



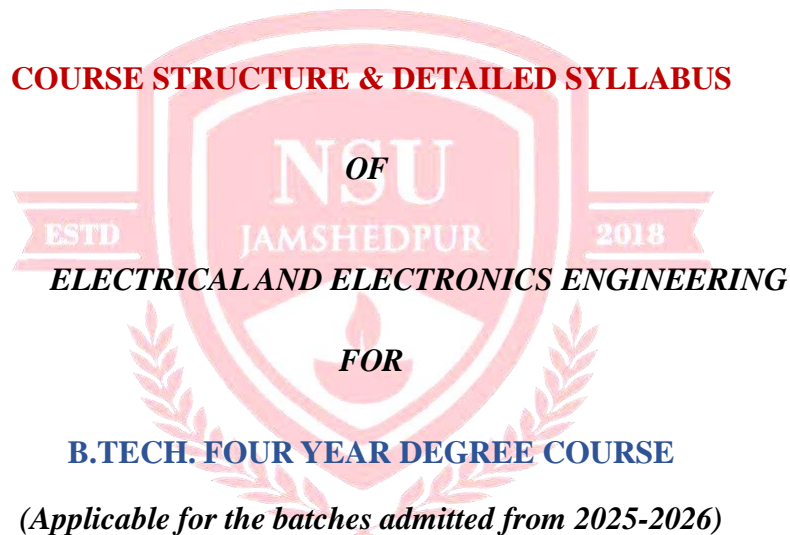
NETAJI SUBHAS UNIVERSITY

JAMSHEDPUR, JHARKHAND

Estd. Under Jharkhand State Private University Act, 2018

Approved by AICTE, PCI, BCI, NCTE, INC & JNRC

COURSE STRUCTURE & DETAILED SYLLABUS



(Applicable for the batches admitted from 2025-2026)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NETAJI SUBHAS UNIVERSITY, JAMSHEDPUR

Pokhari, Near Bhilai Pahadi, Jamshedpur, Jharkhand

PREAMBLE

Electrical and Electronics Engineering involves scientific analysis, problem-solving and knowledge integration using appropriate tools to model, design, produce and maintains products or systems containing Electrical and Electronics Engineering elements to meet the desired requirements.

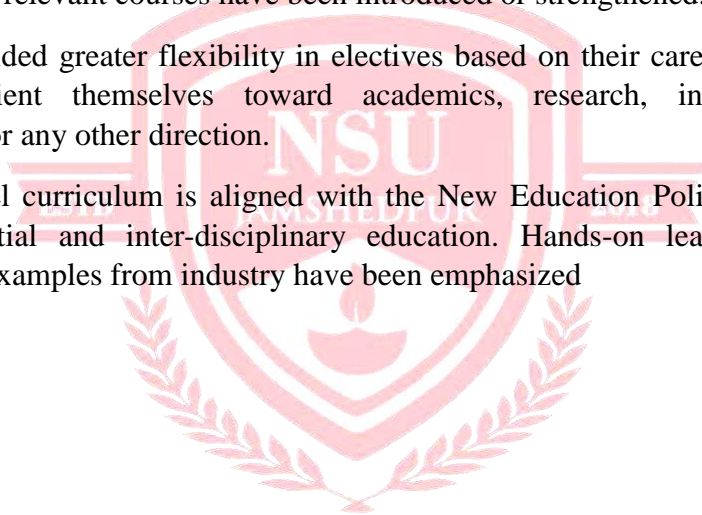
The curriculum revision committee included representation from various engineering institutes, government R&D labs and manufacturing sector. The committee members met multiple times in 2021-2022 to deliberate the curriculum. They studied existing curricula at well-known universities across the world, and had extensive discussions with domain experts representing a wide range of backgrounds and experience.

The revised model curriculum takes into cognizance the prevailing and emerging requirements of the industry and society. It provides a balanced mix of courses related to science, engineering, technology and practice (labs, projects), as well as humanities.

Given the rising importance of electronics, information and communication technology in all aspects of life, the relevant courses have been introduced or strengthened.

Students are provided greater flexibility in electives based on their career aspirations. They can suitably orient themselves toward academics, research, innovation, industry, entrepreneurship or any other direction.

The revised model curriculum is aligned with the New Education Policy, which promotes holistic, experiential and inter-disciplinary education. Hands-on learning, relevant lab experiments and examples from industry have been emphasized

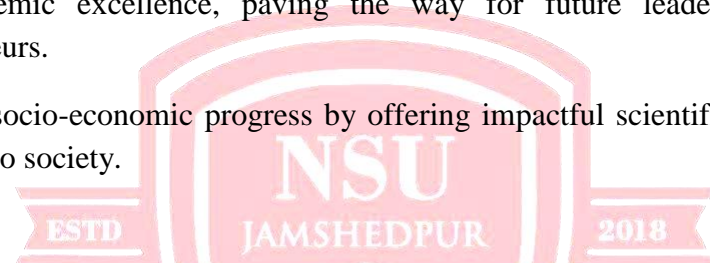


VISION

To strive for excellence in education, research, and entrepreneurship, with the ultimate goal of becoming a global hub for innovation. Committed to advancing scientific and technological services, we aim to contribute meaningfully to society.

MISSION

- ❖ To provide high-quality education that nurtures innovation, entrepreneurship, and ethical values, shaping future professionals equipped for a globally competitive landscape.
- ❖ To collaborate with stakeholders by sharing institutional expertise in education and knowledge, fostering mutual growth in technical learning.
- ❖ To Cultivate an environment that encourages fresh ideas, groundbreaking research, and academic excellence, paving the way for future leaders, innovators, and entrepreneurs.
- ❖ To drive socio-economic progress by offering impactful scientific and technological solutions to society.



PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1	Apply knowledge of mathematics, science, and engineering to solve complex problems in Electrical and Electronics Engineering and contribute effectively to industry, research, or higher education
PEO-2	Pursue lifelong learning through professional development courses, higher education, or certifications to adapt to rapidly evolving technologies and global challenges
PEO-3	Demonstrate leadership, ethical responsibility, and the ability to work effectively in multidisciplinary teams to deliver engineering solutions for real-world problems
PEO-4	Innovate and contribute to the development of sustainable solutions addressing societal, environmental, and economic challenges through responsible engineering practices.

PROGRAM OUTCOMES (POs)

PO-1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering and technology to the solution of complex electrical and electronics engineering problems.
PO-2	Problem analysis: Identify, formulate, review existing literature, and analyze complex engineering problems to reach substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	Design/Development of solutions: Design solutions for electrical and electronics engineering problems and design system components or processes that meet the specified needs with appropriate consideration for societal, economic 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 modeling to complex electrical and electronics 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 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	Ethics: 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 with the engineering communication Module and with society at large, including the ability to comprehend, create effective reports, 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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-1	Apply the knowledge of electrical science and engineering fundamentals to analyze, design, and maintain electrical systems such as power generation, transmission, distribution, and protection systems.
PSO-2	Design and implement electronic circuits, embedded systems, and control systems for applications in automation, instrumentation, consumer electronics and modern tools, simulation software, and programming languages for modeling, analysis, and optimization of electrical and electronics systems while considering energy efficiency and sustainability.



TABLE OF CONTENTS

S. No.	Title	From	To
1	General Course Structure & Theme	1	6
2	Semester Wise Structure	7	13
3	Semester I	14	42
4	Semester II	43	68
5	Semester III	69	90
6	Semester IV	91	113
7	Semester V	114	130
8	Semester VI	131	162
9	Semester VII	163	189
10	Semester VIII	190	215
11	Appendix 1: Professional Elective Courses	216	240
12	Appendix 2: A Guide to Induction Program	241	262

B. TECH IN ELECTRICAL AND ELECTRONICS ENGINEERING**COURSE STRUCTURE****GENERAL COURSE STRUCTURE & THEME****A. Definition of Credit:**

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: In the light of the fact that a typical Model Four-year Under Graduate degree program in Engineering has about 160 credits, the total number of credits proposed for the four-year B. Tech/B.E. in Electrical and Electronics Engineering (Engineering & Technology) is kept as 160.

