Gray Code Converter on breadboard.
EXP-7	To design 4-Bit Gray-to-Binary Code Converter on breadboard.
EXP-8	To study and design 4-Bit magnitude comparator using logic gates on breadboard.
EXP-9	Design and verification of Truth-table ofmultiplexer.
EXP-10	Realization of Half adder and Full adder usingMUX.
EXP-11	Design and verification of Truth-table of Demultiplexer.
EXP-12	Realization of half subtractor and full subtractor usingDEMUX.
EXP-13	To study and verify Truth-table of RS, JK, D, JK Master Slave FlipFlops.
EXP-14	To design MOD-7 Synchronous up-counter using JK/RS/D FlipFlops.
EXP-15	To Study different shift registers: SIPO, SISO, PIPO, andPISO.
EXP-16	To Study digital logicfamilies.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-2401.1**	Become familiar to logic gates ,digital signals, truth table and conversions
CO2	**TEE-2401.2**	Learn how to minimize the hard ware needs for digital circuit ,put them into practice and use them for real time circuit.
CO3	**BTEE-2401.3**	Ability to test and validate the truth table and working condition of combinational and sequential circuits
C04	**BTEE-24014**	Working knowledge to study output input wave form on oscilloscope

Note: At least ten experiments should be performed in semester

SUBJECT TITLE: SYNCHRONOUS MACHINES
SUBJECT CODE: BTEE-3501
SEMESTER: 5
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

IInternal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To make the students aware about the general aspects of synchronous machines.
2. To apprise the students about the construction, operation and characteristics of alternators and synchronous motors.
3. To make them to understand the underlying aspects of parallel operation of alternators.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**General Aspects:** Construction and working principle of synchronous machines, Excitationsystems, Production of sinusoidal electromotive force (EMF) and its equation, flux and magnetomotive force (MMF), phasor diagrams, cylindrical and salient pole rotors, pitch factor, distribution factor
UNIT-II	**Alternators:** Construction, Phasor diagram of cylindrical rotor alternator, ratings, armaturereaction, determination of synchronous reactance; open-circuit and short- circuit characteristics, short-circuit ratio, short-circuit loss. Determination of voltage regulation: EMF, MMF and zero power factor method. Power flow through inductive impedance, Power-angle characteristics of cylindrical and salient pole synchronous machines, Two-reaction theory of salient pole machines, power factor control.
UNIT-III	**Synchronous Motors:** Operating characteristics, power-angle characteristics, condition formaximum power, V-curves and inverted V-curves, methods of starting, synchronous motor applications, synchronous condenser, Hunting, damper windings, Hysteresis motors.
UNIT-IV	**Parallel Operation of Alternators:** Conditions for synchronization of single phase andthree phase alternators, conditions for parallel operation, synchronizing power, current and torque, effect of increasing excitation of one of the alternators, effect of change of speed of one of the alternators, effect of unequal voltages, load sharing.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3201.1**	Understand about the general aspects and winding terminology used in 3-ϕ synchronous machines and 1-ϕ synchronous motors.
CO2	**BTEE-3201.2**	Analyse the various methods of voltage regulation and EMF equations of alternators.
CO3	**BTEE-3201.3**	Memorize power-angle characteristics of synchronous machines and the working and characteristics of synchronous motors.
C04	**BTEE-3201.4**	Understand the concepts about parallel operation and transient conditions of alternators.

Recommended Books

1. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, **2010.**
2. A.E. Fitzgerald, C. Kingsley and S.D. Umans, 'Electric Machinery', 6th Edn., McGrawHill.
3. I.J. Nagrath and D.P. Kothari, 'Electrical Machines', 4th Edn., Tata McGraw Hill, **2011**.
4. M.G. Say, 'Alternating Current Machines', 5th Edn., Sir Isaac Pitman and Sons Ltd., **2004**.
5. S. Sarma Mulukutla and Mukesh K. Pathak, 'Electric Machines', 3rd Indian Reprint, CENGAGE Learning, **2009**.

SUBJECT TITLE: POWER ELECTRONICS & DRIVES
SUBJECT CODE: BTEE-3502
SEMESTER: 5
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

I

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To make the students aware about the power electronic devices and construction, operation and characteristics of most popular member of thyristor family i.e. SCR.

2. To acquaint them with basic concepts of operation of different types of convertors.
3. To impart knowledge about application of converters to motor drives.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introduction:** Thyristor family and SCR, Constructional features of SCR, its static and dynamic characteristics, turn-on and turn-off methods and firing circuits, Ratings and protection of SCR'S, series and parallel operation, commutation circuits.
UNIT-II	**Phase Controlled Converters:** Principle of phase control, single phase and three phase converter circuits with different types of loads, dual converters and their operation. **DC Choppers:** Principle of chopper operation, control strategies, types of choppers, step upand step down choppers, voltage, current and load-commutated choppers.
UNIT-III	**Inverters:** Single phase Voltage source bridge inverters, Modified Mc-Murray half bridge inverter, series inverters, three phase bridge inverters with 180^0 and 120^0 modes. Single phase PWM inverters, Current source inverters. **AC Voltage Controllers:** Types of single-phase voltage controllers, single-phase voltage controller with R and RL type of loads. **Cycloconverters:** Principle of operation, single phase to single phase step up and step down Cycloconverters, three phase to single phase cycloconverters.
UNIT-IV	**DC Motor Drives:** DC motor drive–starting, braking, transient analysis, speed control,controlled rectifier converters for DC drives and chopper fed DC drives. **AC Motor Drives** Induction motor drive–starting, braking, transient analysis, speed control, ac controller fed induction motor, voltage source inverter, current source inverter and cyclo-converter fed induction motor drive.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3502.1**	The students will learn the operation and characteristics of power electronic devices
CO2	**BTEE-3502.2**	The students will be able to analyse operation of diffferent types of converter circuits such as; AC-DC, DC-DC, AC-AC and DC-AC.
CO3	**BTEE-3502.3**	Understand the concepts about parallel operation and transient conditions of alternators.
CO4	**BTEE-3502.4**	Design single phase and three phase inverters

Recommended Books

1. G.K. Dubey, S.R. Doradla, A. Joshi, R.N.K. Sinha, 'Thyristorised Power Controllers', New Age International (P) Limited, Publishers, **2004**.
2. M. Rashid, 'Power Electronics', Prentice Hall of India Private Ltd., **2006**.
3. P.S. Bimbhra, 'Power Electronics', Khanna Publishers, **2004**.
4. Bimal Bose, 'Power Electronics and Motor Drives', Academic Press, **2006**.
5. P.C. Sen, 'Power Electronics', Tata McGraw Hill Company Ltd., New Delhi, **1992**.
6. C. Rai Harish, 'Power Electronics and Industrial Applications', 1st Edn., CBS Publishers& Distributors Pvt Ltd., **2018**.