C. Structure of UG Program in EEE: The structure of UG program in Electrical and Electronics Engineering shall have essentially the following categories of courses with the breakup of credits as given:

Sl. No	Category	Suggested Breakup of Credits (Total 160)
1	Humanities and Social Sciences including Management courses	12*
2	Basic Science courses	29*
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	27*
4	Professional core courses	58*
5	Professional Elective courses relevant to chosen specialization/branch	9*
6	Open subjects – Electives from other technical and /or emerging subjects	9*
7	Project work, seminar and internship in industry or elsewhere	16*
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)
Total		160*

**Minor variation is allowed as per need of the respective disciplines.*

D. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

Category-wise Courses**HUMANITIES & SOCIAL SCIENCES COURSES [HS] & MANAGEMENT COURSES***(2 compulsory + 2 others)*

Number of Humanities & Social Science Courses: 4

Credits: 12

Sl.	Code No.	Subject	Semester	Credits
1	HSMC 01	Communication Skills / English (Compulsory)	2	2:0:2=3
2	HSMC 02	Universal Human Values-2 (Compulsory course)	2	2:1:0=3
3	HSMC 03	Industrial Psychology	5 / 6	3:0:0=3
4	HSMC 04	Operations Research	5 / 6	3:0:0=3
5	HSMC 05	Project Management	5 / 6	3:0:0=3
6	HSMC 06	Finance & Accounting	5 / 6	3:0:0=3
Total Credits:				12

BASIC SCIENCE COURSE [BSC] (Total 8)

Sl.	Code No.	Subject	Semester	Credits
1	BSC 101	Physics-1 (Electromagnetism)	1	3:1:2=5
2	BSC 201	Physics-2 (Optics & Waves)	3	3:1:2=5
3	BSC 102	Mathematics-1 (Calculus & Linear Algebra)	1	3:1:0=4
4	BSC 103	Chemistry-1	2	3:0:2=4
5	BSC 104	Mathematics-2 (ODE, Complex variables)	2	3:1:0=4
6	BSC 202	Mathematics-3 (PDE, Prob/Stat)	3	3:1:0=4
7	BSC 203	Biology for Engineers	3	3:0:0=3
8	BSC 204	Environment Science (Audit)	3	2:0:0=0
Total Credits:				29

ENGINEERING SCIENCE COURSE [ESC] (Total 8)

Sl.	Code No.	Subject	Semester	Credits
1	ESC 101	Basic Electrical Engineering	1	2:1:2=4
2	ESC 102	Engineering Graphics & Design	1	1:0:4=3
3	ESC 103	Design Thinking + Idea Lab (Audit)	1	0:0:2=1
4	ESC 104	Programming for Problem Solving	2	2:0:4=4
5	ESC 105	Manufacturing Practice Workshop	2	0:0:4=2
6	ESC 201	Basic Electronic Engineering	3	3:1:2=5
7	ESC 202	Engineering Mechanics	3	3:1:0=4
8	ESC 203	Applied Thermodynamics	3	3:1:0=4
Total Credits:				27

PROFESSIONAL CORE COURSES [PCC] (Total 16)

Sl.	Code No.	Subject	Semester	Credits
1	PCC-EEE401	Network Analysis	4	3:1:1=5
2	PCC-EE402	Electrical Machines - I	4	3:1:1=5
3	PCC-EE403	Electrical Measurements and Instrumentation	4	3:0:1=4
4	PCC-EE404	Electromagnetic Field Theory	4	3:0:0=3
5	PCC-EE405	Signals and Systems	4	3:1:0=4
6	PCC-EE406	Communications Systems	4	3:0:0=3
7	PCC-EEE501	Digital Electronics	5	3:0:1=4
8	PCC-EEE502	Electrical Machines - II	5	3:1:1=5
9	PCC-EEE503	Analog Electronics	5	3:0:1=4
10	PCC-EEE505	Elements of Power System	5	3:0:0=3
11	PCC-EEE506	Digital Signal Processing	5	3:0:0=3
12	PCC-EEE601	Control Systems	6	3:0:1=4
13	PCC-EEE602	Power System Analysis	6	3:1:0=4
14	PCC-EEE603	Power Electronics	6	3:0:1=4
15	PCC-EEE604	Power Plant Engineering	6	3:0:0=3
16	PCC-EEE605	Products Innovation and Entrepreneurship	6	3:0:0=3
TOTAL				58

PROFESSIONAL ELECTIVE [PEC]**(Total 3 to be taken, at least one from each group)**

Sl.	Code No.	Subject	Semester	Credits
<i>TECHNOLOGY GROUP</i>				
1	BT-EEEL X01	Internet of Things	7 / 8	3:0:0=3
2	BT-EEEL X02	Mechatronics	7 / 8	3:0:0=3
3	BT-EEEL X03	Renewable Energy Sources	7 / 8	3:0:0=3
4	BT-EEEL X04	Communications Systems	7 / 8	3:0:0=3
5	BT-EEEL X05	VLSI Design	7 / 8	3:0:0=3
6	BT-EEEL X06	Biosensors	7 / 8	3:0:0=3
<i>INDUSTRY SECTOR GROUP</i>				
1	BT-EEEL X11	Electric Vehicles	7 / 8	3:0:0=3
2	BT-EEEL X12	Embedded Systems	7 / 8	3:0:0=3
3	BT-EEEL X13	Electric Safety	7 / 8	3:0:0=3
4	BT-EEEL X14	Biomedical Engineering	7 / 8	3:0:0=3
5	BT-EEEL X15	Building Cyber Physical Systems	7 / 8	3:0:0=3
6	BT-EEEL X16	Introduction to Robotics and Automation	7 / 8	3:0:0=3
Total Credits:				12

ENGINEERING PROJECT (3 Stages)

Sl.	Code No.	Subject	Semester	Credits
1	BTEEE608P	Engineering Project-1 (Literature Review)	6	0:0:4=2
2	BTEEE705P	Engineering Project-2 (Design & Analysis)	7	0:0:10=5
3	BTINT706P	Seminar	7	0:0:2=1
4	BTEEE803P	Engineering Project-3 (Prototype & Testing)	8	0:0:16=8
Total Credits:				16

TOTAL = 160 credits | BSC = 18%, ESC = 17%, PCC = 36%, PEL+HSM+OEL = 9%,
PROJ = 10% || LABS = 10%

NEW AND ELECTRONICS/IT-ORIENTED CORE COURSES

Sl.	Code No.	Subject	Semester	Credits
1	ESC 103	Design Thinking & Idea Lab (New)	1	0:0:2=1
2	ESC 103	Programming for Problem Solving	2	3:0:4=5
			Total Credits:	6

INDUCTION PROGRAM

The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal, (Link:<https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induc%20tion%20program.pdf>).

Induction program (mandatory)	Three-week duration
Induction program for students to be offered right at the start of the first year.	<ul style="list-style-type: none"> • Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

Mandatory Visits/ Workshop/Expert Lectures:

- a. It is mandatory to arrange one industrial visit every semester for the students of each branch.
- b. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.
- c. It is mandatory to organize at least one expert lecture per semester for each branch by inviting resource persons from domain specific industry.

Evaluation Scheme (Suggestive only):

- a. **For Theory Courses:**

(The weightage of Internal assessment is 40% and for End Semester Exam is 60%)

b. For Practical Courses:

(The weightage of Internal assessment is 60% and for End Semester Exam is 40%)

c. For Summer Internship / Projects / Seminar etc.

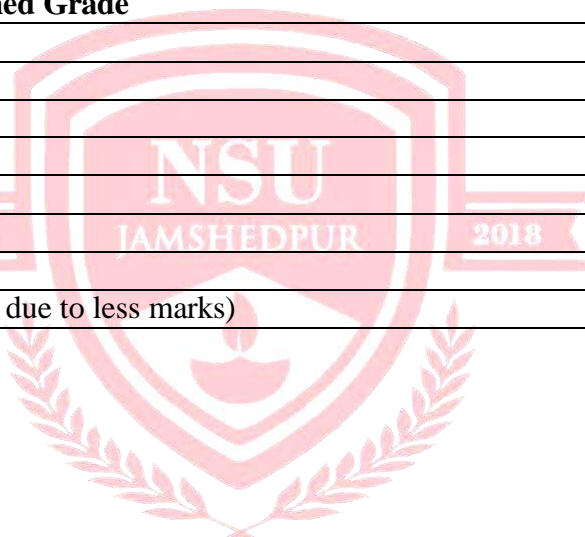
Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Note: The internal assessment is based on the student's performance in mid semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record etc.

Mapping of Marks to Grades

Each course (Theory/Practical) is to be assigned 100 marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Range of Marks	Assigned Grade
91-100	A ⁺
81-90	A
71-80	B ⁺
61-70	B
51-60	C ⁺
46-50	C
40-45	D
< 40	F (Fail due to less marks)



Semester wise Structure**SEMESTER-I**

S. No.	Code No.	Category	Name of the Subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTBSC 101	BSC	Engineering Mathematics- I	3	1	0	4	40	60	100
2	BTBSC 102	BSC	Engineering Physics-1	3	1	-	4	40	60	100
3	BTESC 103	ESC	Basics of Electrical Engineering	3	0	-	3	40	60	100
4	BTESC 104	ESC	Engineering Drawing	1	0	-	1	40	60	100
5	BTMC 105	MC	Indian Knowledge System	3	0	-	3	40	60	100
Practical										
6	BTBSC 102P	BSC	Engineering Physics Lab	-	-	2	1	30	20	50
7	BTESC 103P	ESC	Basics of Electrical Engineering Lab	-	-	2	1	30	20	50
8	BTESC 104P	ESC	Engineering Drawing & Computer Graphics Lab	-	-	4	2	30	20	50
9	BTESC 107P	ESC	Design Thinking & IDEA Lab	-	-	2	1	30	20	50
10	BTAU 106	AU	Sports/NSS/NCC/YOGA/Painting/Music/Classical dance		-	2	0	-	-	-
Total				13	2	12	20	320	380	700

SEMESTER-II

S. No.	Code No.	Category	Name of the Subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTBSC 201	BSC	Engineering Mathematics -II	3	1	-	4	40	60	100
2	BTBSC 202	BSC	Engineering Chemistry	3	0	-	3	40	60	100
3	BTHSMC 203	HSMC	English for technical writing	2	0	0	2	40	60	100
4	BTESC 204	ESC	Programming for Problem Solving	2	0	-	2	40	60	100
5	BTHSMC 205	HSMC	Universal Human Values	2	1	0	3	40	60	100
Practical										
6	BTBSC 202P	BSC	Engineering Chemistry Lab	-	-	2	1	30	20	50
7	BTHSMC 203P	HSMC	English for technical writing	0	0	2	1	30	20	50
8	BTESC 204P	ESC	Programming for Problem Solving Lab	-	-	4	2	30	20	50
9	BTESC 206P	ESC	Manufacturing Practices Workshop			4	2	30	20	50
Total				12	2	12	20	320	380	700