SUBJECT TITLE: GENERATION AND ECONOMICS OF ELECTRIC POWER
SUBJECT CODE: BTEE-3503
SEMESTER: 5
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

I

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To familiarize the students with different types of loads and load curves.
2. To apprise them with different types of costs involved in power plant and tariffs imposed on the electricity consumers
3. To impart knowledge about selection and economic operation of steam plants.
4. To impart knowledge about hydrothermal coordination

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Loads and Load Curves:** Types of load (fixed voltage loads, resistive loads, Inductivemotor loads, mechanical load), effect of load on supply voltage, maximum demand, group diversity factor, peak diversity factor, types of load, chronological load curves, load-duration curve, mass curves, load factor, capacity factor, utilization factor, base load and peak load plants, load forecasting.
UNIT-II	**Power Plant Economics:** Capital cost of plants, annual fixed cost, operating costs andeffect of load factor on cost of energy, depreciation, tariffs and power factor improvement, objectives of tariff making, different types of tariff (domestic, commercial, agricultural and industrial loads). Need for power factor improvement, power factor improvement using capacitors, determination of economic power factor.
UNIT-III	**Selection of Plant:** Plant location, plant size, number and size of units in plants, economiccomparison of alternatives based on annual cost, rate of return, present worth and capitalized cost methods. Economic operation of steam plants, methods of loading turbo-generators, input- output curve, heat rate, incremental cost, method of Lagrangian multiplier, effect of transmission losses, co-ordination equations, and iterative procedure to solve co-ordination equations.
UNIT-IV	**Hydro-Thermal Co-ordination:** Advantages of combined working of Run-off River plantand steam plant, reservoir hydro plants and thermal plants, long-term operational aspects, scheduling methods. Cogeneration: Definition and scope, Topping and Bottoming Cycles, Benefits, cogeneration technologies.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3503.1**	Understand how electricity is generated and how it affects people.
CO2	**BTEE-3503.2**	knowledge of different types of loads and related terminology.
CO3	**BTEE-3503.3**	Demonstrate the working operation and maintenance of substation
CO4	**BTEE-3503.4**	Get knowledge about co-ordinated operation of Hydro and Steam power plants.

Recommended Books

1. M.V. Deshpande, 'Power Plant Engineering', Tata McGraw Hill, **2004**.
2. M.M. EI-Wakit, 'Power Plant Engineering', McGraw Hill, USA, **2010.**
   D.P. Kothari and I.J. Nagrath, 'Power System Engineering', Tata McGraw Hill, **2008**
4. S.C. Arora and S. Dom Kundwar, 'A Course in Power Plant Engineering', 6th RevisedEdn.,Dhanpat Rai,**2011-12**.
5. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill, **2014**.
6. B.R. Gupta, 'Generation of Electrical Energy', S. Chand, **2017**.

SUBJECT TITLE: ELECTROMAGNETIC FIELD THEORY
SUBJECT CODE: BTEE-3504
SEMESTER: 5
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

I

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To provide the knowledge about the time varying fields and Maxwell's equations.
2. To provide knowledge about the propagation of electromagnetic wave along different mediums.
3. Study of physical concept and all the important fundamental parameters of waveguides.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Review of Electrostatic and Magnetostatic Fields:** Review of vector algebra, Review ofCartesian, Cylindrical and spherical coordinate systems, Introduction to del operator, Use of del operator as gradient, divergence, curl. Introduction to coulomb's law, Gaussian law. Laplace's and Poission's equation in various coordinate systems. Introduction to Ampere's law, Magnetic vector potential.
UNIT-II	**Time Varying Fields and Maxwell's Equations:** Equation of continuity, Inconsistency ofAmpere's law for time varying fields, Concept of displacement current, Maxwell's equation in integral and differential form (for static fields, time varying fields, free space, good conductors, harmonically varying fields), Poynting theorem.
UNIT-III	**Uniform Plane Waves:** Introduction, Uniform plane wave propagation, Wave equations:Wave equations for free space, Wave equations for conductors. Transverse nature of uniform plane waves, Reflection of electromagnetic waves by perfect conductor and perfect dielectric, wave impedance and propagation constant, depth of penetration, surface impedance.
UNIT-IV	**Wave Guides:** Introduction, simple waveguides between two infinite and parallelconducting plates, Transverse Electric (TE) Waves or H-Waves, Transverse magnetic (TM) Waves or E-Waves, Characteristics of TE and TM waves, Transverse Electromagnetic (TEM) waves and its characteristics

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3504.1**	Understand concepts of electromagnetic field theory and fundamental field equations.
CO2	**BTEE-3504.2**	Get knowledge of various application of the boundary conditions for fields .
CO3	**BTEE-3504.3**	Have skills to identify, formulates and solves engineering problems related to electromagnetic fields.
CO4	**BTEE-3504.4**	Determine and describe the Dynamic and static magnetic and electric fields for important technologically structures:

Recommended Books

1. Jordan and Balmain, 'Electromagnetic Wave', PHI and Radiation System,**2010.**
2. Kraus, 'Electromagnetics', T.M.H.**2003.**
3. W.H. Hayt and J.A. Buck, 'Problem and Solutions in Electromagnetics', Tata McGrawHill, **1999.**
4. W.H. Hayt, 'Engineering Electromagnetic', Tata McGraw Hill,**2012**.

SUBJECT TITLE: MICROPROCESSORS AND INTERFACING
SUBJECT CODE: BTEE-3505
SEMESTER: 5
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To understand the basic architecture of 8 and 16-bit microprocessor.
2. To understand interfacing of microprocessor with memory and peripheral chips involving system design.
3. To understand the techniques for faster execution of instructions and improve the performance of microprocessor.
4. To understand the concepts of multi core processor.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introduction:** Introduction to microprocessor, Intel 8085 microprocessor architecture and pindiagram, Data flow to/from memory, from/to microprocessor unit, multiplexing and de-multiplexing of address data bus. Bus timings, T state, machine cycle, timing diagram, Memories- RAM, DDR/SDR, ROM, EROM, EPROM, EEPROM, Flash Memory, Cache Memory.
UNIT-II	**Programming with 8085:** Addressing modes, Detail study of 8085 instruction set. I/O andMemory mapping, Interfacing I/O Devices, Interrupts, stack and subroutines, Counter and Time, Delays, Code conversion, BCD Arithmetic and 16-bit data operations, Programming techniques with additional instructions, Program Debugging.
UNIT-III	**Interfacing with 8085:** Architecture, interfacing and programming of 8155/8156(programmable I/O port timer), 8251(universal synchronous, asynchronous receiver transmitter), 8253/ 8254 (programmable interval timer), 8255 (programmable peripheral

	interface), 8279 (keyboard display controller), and 8257 (direct memory access controller).
UNIT-IV	**Other Microprocessor and interfacing:** 8086 -Block diagram, Architecture, pipelining, flagregister, register bank operation, memory segmentation, addressing modes. Introduction to 80186, 80286, 80386, 80486 and Pentium and their comparison, Comparative study of 8-bit microprocessors: Intel 8085, Motorola 6800, Zilog Z-80.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3505.1**	Write program to run on 8085 microprocessor based systems.
CO2	**BTEE-3505.2**	Design system using memory chips and peripheral chips.
CO3	**BTEE-3505.3**	Understand various techniques for faster execution of instructions and improve speed of operations.
CO4	**BTEE-3505.4**	Build systems using microcontrollers for real time applications.