SEMESTER-III

S. No.	Code No.	Category	Name of the Subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTBSC302	BSC	Mathematics-3 (PDE, Prob/Stat)	3	1	0	4	40	60	100
2	BTBSC303	BSC	Physics-2 (Optics & Waves)	3	1	0	4	40	60	100
3	BTBSC304	BSC	Environment Science (Audit)	2	0	0	0	40	60	100
4	BTEESC301	ESC	Basic Electronics Engineering	3	1	0	4	40	60	100
5	BTEESC302	ESC	Network Analysis	3	1	0	4	40	60	100
6	BTEESC303	ESC	Material Science	3	1	0	4	40	60	100
Practical										
7	BTEESC 301P	ESC	Basic Electronics Engineering Lab	-	-	2	1	30	20	50
8	BTEE401P	PCC	Network Analysis Lab	-	-	2	1	30	20	50
Total				17	5	4	22	250	450	700

SEMESTER-IV

Sl. No.	Code No.	Category	Name of the Subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTEEE 401	PCC	Analog Electronics	3	1	0	4	40	60	100
2	BTEEE 402	PCC	Electrical Machines - I	3	1	0	4	40	60	100
3	BTEEE 403	PCC	Electrical Measurements and Instrumentation	3	0	0	3	40	60	100
4	BTEEE 404	PCC	Electromagnetic Field Theory	3	0	0	3	40	60	100
5	BTEEE 405	PCC	Signals and Systems	3	1	0	4	40	60	100
6	BTEEE 406	PCC	Communications Systems	3	0	0	3	40	60	100
Practical										
8	BTEEE 402P	PCC	Electrical Machines – I Lab	-	-	2	1	30	20	50
9	BTEEE 403P	PCC	Electrical Measurements and Instrumentation Lab	-	-	2	1	30	20	50
10	BTEEE 407P	EEC	Summer Internship - I	-	-	4	2	30	20	50
Total				18	3	6	24	330	420	750

SEMESTER-V

S. NO	Code No	Category	Name of the subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTECE50 1	PCC	Digital Electronics	3	1	0	4	40	60	100
2	BTEEE50 2	PCC	Electrical Machines - II	3	1	0	4	40	60	100
3	BTEEE50 4	PCC	Elements of Power System	3	0	0	3	40	60	100
4	BTECE50 5	PCC	Digital Signal Processing	3	0	0	3	40	60	100
5	BTHSMC 506	HSMC	HSS/ Management Elective - I	3	0	0	3	40	60	100
6	BTEEEE C506	EEC	Employment Enhancement Course - I	0	0	2	1	40	60	100
Practical										
7	BTEEE50 1P	PCC	Digital Electronics Lab	0	0	2	1	30	20	50
8	BTEEE50 2P	PCC	Electrical Machines – II Lab	0	0	2	1	30	20	50
9	BTEEE50 3P	PCC	Analog Electronics Lab	0	0	2	1	30	20	50
TOTAL				15	2	8	21	330	420	750

SEMESTER-VI

S. NO	Code No	Category	Name of the subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTEEE601	PCC	Control Systems	3	0	0	3	40	60	100
2	BTEEE602	PCC	Power System Analysis	3	1	0	4	40	60	100
3	BTEEE603	PCC	Power Electronics	3	0	0	3	40	60	100
4	BTEEE604	PCC	Power Plant Engineering	3	0	0	3	40	60	100
5	BTHSMC605	HSMC	HSS/ Management Elective - II	3	0	0	3	40	60	100
6	BTEEE606	EEC	Employment Enhancement Course – II	3	0	0	0	40	60	100
Practical										
8	BTEEE602P	PCC	Power System Simulation Lab	0	0	2	1	30	20	50
9	BTEEE603P	PCC	Power Electronics Lab	0	0	2	1	30	20	50
10	BTEEE607P	EEC	Summer Internship - II	-	-	4	2	30	20	50
11	BTEEE608P	EEC	Control System Lab	0	0	4	2	30	20	50
TOTAL				18	1	8	27	360	440	800

SEMESTER-VII

S. NO	Code No	Category	Name of the subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTEEE 701	PEL	Microprocessor and Microcontroller	3	0	0	3	40	60	100
2	BTEEE 702	PEC	Professional Elective – 1	3	0	0	3	40	60	100
3	BTEEE 703	OEC	Open Elective – 1	3	0	0	3	40	60	100
4	BTEEE 704	OEC	Open Elective - 2	3	0	0	3	40	60	100
Practical										
7	BTEEE 705P	PROJ	Engg. Project – 1 (Design & Analysis)	0	0	10	5	60	40	100
10	BTINT 706P	INT	Internship /Summer Industrial Training/ Seminar (4-6 Week)	0	0	4	2	30	20	50
11	BTEEE 707P	PCC	Microprocessor and Microcontroller Lab	0	0	4	2	30	20	50
TOTAL				12	0	18	21	280	320	600

VIII – SEMESTER

S. No.	Code No.	Category	Name of the Subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTEEE 801	PEC	Professional Elective-3	3	0	0	3	40	60	100
2	BTEEE 802	OEC	Open Elective-3	3	0	0	3	40	60	100
Practical										
3	BTEEE 803P	PROJ	Engineering Project-2 and Literature Review (Prototype & Testing)	-	-	16	8	120	80	200
4	BTEEE 801P	PCC	Digital Signal Processing Lab	0	0	4	2	30	20	50
Total				6	0	20	16	230	220	450

PROFESSIONAL ELECTIVE COURSES

CATEGORY	TECHNOLOGY GROUP	INDUSTRY SECTOR GROUP	CREDITS
PEC	Internet of Things	Electric Vehicles	3
PEC	Mechatronics	Embedded Systems	3
PEC	Renewable Energy Sources	Electric Safety	3
PEC	Communications Systems	Biomedical Engineering	3
PEC	VLSI Design	Building Cyber Physical Systems	3
PEC	Biosensors	Introduction to Robotics and Automation	3

OPEN ELECTIVE COURSES

S. No.	Category	Name of the Subject	Semester	Credits
1	OEC	Optimization Techniques	7/8	3
2	OEC	Introduction to VLSI	7/8	3
3	OEC	Industrial Management	7/8	3
4	OEC	Power System Protection	7/8	3
6	OEC	Power Quality	7/8	3
7	OEC	Industrial Safety	7/8	3
8	OEC	Industrial drives	7/8	3
9	OEC	Sensors and Actuators	7/8	3
10	OEC	Power System Stability and Control	7/8	3
11	OEC	Communication Engineering	7/8	3

HUMANITIES & SOCIAL SCIENCES COURSES [HS] & MANAGEMENT COURSES

Humanities & Social Sciences & Mgt. Electives (HSM): Any 2 courses from the list of those offered.

S. No	Category	Subject	Semester	Credits
1	HSMC	Communication Skills / English (Compulsory)	2	3
2	HSMC	Universal Human Values-2 (Compulsory course)	2	3
3	HSMC	Industrial Psychology	5/6	3
4	HSMC	Operations Research	5/6	3
5	HSMC	Project Management	5/6	3
6	HSMC	Finance & Accounting	5/6	3

Employment Enhancement Courses

Sl.	Category	Subject	Semester	Credits
1	EEEC	Employment Enhancement Course-I	5	01
2	EEEC	Employment Enhancement Course-II	6	01
3	EEEC	Internship / Summer Industrial Training/ Seminar (4-6 Week)	5/7	04
4	EEEC	Engg Project – I/II/III	6/7/8	15



SEMESTER – I



ENGINEERING MATHEMATICS-I

Subject Code: -	BTBSC101	IA Marks	40
Number of Lecture Hours/Week:-	04	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course Objectives:

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Contents:**Module 1: Basic Calculus: (12 hours)**

Curvature, evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Single-variable Calculus (Differentiation): (12 hours)

Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Linear approximation; Indeterminate forms and L' Hospital's rule.

Module 3: Sequences and series: (12 hours)

Limits of sequence of numbers, Calculation of limits, Infinite series; Tests for convergence; Power series, Taylor and Maclaurin series; Taylor theorem, convergence of Taylor series, error estimates.

Module 4: Multivariable Calculus (Differentiation): (12 hours)

Limit, continuity and partial derivatives, directional derivatives, gradient, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 5: Multivariable Calculus (Integration): (12 hours)

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

TEXTBOOKS/REFERENCES:

1. AICTE's Prescribed Textbook: Mathematics-I (Calculus & Linear Algebra) ISBN: 9789391505172
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course outcomes: The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate differentiation and integration. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

At the end of the course, the students will learn

- CO1.** To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- CO2.** The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO3. The tool of power series and Fourier series for learning advanced Engineering Mathematics.

CO4. To deal with functions of several variables that are essential in most branches of engineering.

CO5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.	K ₁
CO2	The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.	K ₂
CO3	The tool of power series and Fourier series for learning advanced Engineering Mathematics.	K ₃
CO4	To deal with functions of several variables that are essential in most branches of engineering.	K ₂
CO5	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.	K ₂

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1									1				
CO2		2			1									
CO3			2				1				1			
CO4								2				1		
CO5				1									1	
CO(Average)	1	2	2	1	1		1	2			1	1	1	

3 –High; 2 –Medium; 1 –Low

ENGINEERING PHYSICS-I (ELECTROMAGNETISM)

SubjectCode:-	BTBSC102	IA Marks	40
Number of Lecture Hours/Week:-	04	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course Objective:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Contents:**Module I: Electrostatics in vacuum (15 hours)**

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Practical examples like Faraday's cage and coffee-ring effect; Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field.