Recommended Books:

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Applications with the 8085' Penram International Pub.
2. D.V. Hall, 'Microprocessor and Interfacing Programming and Hardware', McGraw Hill Co.
3. Barry B. Brey, 'The Intel Microprocessors, Architecture Programming and Interfacing, PHIPublications.
4. B. Ram, Dhanpat Ra, 'Fundamentals of Microprocessor and Microcontrollers'.

SUBJECT TITLE: POWER ELECTRONICS LAB.
SUBJECT CODE: BTEE-3506
SEMESTER: 5
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Course Objectives:

1. To obtain the characteristics of SCR and UJT and to obtain triggering pulses for them.
2. To verify the performance of various converter circuits by measuring the currents and voltages at different points in the circuit and to display their waveforms.
3. To control speed of motors by using thyristors.

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	To obtain V-I characteristics of SCR and measure latching and holding currents.
EXP-2	To plot V-I Characteristics of UJT
EXP-3	To obtain triggering wave forms for SCR using R and RC firing circuits.
EXP-4	To obtain output voltage waveforms of single phase half wave controlled rectifier for R-L load.
EXP-5	To obtain output voltage wave forms for single phase full-wave controlled rectifiers with resistive and inductive loads.
EXP-6	To simulate three phase bridge rectifier and draw load voltage and load current waveform for resistive and inductive loads.
EXP-7	To study different types of chopper circuits and obtain waveforms for at least one of them
EXP-8	To simulate single phase inverter using different modulation techniques and obtain load voltage and load current waveform for different types of loads.
EXP-9	To simulate single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
EXP-10	To study single phase cycloconverter.
EXP-11	To study speed control of induction motor using thyristor
EXP-12	To study speed control of DC motor using thyristor.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3506.1**	verify the characteristics of SCR and UJT and triggering pulses for them.
CO2	**BTEE-3506.2**	Understand Control of Dc motor using single phase half and full controlled bridge rectifier
CO3	**BTEE-3506.3**	visualize and analyse the performance of various converter circuits.

CO4	**BTEE-3506.4**	Control the speed of motors using thyristors.

 # Note: At least ten experiments should be performed in semester.

SUBJECT TITLE: ELECTRICAL MACHINES-II LAB.
SUBJECT CODE: BTEE-3507
SEMESTER: 5
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

Course Objectives:

1. To plot speed-torque characteristics of three-phase and single-phase induction motors.
2. To obtain equivalent circuit parameters of three-phase and single-phase induction motors.
3. To study speed control of induction motors using different techniques.
4. To plot characteristics of a three-phase alternator and a synchronous motor.
5. To synchronise two 3-phase alternators by different methods

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	To perform load-test on three-phase induction motor and to plot speed-torque characteristics
EXP-2	To perform no-load and blocked rotor test on three-phase induction motor to obtain equivalent circuit parameters and to draw circle diagram.
EXP-3	To study the speed control of three-phase induction motor by Kramer's method.
EXP-4	To study the speed control of three-phase induction motor by cascading of two induction motors.

EXP-5	To study star- delta starters and a. To draw electrical connection diagram. b. To start the three-phase induction motor using it. c. To reverse the direction of three-phase induction motor
EXP-6	To start a three-phase slip ring induction motor by inserting different levels of resistance in the rotor circuits and to plot speed- torque characteristics.
EXP-7	To perform no-load and blocked rotor test on single-phase induction motor and to determine the parameters of equivalent circuit.
EXP-8	To perform load test on single-phase induction motor and plot speed-torque characteristics.
EXP-9	To perform no load and short circuit test on three-phase alternator and draw open and short circuit characteristics.
EXP-10	To find voltage regulation of an alternator by zero power factor (ZPF) method.
EXP-11	To study effect of variation of field current upon the stator current and power factor of synchronous motor running at no load and draw V and inverted V curves of motor.
EXP-12	To synchronise two 3-phase alternators using dark lamp method, and two-bright & one dark lamp method
EXP-13	To start a synchronous motor using appropriate method.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3507.1**	Obtain equivalent circuit parameters of single-phase and three- phase Induction motors.
CO2	**BTEE-3507.2**	Control speed of Induction motors by different methods.
CO3	**BTEE-3507.3**	Find voltage regulation of an alternator by using various tests.
CO4	**BTEE-3507.4**	Draw open and short circuit characteristics of three-phase alternator and V and inverted V curves of synchronous motor.

 # Note: At least ten experiments should be performed in semester

SUBJECT TITLE: POWER SYSTEM-II (SWITCHGEAR AND PROTECTION
SUBJECT CODE: BTEE-3601
SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40

End Term Exam: 60

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To provide knowledge about principle and components of protective system.
2. To impart knowledge about basics of Substation, Isolator and Fuses
3. To provide knowledge about operating Principle, types of Relays and Circuit Breakers
4. To provide knowledge about protection of Feeder, Bus bar, Generator and Transformer

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introduction to Components of Protection System:** Need for Protective System, Nature andCauses of Faults, Types and Effects of Faults, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Basic Principle of Protective System, Components and Classification of Protective System, Brief Idea of Instrument Transformers, Circuit Breakers, Relays and related Terminologies. **Substation, Isolator and Fuses:** Functions, Types, Classification, Main Equipment,

	Layout,Bus-bar Arrangement of Substation. Operation, Types and Rating of Isolators. Types, Rating and Characteristics of Fuses.
UNIT-II	**Circuit Breakers:** Circuit Breaker Ratings, Arc Initiation and their Interruption Methods, ArcQuenching Theories, Re-striking voltage, Recovery Voltage, RRRV, Plain Break Oil Circuit Breaker, Minimum Oil Circuit Breaker, Air Circuit Breaker, Air Blast Circuit Breaker, Vacuum Circuit breaker and SF^6 Circuit Breaker. Introduction to D.C. Circuit Breaker. **Protective Relays:** Introduction, Classification, Constructional Features; and Characteristics ofElectromagnetic, Induction, Thermal, Over-current relays, Directional Over Current Relay, Distance relays (Impedance, Reactance and Mho relay), Differential Relays, Trans-lay, Negative sequence relay, introduction to Static and Numerical Relays.
UNIT-III	**Feeder or Transmission Line Protection**: Over current Protection by Time Graded System,Current Graded and Time- Current Graded System, Protection of Parallel Feeder, Protection of Ring Mains, Over Current Earth Fault Protection, Distance Protection of Transmission lines (Impedance, Reactance and Mho Relay), Comparison between Distance Relays, Differential and Percentage Differential Protection, Pilot Relaying Protection of Feeder. **Bus-Bar Protection:** Differential Protection of Bus Bars
UNIT-IV	**Transformer Protection:** Over current protection, percentage differential protection, incipientfaults in transformers, inter-turn fault, protection against over fluxing. **Generator Protection:** Various faults and abnormal operating conditions, protection againstunbalanced loading, over speeding, loss of excitation, loss of prime mover.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3601.1**	Understand about basic components of power system protection system
CO2	**BTEE-3601.2**	Know about basics of Substation, Isolator and Fuses
CO3	**BTEE-3601.3**	Understand about Principle, Operation and types of Relays and Circuit Breakers
CO4	**BTEE-3601.4**	Know about Protection of Feeder, Bus bar, Generator and Transformer

Recommended Books

1. C.L. Wadhwa, 'Electrical Power System', New Age International (P) Ltd.
2. D.N. Badri Ram, D.N. Vishakarma, 'Power System Protection and Switchgear'.
3. Ravindranath and M. Chander, 'Power System Protection and Switchgear'.
4. Dahiya and Attri, 'Substation Engineering', Khanna Publishers
5. B.R. Gupta, 'Power System Analysis and Design', S. Chand & Company (P) Ltd.
6. Nagrath and Kothari, 'Modern Power System Analysis', Tata McGraw Hill.
7. J. Grainger John and Jr. W.D. Stevenson, 'Power System Analysis', McGraw Hill, **1994**.
8. Sunil S. Rao, 'Switchgear Protection and Power Systems', Khanna Publishers.
9. S.L. Uppal, 'Electrical Power', Khanna Publishers.

SUBJECT TITLE: ELECTRICAL POWER UTILIZATION
SUBJECT CODE: BTEE-3602
SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hr

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To acquire knowledge about various elements of A.C and D.C electric motor drives and their characteristics.
2. To acquire detailed knowledge about electric traction systems.
3. To know various phenomena related to electrolytic processes and illumination.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Electric Drives**: Introduction concept of electric drives, classification of electric drives,nature of load, factors effecting selection of drive, Running characteristics of D.C, Series and shunt motor, 3-phase induction motor, 3-phase synchronous motor and A.C series motors,starting methods of D.C series and shunt motors, starting methods of 3-phaseinduction motors, examples, starting methods of synchronous motors and single-phase induction motor. Speed control of D.C series and shunt motors, examples, Speed control of 3- phase induction motor, examples, Methods of electric braking of D.C motor, examples. Braking of 3-phase induction motor, Mechanical features of electric drive, Load equalization, flywheel calculations, examples. Temperatures rise of electric drives, heating and cooling curves, standard ratings of motors, examples Applications of electric drives and selection of drives for particular service, conservation approach to be considered.
UNIT-II	**Electrical Traction:** Introductions, different traction systems, various systems of electrictraction. Locomotives, tramways, trolleys, track electrification, comparison between A.C and D.C systems of railway electrification, Types of speed and speed-time curves, examples. Mechanics of train movement, tractive effort, power, output, examples., Energy output from driving axles, energy output using simplified speed-time curves, examples, Factors affecting energy consumption, dead weight, accelerating weight, adhesion weight, examples., Traction motors and their characteristics, starting and speed control of D.C series and shunt motors, examples, Starting and speed control of A.C series and 3-phase induction motors, Braking of traction motors and mechanical considerations, conservation approach to be considered.
UNIT-III	**Electrical Heating and Welding:** Advantages of electric heating, modes of transfer of heat,classification of electric heating methods, Resistances heating methods, requirements of heating elements, design of heating elements, methods of temperature control, problems, Induction heating: principle, types of induction furnaces, direct core type, vertical core type, indirect core type, core less type, advantages and disadvantages, eddy current heating, applications examples., Arc-furnace: principle, types, direct and indirect arc furnaces, power supply and control, condition for maximum output, examples., Dielectric heating: principles, advantages and disadvantages, applications, choice of frequency, examples., Electric welding: different types of resistance welding and electric arc welding, conservation approach to be considered.
UNIT-IV	**Electrolytic Process:** Principle, Faradays laws of electrolysis, current efficiency, energyefficiency etc., Rating of metals, production of chemicals, Electro deposition, electroplating, power supply for electrolytic processes. **Illumination**: Nature of light, definitions, laws of illumination, different types of lamps,tungsten lamp, discharge lamp, sodium vapour lamp, fluorescent lamp, design of lighting scheme, methods of lighting, calculations

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3602.1**	knowledge about D.C and A.C electric motor drive characteristics and select them for particular traction systems.
CO2	**BTEE-3602.2**	Explore and control various electric heating and welding methods and processes
CO3	**BTEE-3602.3**	Understand the electrical traction .
CO4	**BTEE-3602.4**	Students will be able to calculate illumination requirements

Recommended Books

1. R.K. Rajput, 'Utilization of Electrical Energy',Luxmi Publications Pvt. Ltd., **2006**.
2. J.B. Gupta, 'Utilization of Electric Power & Electric Traction', S.K. Kataria and Sons,Katson Books,**2013**.
3. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy',New ageInternational Pvt. Ltd., Publishers, **2005**.

SUBJECT TITLE: MICROCONTROLLER AND PLC
SUBJECT CODE: BTEE-3603
SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

I

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Learning Outcomes:

1. The course describes Architecture of Microcontrollers, Programming with Application of Microcontroller, Advanced Microcontroller and Interfacing.

2. It explains the Applications & Importance of PLC connection of PLC and a relay panel.
3. It describes the block diagram and operation of a micro PLC, gives an idea of ladder programming.
4. It also explains how to select a PLC for a typical application.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introduction:** Microprocessor, Micro-controllers and their comparison. The 8051 Architecture: Introduction, 8051 micro-controller hardware, input/ output, pins, ports and circuits, external memory, counters and timers, serial data input/ output, interrupts
UNIT-II	**8051 Assembly Language Programming:** The mechanics of programming, assembly language programming process, programming tools and techniques, instruction set (data moving, logical operations, arithmetic operations, jump and call instructions) **8051 Microcontroller Design:** Micro-controller specification, external memory and memory space decoding, reset and clock circuits, expanding input and output (I/O), memory mapped I/O, memory address decoding, memory access times, testing the design, timing subroutines, lookup tables for the 8051, serial data transmission
UNIT-III	**Microcontroller Applications:** Interfacing keyboards, displays, Digital-to-Analog (D/A) and Analog-to-Digital (A/D), multiple interrupts, serial data communications, introduction to the use of assemblers and simulators Embedded Systems: Introduction to PLDs and FPGA- architecture, technology and design issues, implementation of 8051 core.
UNIT-IV	**Programmable Logic Controllers (PLC):** Introduction, operation of PLC, difference between PLC and Hardwired system, difference between PLC and Computer, relay logic and ladder logic, ladder commands and examples of PLC ladder diagram realization, PLC timers, PLC counters, PLC classification