Module II: Electrostatics in a linear dielectric medium (10 hours)

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the center of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

Module III: Magneto statics (10 hours)

Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Module IV: Magneto statics in a linear magnetic medium (10 hours)

Magnetization and associated bound currents; auxiliary magnetic field H ; Boundary conditions on B and H . Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Module V: Faraday's law (15 hours)

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic braking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.

Text Books/Suggested References:

1. AICTE's Prescribed Textbook: Physics (Introduction to Electromagnetic Theory) with Lab Manual, ISBN: 978-93-91505-165
2. Bhattacharya & Nag, Engineering Physics
3. David Griffiths, Introduction to Electrodynamics
4. Halliday and Resnick, Physics
5. W. Saslow, Electricity, magnetism and light
6. Malik, Singh, Engineering Physics, Tata McGraw Hill

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	INTRODUCTION TO ELECTROMAGNETIC THEORY	PROF. MANOJ HARBOLA	IIT KANPUR

Course Outcomes:

At the end of the course, students will be able to

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

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Identify and understand the kinds of experimental results which are incompatible with classical Physics leading to the development of a quantum theory of matter and light.	K ₁
CO2	Use basic concepts to analyse and design a wide range of semiconductor devices.	K ₂

CO3	Understand & solve different types of wave equations.	K ₃
CO4	Use the principles of optics to solve various complex engineering problems.	K ₃
CO5	Use fundamental laws and relations to solve problems in electricity, electromagnetism.	K ₄

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	3										3		
CO2			2		3									1
CO3				2								1		
CO4			3	2										
CO5			3							2				
CO(Average)	2	3	2.6	2	3					2		2		1

3 –High; 2 –Medium; 1 –Low

BASIC ELECTRICAL ENGINEERING

Subject Code: -	BTESC103	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objective:

The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electrical Engineering.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Contents:

Module I: (10 hours)

D. C. Circuits covering, Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; Electromagnetism covering, Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields;

Module II: (10 hours)

Single Phase A.C. Circuits covering, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series- parallel circuits; Three Phase A.C. Circuits covering, Necessity and Advantages of three phase systems, Generation of three phase power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits, measurement of power by two wattmeter method;

Module III: (5 hours)

Transformers covering, Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation; Synchronous Generators covering, Principle of operation; Types and constructional features; EMF equation;

Module IV: (10 hours)

DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor;

Module V: (10 hours)

Three Phase Induction Motors covering; Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.

TEXT/REFERENCES BOOKS:

1. AICTE's Prescribed Textbook: Basic Electrical Engineering (ISBN: 978-93-91505-158)
2. Ritu Sahdev (2022), Basic Electrical Engineering, Khanna Book Publishing.
3. Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.
4. Hayt and Kimberly, Engineering Circuit Analysis, Tata McGraw Hill.
5. Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.

6. Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall, India
Hughes, E. 2005)
7. Mittel & Mittal, Basic Electrical Engineering, Tata McGraw Hill.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	BASIC ELECTRIC CIRCUITS	PROF. ANKUSH SHARMA	IIT KANPUR
2	BASIC ELECTRICAL CIRCUITS	PROF. NAGENDRA KRISHNAPURA	IITM
3	FUNDAMENTALS OF ELECTRICAL ENGINEERING	PROF. DEBAPRIYA DAS	IIT KGP

COURSE OUTCOMES:

At the end of the course, the students will learn:

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

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Identify and understand the kinds of experimental results which are incompatible with classical Physics leading to the development of a quantum theory of matter and light.	K ₁
CO2	Use basic concepts to analyse and design a wide range of semiconductor devices.	K ₂
CO3	Understand & solve different types of wave equations.	K ₃
CO4	Use the principles of optics to solve various complex engineering problems.	K ₃
CO5	Use fundamental laws and relations to solve problems in electricity, electromagnetism.	K ₄

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	3										3		
CO2			2		3									1
CO3				2								1		
CO4			3	2										
CO5			3							2				
CO(Average)	2	3	2.6	2	3					2		2		1

3 –High; 2 –Medium; 1 –Low

ENGINEERING DRAWING

Subject Code: -	BTESC104	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

COURSE OBJECTIVE(S):

The objective of this Course is to provide the basic knowledge about Engineering Drawing. Detailed concepts are given in projections, technical drawing, dimensioning and specifications, so useful for a student in preparing for an engineering career.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

COURSE CONTENTS:

Traditional Engineering Graphics: Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Module I: Introduction to Engineering Drawing (10 hours)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module II: Orthographic Projections (10 hours)

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module III: Projections of Regular Solids (5 hours)

Covering those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module IV: Sections and Sectional Views of Right Angular Solids (10 hours)

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids

- Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only).

Module V: Isometric Projections (10 hours)

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Text/Reference Books:

1. AICTE's Prescribed Textbook: Engineering Graphics & Design (ISBN: 978-93-91505-066)
2. Jain, Maheshwari, Gautam (2021), Engineering Graphics & Design, Khanna Book Publishing.
3. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing.
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson.
5. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
6. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
7. (Corresponding set of) CAD Software Theory and User Manuals.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	PROF. RAJARAM LAKKARAJU	IIT KHARAGPUR	Engineering Drawing and Computer Graphics
2	PROF. NIHAR RANJAN PATRA	IIT KANPUR	Engineering Graphics

Course Outcomes:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

At the end of the course, the students will learn:

- CO1. To describe engineering design and its place in society.
- CO2. To discuss the visual aspects of engineering design.
- CO3. To use engineering graphics standards.
- CO4. To illustrate solid modelling.
- CO5. To use computer-aided geometric design.
- CO6. To design creating working drawings.
- CO7. To inspect engineering communication.

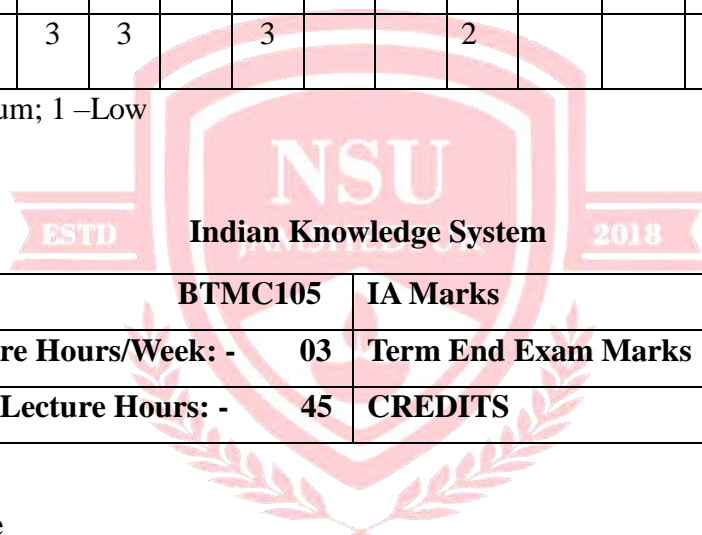
Course Outcome No	Statement	Knowledge Level (KL)
CO1	To describe engineering design and its place in society.	K ₁
CO2	To discuss the visual aspects of engineering design.	K ₂
CO3	To use engineering graphics standards.	K ₃
CO4	To illustrate solid modelling.	K ₂
CO5	To use computer-aided geometric design.	K ₃
CO6	To design creating, working, drawings.	K ₆
CO7	To inspect engineering communication.	K ₅

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create**Course Articulation Matrix: (Mapping of COs with POs)**

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1			3											
CO2				3					2					
CO3		2												
CO4						3								
CO5														
CO6		2							2			1	1	1
CO7	2													
CO(Average)	2	2	3	3		3			2			1	1	1

3 –High; 2 –Medium; 1 –Low



Subject Code: -	BTMC105	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objective

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

Course Outcomes:

At the end of the course, students will be able to

- CO1.** Basic principles of thought process, reasoning and differencing.
- CO2.** Introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care systems.
- CO3.** Focuses on Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

SYLLABUS

BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM: Basic structure of Indian Knowledge System.

BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM:

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

YOGA AND HOLISTIC HEALTH CARE LAWS: Yoga and Holistic Health care.

CASE STUDIES: Case studies.

TEXT BOOKS

1. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bhartiya.
2. Vidya Bhavan, Mumbai. 5th Edition, 2014 Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan.
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Fritzof Capra, The Wave of life.

REFERENCE BOOKS

1. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay
2. Foundation, Velliarnad, Arnakulam Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata R3. GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya
3. VidyanidhiPrakashan, Delhi 2016 RNJha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi
4. Prakashan, Delhi 2016 P B Sharma (English translation), ShodashangHridayan

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Basic principles of thought process, reasoning and differencing.	K ₁
CO2	Introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care systems.	K ₂
CO3	Focuses on Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create
Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1			3											
CO2				3					2					
CO3		2												
CO(Average)	2	2	3	3		3			2			1	1	1

3 –High; 2 –Medium; 1 –Low

ENGINEERING PHYSICS LAB

Subject Code: -	BTBSC102P	IA Marks	30
Number of Lecture Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Course Objective

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

Course Outcomes:

At the end of the course, students will be able to

CO1. Understand calculation of specific resistance of wire by Carey Foster bridge

CO2. Calculate thermal conductivity of poor conductors

CO3. Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current

CO4. Study the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance.