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3603.1**	Understand the architecture of microcontroller and understand the counter & timers.
CO2	**BTEE-3603.2**	Design the PLC ‘ architecture
CO3	**BTEE-3603.3**	Know various application of the M C 8051
CO4	**BTEE-3603.4**	Implement PLC interfacing

RECOMMENDED BOOKS:

1. Kenneth J Ayola, *The 8051 Micro Controller- Architecture, Programming and Application*, Penram International Publication

2. John B Peatman, *Design with Micro Controller*, Tata McGraw Hill
3. Ray A. K. and Bhurchandi K. M., *Advanced Microprocessors and Peripherals; Architecture, Programming and Interfacing*, Tata McGraw Hill
4. Mazidi M. A. and Mazidi J. G., *The 8051 Micro-controller and Embedded System*, Pearson Education.
5. Udayashankara V. and Mallikarjunaswamy M.S., *8051 Microcontroller Hardware, Software and Applications*, TataMcGraw Hill Education Pvt. Ltd., (2010)
6. Surekha Bhanot, *Process Control*, Oxford Higher Education.
7. Otter, Job Dan, *Programmable Logic Controlle*r, P.H. International, Inc, USA
8. Dunning Gary, *Introduction to PLCs*, Tata McGraw Hill
9. Kumar Rajesh, *Module on PLCs and their Applications*, NITTTR Chandigarh

(Department Elective: I)

SUBJECT TITLE: SIGNALS AND SYSTEMS
SUBJECT CODE: BTEE-3611
SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

I

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To understand the classification of signals.
2. To apply Fourier series and Fourier Transformation to periodic and aperiodic signals.
3. To introduce the concepts of probability of occurrence of random events.
4. To understand different types of noise associated with signals.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introduction:** Classification of Signals and Systems, Linear time invariant systems,Convolution, Representation of signals in terms of impulses, Signal Representation using Fourier Series, Complex and Exponential Fourier Series, Fourier Series Representation of Periodic Signals, Properties of Fourier series, Parseval's theorem.
UNIT-II	**Signal Analysis**: Aperiodic Signal Representation using Fourier Transforms, FourierTransforms of Periodic Power Signals, Signal Transmission through Linear Networks, Convolution Theorem and its graphical interpretation, Sampling Theorem, Correlation, Autocorrelation.

UNIT-III	**Probability:** Introduction to Probability Theory, Definition of Probability of RandomEvents, Joint and Conditional Probability, Cumulative Distribution Function (CDF), Probability Density Functions (PDF) and Statistical Averages of random variables, introduction to random processes.
UNIT-IV	**Noise:** Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise, Noise inBipolar Junction Transistors (BJTs), FET noise, Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure, Experimental determination of Noise Figure.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3611.1**	Learn about various types of signals and systems.
CO2	**BTEE-3611.2**	Explain state space analysis of LTI systems .
CO3	**BTEE-3611.3**	Evaluate various types of Fourier transformer and series for discreate and continuous time signals.
CO4	**BTEE-3611.4**	Analyze signal and system properties like stability and causality using Laplace and Z transforms

Recommended Books

1. V. Oppenheim Alan, 'Signals and Systems', Prentice Hall, **1997**.
2. S. Haykins and B.V. Veen, 'Signals and Systems', John Wiley and Sons, **2007.**
3. M.J. Roberts, 'Fundamentals of Signals and Systems', SIE Edn., McGraw HillEducation, **2007**.
4. B.P. Lathi, 'Linear Systems and Signals', Oxford University Press, **2009**.
5. Sanjay Sharma, 'Signals and Systems', Katson Publishers, **2013**.
6. Rajeswari K. Raja, Rao B. Visvesvara, 'Signals and Systems', PHI Learning Pvt. Ltd., **2014**.
7. M. Nahvi, 'Signals and Systems', McGraw Hill Education, **2015.**

SUBJECT TITLE: FLEXIBLE AC TRANSMISSION SYSTEM DEVICES
SUBJECT CODE:
SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

I

Internal Assessment: 40

End Term Exam: 60

Duration of Exam; 3 Hrs

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Course Objectives:

1. To review the power electronics fundamentals.
2. To review power transmission fundamentals and to introduce the FACTS concept.
3. To introduce to the need of shunt and series compensation and UPFC.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Power Electronics Fundamentals:** Basic function of power electronics, Powersemiconductor device for high power converters, Static power convertor structures, AC controller based structure, DC link convertor topologies, Convertor output and harmonic control.
UNIT-II	**Power Transmission Control:** Fundamental of ac power transmission, Transmissionproblems and needs, the emergence of FACTS, FACTS control considerations, FACTS controllers
UNIT-III	**Shunt and Series Compensation:** Shunt SVC principles, Configuration and control,STATCOM, Configuration applications. Fundamental of series compensation using GCSC, TCSC and TSSC, Application of TCSC for different problems of power system, TCSC lay out, SSSC principle of operation

UNIT-IV	**Unified Power Flow Controllers:** Basic operating principles and characteristics,independent active and reactive power flow control, control of UPFC, installation, applications, UPFC model for power flow studies, comparison of UPFC with the controlled series compensators and phase shifters.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3613.1**	Understand the working of various FACTS devices.
CO2	**BTEE-3613.2**	Learn to choose the controllers for various scenarios.
CO3	**BTEE-3613.3**	Examine various FACT devices under various stability conditions
CO4	**BTEE-3613.4**	Select an appropriate FACTS device for a particular application

Recommended Books

1. A. Ghosh and G. Ledwich, 'Power Quality Enhancement Using Custom Power Devices', Kluwer Academic Publishers, **2005**.
2. N.G. Hingorani and L. Gyragyi, 'Understanding FACTS: Concepts and Technology of Flexible AC Transmission System', Standard Publishers and Distributors,**2005**.
3. Y.H. Sang and A.T. John, 'Flexible AC Transmission Systems', IEEE Press,**2006**.
4. R.M. Mathur and R.K. Verma, 'Thyristor Based FACTS Controllers for Electrical Transmission Systems', IEEE Press, **2002**.T.J.E. Miller, 'Reactive Power Control in Electric Systems', John Wiley, **1982**

SUBJECT TITLE: INSTRUMENTATION IN POWER SYSTEM

SUBJECT CODE: BTEE-3612

SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal assessment:40

End Term exam: 60

Duration of exam : 3 Hrs.