CO5. Work with laboratory sodium light and lasers. Understand method to measure the wavelength of the light emitted from a laser and Sodium light.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

SYLLABUS

Sl. No.	Name of Experiments
1.	To determine the specific resistance of the material of a wire by Carey Foster bridge
2.	To determine the Planck's constant using LED.
3.	To determine the wavelength of sodium light by using Newton's ring apparatus.
4.	To find the wave length of sodium light using Fresnel's biprism
5.	To determine dispersive power of the material of the prism with the help of a Spectrometer
6.	To determine the number of lines per centimeter of the plane diffraction grating by using sodium light.
7.	To determine the thermal conductivity of following bad conductor (a) ebonite (b) mica sheet (c) wooden By Lee's disc method
8.	To determine the co-efficient of viscosity of glycerin by Stoke's method.
9.	To determine acceleration due to gravity by a Bar Pendulum.
10.	To determine input & output characteristics of a PNP Junction Transistor in CE and CB configuration.
11.	To determine input & output characteristics of a NPN Junction Transistor in CE and CB configuration
12.	To study resonance phenomena in LCR circuits with AC current

13.	To measure moment of inertia of Flywheel
14.	To determine the Lorentz force in a vacuum tube.
15.	To measure the numerical aperture of an optical fiber.
16.	To obtain the particle size by Laser
17.	To obtain forbidden energy gap of Semiconductor Diode.
18.	To obtain Dielectric constant.
19.	To obtain Curie temperature
20.	To determine the time constant of an RC circuit.

Text Book:

1. A Text Book of Engineering Physics Practical by Dr. Ruby Das, C.S. Robinson, Dr. Rajesh Kumar & Prashant Kumar Sahu; Pub University Science Press.
2. Fundamentals of Physics extended volume by Resnick, Halliday and Walker; Pub.:John Wiley & Sons. Inc. Asian Edition.

Reference Books:

1. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers.
2. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Understand calculation of specific resistance of wire by Carey Foster bridge	K ₁
CO2	Calculate thermal conductivity of poor conductors	K ₂
CO3	Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current	K ₃
CO4	Study the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance.	K ₂
CO5	Work with laboratory sodium light and lasers. Understand method to measure the wavelength of the light emitted from a laser and Sodium light.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	3										3		
CO2			2		3									1
CO3				2								1		
CO4			3	2										
CO5			3							2				
CO(Average)	2	3	2.6	2	3					2		2		1

3 –High; 2 –Medium; 1 –Low

BASICS OF ELECTRICAL ENGINEERING LAB

Subject Code: -	BTESC103P	IA Marks	30
Number of Lecture Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Course Objective

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

Course Outcomes:

At the end of the course, students will be able

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

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Study different meters and instruments for measurement of electrical quantities	K ₁
CO2	Study the linear and nonlinear characteristics of different types of loads experimentally.	K ₂
CO3	Design and experiment potential divider circuits	K ₃
CO4	Experimentally verify the basic circuit theorems.	K ₂
CO5	Measure power and power factor in ac circuits.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3													
CO2		1	2											
CO3				3									1	1
CO4														
CO5														
CO(Average)	3	1	2	3									1	1

3 –High; 2 –Medium; 1 –Low

ENGINEERING DRAWING & COMPUTER GRAPHICS LAB

Subject Code: -	BTESC104P	IA Marks	30
Number of Lecture Hours/Week: -	04	Term End Exam Marks	20
Total Number of Lecture Hours: -	30	CREDITS	02

Course Objective

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

Course Outcomes:

At the end of the course, students will be able

CO1. Perform basic sketching techniques

CO2. Understanding of architectural and engineering scales will increase.

CO3. Able to draw orthographic projections and sections.

CO4. Ability to produce engineered drawings will improve.

CO5. Become familiar with office practice and standards.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content

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

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

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

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

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

TEXT BOOKS

1. Engineering Graphics, N.D Bhatt, Charotar Publishing House Pvt. Limited
2. Principle of Engineering Graphics and Drawing, R.K Dhawan, S. Chand Publishing
3. Engineering Graphics and Drafting, P.S GILL, S. K. Kataria& Sons

REFERENCE BOOKS

1. Engineering Drawing and Computer Graphics, Shah, M.B. & Rana B.C. Pearson Education
2. Engineering Graphics, Agrawal B. & Agrawal C. M, TMH Publication
3. Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah, Scitech Publishers

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Perform basic sketching techniques.	K ₁
CO2	Understanding of architectural and engineering scales will increase.	K ₂
CO3	Able to draw orthographic projections and sections.	K ₃
CO4	Ability to produce engineered drawings will improve.	K ₂
CO5	Become familiar with office practice and standards.	K ₃

KL- Bloom’s Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2										
CO2	1													
CO3													2	
CO4					1				2					
CO5														
CO(Avg)	2	3		2	1				2				2	

3 –High; 2 –Medium; 1 –Low

DESIGN THINKING & IDEA LAB

Subject Code: -	BTESC107P	IA Marks	30
Number of Lecture Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

COURSE OBJECTIVE(S):

The objective of this Course is to provide the new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

COURSE CONTENTS:

Module 1: An Insight to Learning Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting

Module 2: Basics of Design Thinking

Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test

Module 3: Prototyping & Testing

What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing

Module 4: Design Thinking & Customer Centricity

Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design

Module 5: Feedback, Re-Design & Re-Create

Feedback loop, Focus on User Experience, Address “ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – “Solving Practical Engineering Problem through Innovative Product Design & Creative Solution”.

Course Outcomes (CO):

Student will able to:

- CO1.** Compare and classify the various learning styles and memory techniques and apply them in their engineering education.
- CO2.** Analyse emotional experience and inspect emotional expressions to better understand users while designing innovative products.

- CO3.** Develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.
- CO4.** Propose real-time innovative engineering product designs and choose appropriate frameworks, strategies, techniques during prototype development.
- CO5.** Perceive individual differences and its impact on everyday decisions and further Create a better customer experience.

Text/Reference Books:

1. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.

IDEA Lab Workshop

Course Objectives:

- CO1. To learn all the skills associated with the tools and inventory associated with the IDEA Lab.
- CO2. Learn useful mechanical and electronic fabrication processes.
- CO3. Learn necessary skills to build useful and standalone system/ project with enclosures.
- CO4. Learn necessary skills to create print and electronic documentation for the system/project

Course Contents:

Unit	Topics	
1.	Electronic component familiarization, Understanding electronic system design flow. Schematic design and PCB layout and Gerber creation using EagleCAD. Documentation using Doxygen, Google Docs, Overleaf. Version control tools - GIT and GitHub. Basic 2D and 3D designing using CAD tools such as FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT.	Introduction to basic hand tools - Tape measure, combination square, Vernier caliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits,

2.	<p>Familiarization and use of basic measurement instruments - DSO including various triggering modes, DSO probes, DMM, LCR bridge, Signal and function generator. Logic analyzer and MSO. Bench power supply (with 4-wire output)</p> <p>Circuit prototyping using (a) breadboard, (b) Zero PCB (c) 'Manhattan' style and (d) custom PCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab. Soldering using soldering iron/station. Soldering using a temperature controlled reflow oven. Automated circuit assembly and soldering using pick and place machines.</p>	<p>Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc.</p> <p>Basic welding and brazing and other joining techniques for assembly.</p> <p>Concept of Lab aboard a Box.</p>
3.	<p>Electronic circuit building blocks including common sensors. Arduino and Raspberry Pi programming and use. Digital Input and output. Measuring time and events. PWM. Serial communication. Analog input.</p> <p>Interrupts programming. Power Supply design (Linear and Switching types), Wireless power supply, USB PD, Solar panels, Battery types and charging</p>	<p>3D printing and prototyping technology – 3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverse engineering.</p> <p>Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers.</p> <p>Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab</p>
4.	Discussion and implementation of a mini project.	
5.	Documentation of the mini project (Report and video).	

Laboratory Activities:

S. No.	List of Lab activities and experiments
1.	Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2.	Machining of 3D geometry on soft material such as soft wood or modelling wax.
3.	3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.

4.	2D profile cutting of press fit box/casing in acrylic (3- or 6-mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5.	2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6.	Familiarity and use of welding equipment.
7.	Familiarity and use of normal and wood lathe.
8.	Embedded programming using Arduino and/or Raspberry Pi.
9.	Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.

Reference Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), ISBN: 978-9391505332
2. All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
3. Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.
4. 3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
5. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.
6. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978-1681881584.
7. Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374
8. The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press. ISBN: 9780521809269
9. Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542
10. Encyclopedia of Electronic Components (Volume 1, 2 and 3). Charles Platt. Shroff Publishers. ISBN-13: 978-9352131945, 978-9352131952, 978-9352133703
11. Building Scientific Apparatus. 4th edition. John H. Moore, Christopher C. Davis, Michael Coplan and Sandra C. Greer. Cambridge University Press. ISBN-13: 978-0521878586
12. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633

13. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13: 978-1260019193.
14. Pro GIT. 2nd edition. Scott Chacon and Ben Straub. A press. ISBN-13: 978-1484200773
15. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer, 2004.
16. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010
17. Chapman W.A.J, “Workshop Technology”, Volume I, II, III, CBS Publishers and distributors, 5th Edition,2002.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Compare and classify the various learning styles and memory techniques and apply them in their engineering education.	K ₁
CO2	Analyse emotional experience and inspect emotional expressions to better understand users while designing innovative products.	K ₃
CO3	Develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.	K ₄
CO4	Propose real-time innovative engineering product designs and choose appropriate frameworks, strategies, techniques during prototype development.	K ₄
CO5	Perceive individual differences and its impact on everyday decisions and further Create a better customer experience.	K ₃

KL- Bloom’s Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3													
CO2			2					2						1
CO3														
CO4	1		1							1		1		1
CO5														
CO(Average)	2		1.5					2		1		1		1

3 –High; 2 –Medium; 1 –Low

SPORTS AND YOGA

Subject Code: -	BTESC107P	IA Marks	00
Number of Lecture Hours/Week: -	02	Term End Exam Marks	00
Total Number of Lecture Hours: -	15	CREDITS	00

Course Objective(s):

- To make the students understand the importance of sound health and fitness principles as they relate to better health.
- To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
- To create a safe, progressive, methodical and efficient activity-based plan to enhance improvement and minimize risk of injury.
- To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

Course Contents:**Module I: Introduction to Physical Education**

- Meaning & definition of Physical Education
- Aims & Objectives of Physical Education
- Changing trends in Physical Education

Module II: Olympic Movement

- Ancient & Modern Olympics (Summer & Winter)
- Olympic Symbols, Ideals, Objectives & Values
- Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

Module III: Physical Fitness, Wellness & Lifestyle

- Meaning & Importance of Physical Fitness & Wellness
- Components of Physical fitness
- Components of Health related fitness
- Components of wellness
- Preventing Health Threats through Lifestyle Change
- Concept of Positive Lifestyle

Module IV: Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga

- Define Anatomy, Physiology & Its Importance
- Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)

Module V: Kinesiology, Biomechanics & Sports

- Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
- Newton's Law of Motion & its application in sports.
- Friction and its effects in Sports.

Module VI: Postures

- Meaning and Concept of Postures.
- Causes of Bad Posture.
- Advantages & disadvantages of weight training.
- Concept & advantages of Correct Posture.
- Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.
- Corrective Measures for Postural Deformities

Module VII: Yoga

- Meaning & Importance of Yoga
- Elements of Yoga
- Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas
- Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana)
- Relaxation Techniques for improving concentration - Yog-nidra

Module VIII: Yoga & Lifestyle

- Asanas as preventive measures.
- Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.
- Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.
- Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
- Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.
- Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

Module IX: Training and Planning in Sports

- Meaning of Training
- Warming up and limbering down
- Skill, Technique & Style
- Meaning and Objectives of Planning.
- Tournament – Knock-Out, League/Round Robin & Combination.

Module X: Psychology & Sports

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development

- Adolescent Problems & Their Management
- Emotion: Concept, Type & Controlling of emotions
- Meaning, Concept & Types of Aggressions in Sports.
- Psychological benefits of exercise.
- Anxiety & Fear and its effects on Sports Performance.
- Motivation, its type & techniques.
- Understanding Stress & Coping Strategies.

Module XI: Doping

- Meaning and Concept of Doping
- Prohibited Substances & Methods
- Side Effects of Prohibited Substances

Module XII: Sports Medicine

- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention.
- Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

Module XIII: Sports / Games

Following subtopics related to any one Game/Sport of choice of student out of:

Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.

- History of the Game/Sport.
- Latest General Rules of the Game/Sport.
- Specifications of Play Fields and Related Sports Equipment.
- Important Tournaments and Venues.
- Sports Personalities.
- Proper Sports Gear and its Importance.

Text Books/References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga by B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

Course Outcomes:

On successful completion of the course the students will be able:

1. To practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
2. To learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
3. To learn breathing exercises and healthy fitness activities
4. To understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.

5. To perform yoga movements in various combination and forms.
6. To assess current personal fitness levels.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	To practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.	K ₁
CO2	To learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.	K ₃
CO3	To learn breathing exercises and healthy fitness activities	K ₄
CO4	To understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.	K ₄
CO5	To perform yoga movements in various combination and forms.	K ₃
CO6	To assess current personal fitness levels.	K ₄

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3													
CO2		1	2											
CO3				3									1	1
CO4														
CO5														
CO6										1				
CO(Average)	3	1	2	3						1			1	1

3 –High; 2 –Medium; 1 –Low



ENGINEERING MATHEMATICS- II

Subject Code: -	BTBSC201	IA Marks	40
Number of Lecture Hours/Week:-	04	Term End Exam Marks	60
Total Number of Lecture Hours: -	60	CREDITS	04

Course Objective:

Mathematics fundamental necessary to formulate, solve and analyse engineering problems.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:**Module 1: Matrices (10 hours)**

Linear Systems of Equations; Linear Independence; Rank of a Matrix; Determinant, Inverse of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem.

Module 2: First order ordinary differential equations: (10 hours)

Exact, linear and Bernoulli's equations. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 3: Ordinary differential equations of higher orders: (10 hours)

Second order linear differential equations with variable coefficients: Euler-Cauchy equations, solution by variation of parameters; Power series solutions: Legendre's equations and Legendre polynomials, Frobenius method, Bessel's equation and Bessel's functions of the first kind and their properties.

Module 4: Complex Variable – Differentiation: (15 hours):

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 5: Complex Variable – Integration: (15 hours):

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

TEXTBOOKS/REFERENCES:

1. [AICTE's Prescribed Textbook: Mathematics-II \(Calculus, Ordinary Differential Equations and Complex Variable\) ISBN: 978-93-91505-28-8](#)
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
7. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
8. S. L. Ross, Differential Equations, 3rd Edition, Wiley India, 1984.
9. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
10. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
11. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
12. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
13. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Note: The modules have been prepared keeping the following from the Textbooks/References in mind:

- (1) Module 1: Sections 7.3-7.5, 7.7, 7.8, 8.1-8.4 of [1].
- (2) Module 2: Sections 1.4, 1.5 of [1]; Section 5.1 of [2].
- (3) Module 3: Sections 2.5, 2.6, 2.10, 5.1, 5.3, 5.4, 5.5 of [1].
- (4) Module 4: Sections 13.3 – 13.7, 17.1 – 17.3 of [1].
- (5) Module 5: Sections 14.1 – 14.4, 15.2 – 15.4, 16.1 – 16.4 of [1].

COURSE OUTCOMES: The objective of this course is to familiarize the prospective engineers with techniques in matrices, ordinary differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

- CO1.** The essential tool of matrices and linear algebra in a comprehensive manner.
CO2. The effective mathematical tools for the solutions of differential equations that model physical processes.
CO3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	The essential tool of matrices and linear algebra in a comprehensive manner.	K ₁
CO2	The effective mathematical tools for the solutions of differential equations that model physical processes.	K ₂
CO3	The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO(Average)	3	1	2	3			1		1				1	

3 –High; 2 –Medium; 1 –Low

ENGINEERING CHEMISTRY

Subject Code: -	BTBSC202	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objective:

The objective of the Chemistry-I is to acquaint the students with the basic phenomenon/concepts of chemistry, the student faces during course of their study in the industry and Engineering field. The student with the knowledge of the basic chemistry, will understand and explain scientifically the various chemistry related problems in the industry/engineering field. The student will be able to understand the new developments and breakthroughs efficiently in engineering and technology. The introduction of the latest (R&D oriented) topics will make the engineering student upgraded with the new technologies.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:**Module I: Atomic and Molecular Structure (10 hours):**

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Module II: Spectroscopic techniques and applications (8 hours):

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.

Module III: Intermolecular forces and potential energy surfaces (7 hours):

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H₃, H₂F and HCN and trajectories on these surfaces.

Module IV: Use of free energy in chemical equilibria (10 hours):

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and EMF. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

Module V: Periodic properties (10 hours):

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Text/Reference Books:

1. [AICTE's Prescribed Textbook: Chemistry – I with Lab Manual \(ISBN: 978-93-91505-141\)](#)
2. Engineering Chemistry, by Manisha Agrawal.
3. University chemistry, by B. H. Mahan.
4. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
6. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
7. Physical Chemistry, by P. W. Atkins.
8. A Textbook of Engineering Chemistry, Shashi Chawla.
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition <http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Determination of surface tension and viscosity.	http://pcv-au.vlabs.ac.in/physical-chemistry/Determination_of_Viscosity_of_Organic_Solvents/
2	Ion exchange column for removal of hardness of water.	http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Chemical_Parameters/

3	Determination of chloride content of water.	http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/experiments/determination-of-chloride-nitk/simulation.html
4	Colligative properties using freezing point depression.	http://pcv-au.vlabs.ac.in/physical-chemistry/Cryoscopy/
5	Determination of the rate constant of a reaction.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
6	Determination of cell constant and conductance of solutions.	http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Physical_Parameters/
7	Potentiometry - determination of redox potentials and EMFs.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
8	Saponification/acid value of an oil.	http://biotech01.vlabs.ac.in/bio-chemistry/Estimation_of_Saponification_Value_of_Fats_or_Oils/

Course Outcomes: The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the students:

- CO1.** To analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- CO2.** To rationalise bulk properties and processes using thermodynamic considerations.
- CO3.** To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- CO4.** To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- CO5.** To list major chemical reactions that are used in the synthesis of molecules.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	To analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.	K ₁
CO2	To rationalise bulk properties and processes using thermodynamic considerations.	K ₂
CO3	To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	K ₃
CO4	To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.	K ₃
CO5	To list major chemical reactions that are used in the synthesis of molecules.	K ₄

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2	2	1	2											
CO3				3									1	
CO4							2							
CO5	1													
CO(Average)	2	1	2	3			1.5		1				1	

3 –High; 2 –Medium; 1 –Low

ENGLISH FOR TECHNICAL WRITING

Subject Code: -	BTHSMC203	IA Marks	40
Number of Lecture Hours/Week:-	02	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	02

Course Objective:

1. To provide learning environment to practice listening, speaking, reading and writing skills.
2. To assist the students to carry on the tasks and activities through guided instructions and materials.