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Learning Objectives:

1. To acquire knowledge about the various elements of instrumentation systems.
2. To acquire knowledge about working of data acquisition and corresponding signal conditioning.
3. To know about different types of display devices and recorders.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introduction:** Measurement of electrical quantities, Active and reactive power in power plants, Energy meters, Instrument transformers and their transient response.
UNIT-II	**Instrumentation Techniques:** Telemetry, Remote Control, remote signaling and supervisory control and data acquisition (SCADA), signal formation, conversion and transmission

UNIT-III	**Signal Transmission Techniques:** Analog pulse and digital modulation, Amplitude modulation(AM) and Frequency modulation (FM), AM and FM Transmitter and Receiver, Phase Modulation, Pulse modulation, Digital transmission techniques, error detection and correction. **Telemetry:** Telemetry errors, DC, pulse and digital telemetry methods and systems.
UNIT-IV	**Supervisory Control and Data Acquisition:** Function of SCADA system remote terminal unit(RTU) details, Control center details, Communication between control centers, control center and remote terminal unit.
UNIT-V	**Power Plant Instrumentation:** Hydroelectric power plant instrumentation, Thermal power plant instrumentation, Nuclear Power plant Instrumentation. Applications of SCADA system to Indian Power Systems

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-3612.1**	Know various types of transducers, signal conditioning and data acquisition systems.
CO2	**BTEE-3612.2**	Familiar with digital measurement systems, display devices and recorders.
CO3	**BTEE-3612.3**	Understand the concept of data transmission and telemetry.
CO4	**BTEE-3612.4**	Uderstand about measurement of different parameters in power plant.

. **RECOMMENDED BOOKS:**

1. Cegrell,T., *Power System Control Technology*, Prentice-Hall of India Private Limited(2001).`
2. Lindsley, D.M. , *Power Plant Control and Instrumentation*, IEEE Press (2000).
3. Jarvis, E.W., *Modern Power Station Practice: Control and Instrumentation (Vol. F)*, British Electricity International (1980).

SUBJECT TITLE: ELECTRICAL: ESTIMATION & COSTING LAB
SUBJECT CODE: BTEE-3605
SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

IInternal Assessment: 60

End Term Exam: 40

Course Objectives:

1. To know about layout of wiring circuits of electrical installations of a residential building or/and an educational institute or/and an industry.
2. To estimate the various costs involved in these electrical installations.
3. To know about wiring arrangements of motor control circuits and to do energy audit of a small utility.

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	To study Indian electricity act 2003.
EXP-2	To carry out wiring diagram of residential building/educational institute/industry.
EXP-3	To study design parameters of electrical panel boards.
EXP-4	To estimate the cost of a domestic installation (Residential building/laboratory/drawing hall) with concept of illumination design
EXP-5	To estimate the cost of industrial installation.
EXP-6	To estimate the cost of overhead service connection.
EXP-7	To estimate the cost of underground service connection.

EXP-8	To estimate the load and cost of any five electrical appliances
EXP-9	To estimate the cost of repair and maintenance of any five domestic appliances
EXP-10	To study various types of light sources and lighting schemes.
EXP-11	To draw wiring diagrams of motor control circuits for starting of induction and synchronous motors.
EXP-12	To carryout electrical energy audit of laboratory/office/workshop**.**

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-36051**	Understand different types of materials needed for wiring
CO2	**BTEE-3605.2**	Comprehend the estimation of a domestic installation.
CO3	**BTEE-3605.3**	know different systems of earthing
CO4	**BTEE-3605.4**	Comprehend the estimation of substations

Note: At least ten experiments should be performed in semester.

SUBJECT TITLE: MICROCONTROLLER AND PLC LAB
SUBJECT CODE: BTEE-3606
SEMESTER: 6
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	**0**	**2**	**1**

I

Internal Assessment: 60

End Term Exam: 40

LIST OF EXPERIMENTS

Sr. No	Contents
EXP-1	Study of 8051/8031 Micro-controller kits.
EXP-2	Write a program to add two numbers lying at two memory locations and display the result.
EXP-3	Write a program for multiplication of two numbers lying at memory location and display the result. 4. Write a program to check a number for being ODD or EVEN and show the result on display.
EXP-4	Write a program to split a byte in two nibbles and show the two nibbles on display.
EXP-5	Write a program to arrange TEN numbers stored in memory location in ascending and descending order.
EXP-6	Write a program to find a factorial of a given number.
EXP-7	Study of interrupt structure of 8051/8031 micro-controllers.
EXP-8	Write a program to show the use of INT0 and INT1.
EXP-9	Write a program of flashing LED connected to port 1 of the micro-controller.
EXP-10	Write a program to control a stepper motor in direction, speed and number of steps.
EXP-11	Write a program to control the speed of DC motor. 13. Implementation of different gates using PLC.
EXP-12	Implementation of DOL and star delta starter using PLC.
EXP-13	Implement basic logic operations, motor start and stop operation using (i) Timers (ii) Counters
EXP-14	Motor forward and reverse direction control using PLC.
EXP-15	1. Make a PLC based system for separating and fetching work pieces.
	2. Make a PLC based control system for conveyor belt.
EXP-16	Implement a PLC based traffic light control.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-36051**	Identifying and defining the automation control requirements, and specifying tasks to be performed .
CO2	**BTEE-3605.2**	Choose the proper actuators and control hardware (Microcontroller, PLC, or PAC)
CO3	**BTEE-3605.3**	Setting up and testing of actuators and control hardware
CO4	**BTEE-3605.4**	Documenting and presenting an appropriate solution

Note: At least ten experiments should be performed in semester.

SUBJECT TITLE: POWER SYSTEM ANALYSIS

SUBJECT CODE: BTEE-4701

SEMESTER: 7
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal assessment:40

End Term exam: 60

Duration of exam : 3 Hrs.

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Learning Objectives:

1. To understand the importance of per unit system, single line diagram and impedance diagrams of electric networks in power system analysis.
2. To gain the information about various types of buses in the electric network and the type of data required for power flow studies.
3. To understand the different types of faults in the system and methods to analyze these faults.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**SYSTEM MODELLING:** System modelling of synchronous machines, transformers, loads etc, per unit system, single line diagram of electrical networks, single phase impedance diagrams. Formulation of impedance and admittance matrices for the electrical networks.

UNIT-II	**LOAD FLOW STUDIES:** Data for the load flow studies, Swing Bus, Formulation of simultaneous equations, Iterative solutions by the Gauss-Seidal method and Newton-Raphson Method.
UNIT-III	**FAULT ANALYSIS:** Transients on transmission line, short circuit of synchronous machine, selection of circuit breakers, Algorithm for short circuit studies, Symmetrical Component transformation, and construction of sequence networks of power systems. Symmetrical Analysis of Unsymmetrical Line-to-ground (LG), Line-to line (LL), double line to ground (LLG) faults using symmetrical components
UNIT-IV	**POWER SYSTEM STABILITY:** Steady state stability, Dynamics of a synchronous machine, Power angle equations, Transient stability, equal area criterion, Numerical solution of swing equation, factors effecting transient stability.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-4701.1**	Develop per unit system models of synchronous machines, transformers, transmission lines and static loads for power system studies.
CO2	**BTEE-4701.2**	touse bus admittance matrix to do load flow analysis and to do fault analysis by bus impedance matrix.
CO3	**BTEE-4701.3**	Compare features of Gauss-Siedel, Newton-Raphson and Fast decoupled methods of load flow analysis.
CO4	**BTEE-4701.4**	Examine the impact of various faults on power system.