3. To effectively integrate English language learning with employability skills and training.
4. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:

Module I: Vocabulary Building

- 1.1. The concept of Word Formation
- 1.2. Root words from foreign languages and their use in English
- 1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4. Synonyms, antonyms, and standard abbreviations.

Module II: Basic Writing Skills

- 1.1. Sentence Structures
- 1.2. Use of phrases and clauses in sentences
- 1.3. Importance of proper punctuation
- 1.4. Creating coherence
- 1.5. Organizing principles of paragraphs in documents
- 1.6. Techniques for writing precisely

Module III: Identifying Common Errors in Writing

- 1.1. Subject-verb agreement
- 1.2. Noun-pronoun agreement
- 1.3. Misplaced modifiers
- 1.4. Articles
- 1.5. Prepositions
- 1.6. Redundancies
- 1.7. Clichés

Module IV: Nature and Style of sensible Writing

- 1.1. Describing

- 1.2. Defining
- 1.3. Classifying
- 1.4. Providing examples or evidence
- 1.5. Writing introduction and conclusion
- 1.6. Comprehension
- 1.7. Précis Writing
- 1.8. Essay Writing

Module V: Oral Communication

(This Module involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Text/Reference Books:

1. [AICTE's Prescribed Textbook: English \(with Lab Manual\), Khanna Book Publishing Co.](#)
2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan.2007
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	English language for competitive exams	Prof. Aysha iqbal	IIT MADRAS
2.	Technical English for engineers	Prof. Aysha iqbal	IITM

Course Outcomes:

At the end of the course, students will be able to

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

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Remembering the basic of the comm Represent unication process and to know the practical implementations in the work place.	K ₁
CO2	Understanding verbal and non-verbal modes of communication effectively in practical situations	K ₂
CO3	Analyzing vocalics and basic grammar.	K ₃
CO4	Creating competence in reading and writing.	K ₆
CO5	Evaluation of speaking process.	K ₅

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3	1			2									1	
CO4					2									
CO5														
CO(Average)	2	1	2	3	2		1		1				1	

3 –High; 2 –Medium; 1 –Low

PROGRAMMING FOR PROBLEM SOLVING

Subject Code: -	BTESC204	IA Marks	40
Number of Lecture Hours/ Week: -	02	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	02

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.
- To understated and formulate algorithm for programming script
- To analyze the output based on the given input variables.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Contents:**Module I: (8 hours)**

Introduction to Programming; Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Module II: (7 hours)

Arithmetic expressions and precedence. Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops. Arrays, Arrays (1-D, 2-D), Character arrays and Strings. Basic Algorithms, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module III: (8 hours)

Function, Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion, Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module IV: (7 hours)

Structures, Defining structures and Array of Structures. Pointers, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation).

Module V: (5 hours)

File handling (only if time is available, otherwise should be done as part of the lab).

TEXT/REFERENCE BOOKS:

1. [AICTE's Prescribed Textbook: Programming for Problem Solving \(ISBN: 978-93-91505-219\)](#)
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Introduction to programming in c	Prof. Satyadev nandakumar	IIT KANPUR
2	Problem solving through programming in c	Prof. Anupam basu	IIT KHARAGPUR

COURSE OUTCOMES:

The student will learn following through lectures:

- CO1.** To formulate simple algorithms for arithmetic and logical problems.
- CO2.** To translate the algorithms to programs (in C language).
- CO3.** To test and execute the programs and correct syntax and logical errors.
- CO4.** To implement conditional branching, iteration and recursion.
- CO5.** To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- CO6.** To use arrays, pointers and structures to formulate algorithms and programs.
- CO7.** To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- CO8.** To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	To formulate simple algorithms for arithmetic and logical problems.	K ₁
CO2	To translate the algorithms to programs (in C language).	K ₂
CO3	To test and execute the programs and correct syntax and logical errors.	K ₃
CO4	To implement conditional branching, iteration and recursion.	K ₄
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.	K ₁
CO6	To use arrays, pointers and structures to formulate algorithms	K ₃

	and programs.	
CO7	To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.	K ₃
CO8	To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3	1			2									1	
CO4					2					2				
CO5											2			
CO6	3													
CO7	1		2				1							
CO8														
CO(Average)	2	1	2	2	2		1		1				1	

3 –High; 2 –Medium; 1 –Low

UNIVERSAL HUMAN VALUES

Subject Code: -	BTHSMC205	IA Marks	40
Number of Lecture Hours/ Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objectives

This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic

perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content

Module 1 – Introduction to Value Education

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session -Sharing about Oneself

Lecture 3: Self-exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session-Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfil the Basic Human Aspirations

Tutorial 3: Practice Session -Exploring Natural Acceptance

Module 2 – Harmony in the Human Being

Lecture 7: Understanding Human being as the Co-existence of the Self and the Body

Lecture 8: Distinguishing between the Needs of the Self and the Body

Tutorial 4: Practice Session -Exploring the difference of Needs of Self and Body

Lecture 9: The Body as an Instrument of the Self

Lecture 10: Understanding Harmony in the Self

Tutorial 5: Practice Session -Exploring Sources of Imagination in the Self

Lecture 11: Harmony of the Self with the Body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session -Exploring Harmony of Self with the Body

Module 3 – Harmony in the Family and Society

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction

Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session -Exploring the Feeling of Trust

Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session- Exploring the Feeling of Respect Lecture 16: Other Feelings,

Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session -Exploring Systems to fulfil Human Goal

Module 4 – Harmony in the Nature/Existence

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

Tutorial 10: Practice Session -Exploring the Four Orders of Nature

Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session -Exploring Co-existence in Existence

Module 5 – Implications of the Holistic Understanding – a Look at Professional Ethics

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order.

The Textbook

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-
3. Professional Ethics and Human Values, Premvir Kapoor, ISBN: 978-93-86173-652, Khanna Book Publishing Company, New Delhi, 2022.

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

COURSE OUTCOME:

- CO1. Understand the role of values in achieving happiness and prosperity through right understanding and relationships.
- CO2. Analyze harmony in self, family, society, and nature for ethical and responsible living.
- CO3. Apply human values and ethics in professional and personal life for a value-based society.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Understand the role of values in achieving happiness and prosperity through right understanding and relationships.	K ₁
CO2	Analyze harmony in self, family, society, and nature for ethical and responsible living.	K ₄
CO3	Apply human values and ethics in professional and personal life for a value-based society.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	3				2			2				1	1
CO2	1			2							1			
CO3	1	2												
CO(Average)	1.3	2.5		2		2			2		1		1	1

3 –High; 2 –Medium; 1 –Low

ENGINEERING CHEMISTRY LAB

Subject Code: -	BTBSC202P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

LABORATORY

1. Determination of surface tension and viscosity.
2. Thin layer chromatography.
3. Ion exchange column for removal of hardness of water.
4. Determination of chloride content of water.
5. Determination of the rate constant of a reaction.
6. Determination of cell constant and conductance of solutions.
7. Potentiometry - determination of redox potentials and EMFs.
8. Synthesis of a polymer/drug.
9. Saponification/acid value of an oil.
10. Chemical analysis of a salt.
11. Adsorption of acetic acid by charcoal.
12. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Text/Reference Books:

1. AICTE's Prescribed Textbook: Chemistry – I with Lab Manual (ISBN: 978-93-91505-141)
2. Engineering Chemistry, by Manisha Agrawal.
3. University chemistry, by B. H. Mahan.
4. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
6. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
7. Physical Chemistry, by P. W. Atkins.

8. A Textbook of Engineering Chemistry, Shashi Chawla.
9. Organic Chemistry: Structure and Function by K. P. C. Vollhardt and N. E. Schore, 5th Edition <http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

Laboratory Outcomes: The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn:

- CO1. To estimate rate constants of reactions from concentration of reactants/products as a function of time.
- CO2. To measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
- CO3. To synthesize a small drug molecule and analyze a salt sample.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	To estimate rate constants of reactions from concentration of reactants/products as a function of time.	K ₁
CO2	To measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.	K ₂
CO3	To synthesize a small drug molecule and analyze a salt sample.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1										1		1	
CO2		2			1									
CO3			2				1				1			1
CO(Average)	1	2	2		1		1				1		1	1

3 –High; 2 –Medium; 1 –Low

ENGLISH FOR TECHNICAL WRITING LAB

Subject Code: -	BTHSMC202P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Course Objectives

1. To improve fluency in spoken English and to practice correct pronunciation.
2. To introduce the techniques of presentation skills
3. Help improve speaking skills through participation in activities such as role plays, discussions, and structured talks/ oral presentations

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Module- I

The sounds of English

Practicing correct Pronunciation through IPA, Stress, Intonation, Rhythm

Module –II

Group Discussions

Purpose, Different roles for participants, Etiquette in a structured GD - Practice GDs

Module –III

Interpersonal Skills

1. Introduction of self and others, making announcements
2. Getting Someone's Attention, and Interrupting Conversations
3. Making Requests and Responding to them, asking for directions

Module –IV

Listening Skills Listening to unknown passages – for global understanding, identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Module –V