BOOKS RECOMMENDED

1. Elgerd O.I., *Electric Energy Systems Theory*, Tata McGrawHill
2. Nagrath I.J., Kolthari D.P., *Modern Power System Analysis*, Tata McGrawHill
3. StevensonW.D., *Elements of Power System* Analysis, McGraw Hill
4. Nagrath I.J. and Kothari D.P., *Power System Engineering, Tata McGrawHill*

SUBJECT TITLE: NON-LINEAR AND DIGITAL CONTROL SYSTEMS

SUBJECT CODE: BTEE-4702

SEMESTER: 7
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal assessment:40

End Term exam: 60

Duration of exam : 3 Hrs.

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Learning Objectives:

1. To make the students aware about digital control system, sampling process and Z-transform.

2. To introduce the students to state variable analysis and design of digital control systems.
3. To make them familiar with nonlinear control systems and to understand their stability criterion

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**STATE VARIABLE TECHNIQUES:** State variable representation of systems by variousmethods, solution of state variable model. Controllability and observability.
UNIT-II	**PHASE PLANE ANALYSIS:** Singular points, Method of isoclines, delta method, phase portraitof second order nonlinear systems, limit cycle.
UNIT-III	**DESCRIBING FUNCTION ANALYSIS:** Definition, limitations, use of describing function forstability analysis, describing function of ideal relay, relay with hysteresis, dead zone, saturation, coulomb friction and backlash.
UNIT-IV	**LYAPUNOV'S STABILITY METHOD:** Lyapunov's direct method, generation of Lyapunov'sfunction by Krasovskii's and Variable Gradient methods
UNIT-V	**SAMPLED DATA SYSTEMS:** Sampling process, mathematical analysis of sampling process,application of Laplace transform. Reconstruction of sampled signal, zero order, first order hold. Z-transform definition, evaluation of Z-transform, inverse Z-transform, pulse transfer function, limitations of Z-transform, State variable formulation of discrete time systems, solution of discrete time state equations. Stability definition, Jury's test of stability, extension of Routh-Hurwitz criterion to discrete time systems.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-4702.1**	examine discrete time systems
CO2	**BTEE-4702.2**	Design and evaluate digital controllers.
CO3	**BTEE-4702.3**	Understand Non Linear control systems and analyze their stability
CO4	**BTEE-4702.4**	Implement observers and estimators for nonlinear systems.

BOOKS RECOMMENDED:

1. Ogata K., *Modern control engineering*. Prentice Hall (India)
2. Nagrath I.J., Gopal M., *Control system engineering*, New Age Publications
3. Hsu J.C. and Meyer A.U., *Modern control principles and application*
4. Gopal M., *Digital Control and State Variable Methods*, Tata McGraw Hill
5. Kuo B.C. and Golnaraghi F., *Automatic Control System, Wiley* Publications
6. Dorf R.V. and Bishop R.H., *Modern Control Systems*, Adison Wesley

SUBJECT TITLE: NON CONVENTIONAL ENERGY RESOURCES

SUBJECT CODE: BTEE-4703

SEMESTER: 7
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal assessment:40

End Term exam: 60

Duration of exam : 3 Hrs.

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Learning Objectives:

1. To obtain knowledge about renewable energy sources and solar energy and their utilization.
2. To introduce to wind energy conversion and bio-mass energy conversion systems.
3. To introduce to geothermal energy and energy from ocean. To make them aware about hydrogen energy sources.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**INTRODUCTION:** Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.
UNIT-II	**MHD GENERATORS:** Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of Magneto-Hydro-Dynamic (MHD) generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.
UNIT-III	**THERMO-ELECTRIC GENERATORS:** Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect.
UNIT-IV	**PHOTOVOLTAIC EFFECT AND SOLAR ENERGY:** Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.
UNIT-V	**FUEL CELLS:** Principle of action, Gibb's free energy, general description of fuel cells, types, construction, operational characteristics and application.
UNIT-VI	**MISCELLANEOUS SOURCES:** Geothermal system, hydro-electric plants,

	wind power, tidal energy, Bio-mass energy

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-4703.1**	Understand the need of conversion of various energy sources
CO2	**BTEE-4703.2**	Examine fuel cell and magneto hydrodynamics technologies..
CO3	**BTEE-4703.3**	Understand harnessing of biomass energy and wind energy.
CO4	**BTEE-4703.4**	Analyze harnessing of Geothermal and Ocean energies

BOOKS RECOMMENDED:

1. Gupta B. R., Generation of Electrical Energy, S. Chand.
2. Rai, G.D., Non Conventional Energy Sources, Khanna Publishers.
3. Rao, S. and Parulekar, B.B., Energy Technology: Non Conventional, Renewable and Conventional,
Khanna Publishers.

4. Wadhwa, C.L., Generation, Distribution and Utilization of Electric Energy, New Age International
(P) Limited, Publishers.

SUBJECT TITLE: POWER SYSTEM ANALYSIS LAB

SUBJECT CODE: BTEE 4704

SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 60

End Term Exam: 40

LIST OF EXPERIMENT

Sr. no	Contents
EXP-1	Design of transmission systems for given power anddistance.
EXP-2	Short circuit calculations and calculations of circuit breaker ratings for a power system network.
EXP-3	Design ofsubstations
EXP-4	Design of distributionsystems
EXP-5	Y-busformation
EXP-6	Z-busformulation
EXP-7	Load flow analysis by Gauss-Seidalmethod
EXP-8	Load flow analysis by Newton-Raphsonmethod
EXP-9	Fault analysis for line-to-line (L-L), Line-to-Ground (L-G)etc
EXP-10	Design of underground cabling system forsubstation.
EXP-11	To obtain power system stability on High Voltage Alternating current (HVAC) systemwith the help of Flexible Alternating Current Transmission Systems (FACTS)devices.
EXP-12	Optimal Capacitor placement on a system having variable reactive power and lowvoltage profile.
EXP-13	To obtain relay co-ordination on a powersystem.
EXP-14	To obtain optimal generator pricing on hydro-thermal and renewable energysystems.
EXP-15	To find synchronous reactance (Transient, sub-transient) during faultanalysis.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-4704.1**	Modeling of power system
CO2	**BTEE-4704.2**	Effectively employ different techniques to analyse different power system
CO3	**BTEE-4704.3**	3Design of distribution systems , substations
CO4	**BTEE-4704.4**	To obtain relay co-ordination on a power system

Note: Atleast TEN experiments are to be performed in a semester. List of experiments is given below:

Program Name: B. Tech. Electrical Engineering
Program Code: BOT-301

DEPARTMENTAL ELECTIVE -II

SUBJECT TITLE: POWER SYSTEM OPERATION AND CONTROL

SUBJECT CODE: BTEE -4711

SEMESTER: 7
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal assessment:40

End Term exam: 60

Duration of exam : 3 Hrs.

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Learning Objectives:

1. To make students express Economic operation of power system and importance of LFC control.
2. To allow students discuss about thermal and hydro power plants operation in meeting the load demand optimally and expressing importance of reactive power control.
3. Ability to discuss single area load frequency control and two area load frequency control along with express variation of frequency in the power system with varying load.
4. Ability to model and design turbine and Automatic controller.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Introduction to Power Generation Units:** Characteristics and its variations, **Economic Operation of Power Systems:** Fuel consumption, Characteristics of thermal unit, Incremental fuel rate and their approximation, minimum and maximum power generation limits.
UNIT-II	**Economic Dispatch:** Economic dispatch problem with and without transmission line losses, Unit Commitment and solution methods. Hydrothermal scheduling: fixed-head and variable head, Short- term and Long-term,
UNIT-III	**Power System Control:** Power system control factors, interconnected operation, tie-line operations, Reactive power requirements, during peak and off peak hours, Elementary ideas of load frequency and voltage, reactive power control; block diagrams of P-f and Q-V controllers, ALFC control, Static and Dynamic performance characteristics of automatic load frequency control (ALFC) and automatic voltage regulator (AVR) controllers, Excitation systems.
UNIT-IV	**Power System Security:** Factors affecting security, Contingency analysis, Network sensitivity, correcting the generation dispatch by using sensitivity method and linear programming.
UNIT-VI	**Power flow analysis in AC/DC systems**: General, modelling of DC links, solution of DC load flow, discussion, per unit system for DC quantities, solution techniques of AC-DC power flow equations

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-4704.1**	understand operation of generators in various power plants
CO2	**BTEE-4704.2**	Students will able to design the mathematical model of the speed governing systems, turbines and excitation systems.
CO3	**BTEE-4704.3**	Students will able to discuss about load frequency control.
CO4	**BTEE-4704.4**	Students will able to understand different types of loads and their characteristics

BOOKS RECOMMENDED:

1. Nagrath,I.J.andKothari,D.P.,*PowerSystemEngineering*,TataMcGrawHill.

2. Stevenson W.D. and Grainger J.J., *Power System Analysis*, McGraw Hill.
3. Arrillaga J. and Smith Bruce, *AC-DC Power System Analysis*, IEEPress
4. Elgerd, O.I., *Electric Energy Systems Theory: An Introduction*. 2nd Ed., Tata McGraw Hill.
6. Dhillon J.S., Kothari D.P., *Power System Optimisation*, 2nd Ed., Prentice Hall India.
7. Kundur P, "*Power System Stability and Control*", Third Reprint, tat McGraw Hill.

1. Kennedy, B., Power Quality Primer, McGraw Hill.
2. Bollen, M.H.J., Power Quality Problems: Voltage Sag and Interruptions, IEEE Press.
3. Mohan, N., Power Electronics, New Age International (P) Limited, Publishers.

SUBJECT TITLE: HIGH VOLTAGE ENGINEERING

SUBJECT CODE: BTEE-4713

SEMESTER:
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal assessment:40

End Term exam: 60

Duration of exam : 3 Hrs.

Instructions for Question Paper

The question paper consist of three sections A, B & C. Section-A is compulsory consisting of 10 short answer type questions of 2 marks each from the whole syllabus. Section-B consists of 6 questions covering whole syllabus. Students will attempt any four questions. Each question carries 5 marks. Section-C consists of 3 questions from the whole syllabus. Students will attempt any two questions. Each question carries 10 Marks

Learning Objectives:

1. To know about how power systems are subjected to over voltages and what are protection methods adopted against these over voltages.
2. To understand the basic physical phenomenon related to various breakdown processes in solid, liquid and gaseous insulating materials at high voltages.
3. To know about generation and measurement of D. C., A.C., & Impulse voltages.
4. To know about various tests on H. V. equipment and on insulating materials, as per the standards.

Contents of Syllabus:

Sr. No	Contents
UNIT-I	**Extra High Voltage (EHV) Transmission and Corona Loss:** Need for EHV Transmission. Use of bundled conductors, corona characteristics of smooth bundled conductors with different configurations, Corona loss. Factors affecting the corona loss. Radio interference due to corona. Shunt and series compensation in EHV lines. Tuned power lines. InsulationCo-ordination.
UNIT-II	**High Voltage Direct Current (HVDC) Transmission:** Advantages, disadvantages and economics of HVDC Transmission system.Types of Direct Current (DC) links, converter station equipment, their characteristics.
UNIT-III	**Insulating materials for High Voltage** Applications of insulating materials used in power transformers rotating machines, circuit breakers, cables, power capacitors. Conduction and breakdown in Gases, Liquids and Solid Dielectrics: **Solids-**Intrinsic, electromechanical and thermal breakdown composite dielectrics, solid dielectrics used in practice. **Liquids-**Conduction and breakdown in pure and commercial liquids, suspended particle theory, cavitation and bubble theory, stressed oil volume theory, Liquids used in practice. **Gases-**Ionization process, Townsend's current growth equations, Ist and 2nd ionization coefficients. Townsend's criterion for breakdown. Streamer theory of breakdown, Pashen's law of Gases. Gases used in practice.
UNIT-IV	**Generation of High Voltages:** High Voltage Direct Current (HVDC), High

	Voltage Alternating Current (HVAC), Power frequency and High frequency: Impulse voltage and impulse current Generation, Tripping and contact of Impulse Generator. Measurement of voltage and current: High voltage direct current, Alternating current and Impulse voltage and currents.

Course Outcomes: On successful completion of this course, the learner will be able to

CO1	**BTEE-4713.1**	various principles of HV generation and its measurements
CO2	**BTEE-4713.2**	Examine lightning phenomena and high voltage insulation environment pollution.
CO3	**BTEE-4713.3**	Understand the basic physical phenomenon occurring in various breakdown processes in solid, liquid and gaseous insulating materials.
CO4	**BTEE-4713.4**	Know about generation and measurement of D. C., A.C., & Impulse voltages.

BOOKS RECOMMENDED:

2. Bagamudre, Rakesh Das Extra High Voltage A.C. Transmission Engineering, New Age International Publishers.
3. Kimbark E.W., High Voltage Direct Current Transmission, Wiley-Interscience
4. Kamaraju V. and Naidu M.S., High Voltage Engineering, Tata McGraw-Hill Education
5. Jha R.S., High Voltage Engineering, Dhanpat Rai

Program Name: B. Tech. Electrical Engineering
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