Presentation skills

1. Oral Presentations (JAMs)
2. Describing and analysing videos and pictures.
3. Interpreting and analysing data from graphs and charts

Course Outcomes

By the end of the course, the student will be able to:

- CO1. Speak English with proper pronunciation and intonation
 CO2. Make effective oral presentations by interpreting and analysing data, pictures and videos and participate in Group Discussion on general topics
 CO3. Make meaningful conversations and follow logical flow of thought; answer questions on key concepts after listening to extended passages.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Speak English with proper pronunciation and intonation	K ₁
CO2	Make effective oral presentations by interpreting and analysing data, pictures and videos and participate in Group Discussion on general topics	K ₂
CO3	Make meaningful conversations and follow logical flow of thought; answer questions on key concepts after listening to extended passages.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1													
CO2		2		1			2		2				1	
CO3			2											1
CO(Average)	1	2	2	1			2		2				1	1

3 –High; 2 –Medium; 1 –Low

PROGRAMMING FOR PROBLEM SOLVING LAB

Subject Code: -	BTESC204P	IA Marks	30
Number of Lab Hours/Week: -	04	Term End Exam Marks	20
Total Number of Lecture Hours: -	30	CREDITS	02

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of C programming language.
4. To learn the usage of structured programming approach in solving problems.
5. To understated and formulate algorithm for programming script
6. To analyze the output based on the given input variables

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

PRACTICALS:

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems e.g., sum of series
5. 1D Array manipulation
6. Matrix problems, String operations
7. Simple functions
8. Programming for solving Numerical methods problems
9. Recursive functions
10. Pointers and structures
11. File operations

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Simple computational problems using arithmetic expressions.	http://ps-iiith.vlabs.ac.in/exp7/Introduction.html?domain=Computer%20Science&lab=Problem%20Solving%20Lab
2	Iterative problems e.g., sum of series.	http://ps-iiith.vlabs.ac.in/exp4/Introduction.html?domain=Computer%20Science&lab=Problem%20Solving%20Lab
3	1D Array manipulation.	http://cse02-iiith.vlabs.ac.in/exp4/index.html
4	Matrix problems, String operations.	http://ps-iiith.vlabs.ac.in/exp5/Introduction.html?domain=Computer%20Science&lab=Problem%20Solving%20Lab
5	Simple functions.	http://cse02-iiith.vlabs.ac.in/exp2/index.html
6	Programming for solving Numerical methods problems.	http://ps-iiith.vlabs.ac.in/exp1/Introduction.html?domain=Computer%20Science&lab=Problem%20Solving%20Lab
7	Recursive functions.	http://ps-iiith.vlabs.ac.in/exp6/Introduction.html?domain=Computer%20Science&lab=Problem%20Solving%20Lab

Course Outcomes

The student will learn following through Practicals:

1. To formulate the algorithms for simple problems.
2. To translate given algorithms to a working and correct program.
3. To be able to correct syntax errors as reported by the compilers.
4. To be able to identify and correct logical errors encountered at run time.
5. To be able to write iterative as well as recursive programs.
6. To be able to represent data in arrays, strings and structures and manipulate them through a program.
7. To be able to declare pointers of different types and use them in defining self-referential structures.

8. To be able to create, read and write to and from simple text files.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	To formulate the algorithms for simple problems.	K ₁
CO2	To translate given algorithms to a working and correct program.	K ₂
CO3	To be able to correct syntax errors as reported by the compilers.	K ₃
CO4	To be able to identify and correct logical errors encountered at run time.	K ₁
CO5	To be able to write iterative as well as recursive programs.	K ₁
CO6	To be able to represent data in arrays, strings and structures and manipulate them through a program.	K ₂
CO7	To be able to declare pointers of different types and use them in defining self-referential structures.	K ₂
CO8	To be able to create, read and write to and from simple text files.	K ₆

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	3				2			2				1	1
CO2	3			2							1			
CO3		2						1						
CO4	1											1		
CO5				3										
CO6	3							3					3	
CO7					1									
CO8														
CO(Average)	2.3	2.5		2.5	1	2		2	2		1	1	2	1

3 –High; 2 –Medium; 1 –Low

WORKSHOP/MANUFACTURING PRACTICES LAB

Subject Code: -	BTESC206P	IA Marks	30
Number of Lab Hours/Week: -	04	Term End Exam Marks	20
Total Number of Lecture Hours: -	30	CREDITS	02

Course Objective:

1. To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
2. To have a study and hands-on-exercise on plumbing and carpentry components.
3. To have a practice on gas welding, foundry operations and fitting
4. To have a study on measurement of electrical quantities, energy and resistance to earth.
5. To have a practice on soldering.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:

Module I: Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.

Module II: CNC machining, Additive manufacturing.

Module III: Fitting operations & power tools.

Module IV: Electrical & Electronics.

Module V: Carpentry.

Module VI: Plastic moulding, glass cutting.

Module VII: Metal casting.

Module VIII: Welding (arc welding & gas welding), brazing.

Practicals:

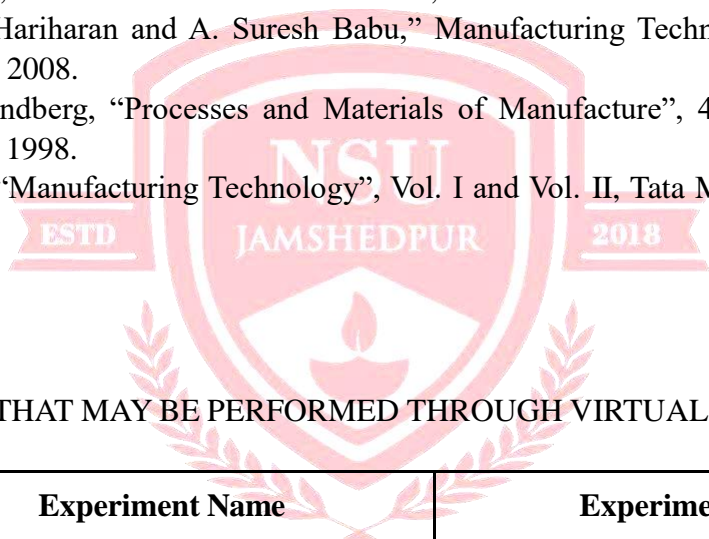
1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical & Electronics

5. Welding shop (Arc welding + Gas welding)
6. Casting
7. Smithy
8. Plastic moulding & Glass Cutting

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Suggested Text/Reference Books:

1. [AICTE's Prescribed Textbook: Workshop / Manufacturing Practices \(with Lab Manual\) ISBN: 978-93-91505-332](#)
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
4. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
5. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
6. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.



EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Welding shop (Arc welding + Gas welding).	http://mm-coep.vlabs.ac.in/LaserSpotWelding/Theory.html?domain=Mechanical%20Engineering&lab=Welcome%20to%20Micromachining%20laboratory
2	Casting	http://fab-coep.vlabs.ac.in/exp7/Theory.html?domain=Mechanical%20Engineering&lab=Welcome%20to%20FAB%20laboratory

Laboratory Outcomes:

Upon completion of this laboratory course, students will be able:

1. To fabricate components with their own hands.
2. To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. To design small devices of their interest by assembling different components.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	To fabricate components with their own hands.	K ₁
CO2	To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	K ₂
CO3	To design small devices of their interest by assembling different components.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	3				2			2				1	1
CO2	1			2							1			
CO3	1	2												
CO(Average)	1.3	2.5		2		2			2		1		1	1

3 –High; 2 –Medium; 1 –Low

SEMESTER III



PHYSICS-2 (OPTICS & WAVES)

Subject Code: -	BTBSC303	IA Marks	40
Number of Lecture Hours/Week:-	04	Term End Exam Marks	60
Total Number of Lecture Hours: -	60	CREDITS	04

Course Objective: To provide students with a foundational understanding of wave phenomena, including their properties, behaviour, and applications, particularly in relation to light.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:

Module I: Simple harmonic motion, damped and forced simple harmonic oscillator Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator, power absorbed by oscillator.

Module II: Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their Eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity.

Module III: The propagation of light and geometric optics Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them, transfer formula and the matrix method.

Module IV: Wave optics Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment,

Newton's rings, Michelson interferometer, Mach-Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Module V: Lasers Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO₂), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: monochromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Laboratory - Oscillations, waves and optics

Suggested list of experiments from the following:

Diffraction and interference experiments (from ordinary light or laser pointers); measurement of speed of light on a table top using modulation; minimum deviation from a prism.

TEXTBOOKS/REFERENCES:

1. AICTE's Prescribed Textbook: Physics (Oscillations, Waves & Optics) with Lab Manual ISBN: 978-93-91505-13-4
2. Bhattacharya & Nag, Engineering Physics
3. Ian G. Main, Oscillations and waves in physics
4. H.J. Pain, The physics of vibrations and waves
5. E. Hecht, Optics
6. A. Ghatak, Optics
7. O. Svelto, Principles of Lasers

COURSE OUTCOMES : A Physics course in Waves and Optics aims to provide students with a comprehensive understanding of wave phenomena and their applications in various fields. Students will learn to analyze wave behavior, apply mathematical tools to solve problems, and develop experimental skills in related areas.

The students will learn:

- CO 1.** Students should be able to define and describe different types of waves (e.g., longitudinal, transverse) and understand their fundamental properties (wavelength, frequency, speed).
- CO 2.** Students should comprehend how waves interact with matter, including concepts like reflection, refraction, diffraction, and interference.
- CO 3.** Analyze the operation of lenses and prisms based on the principles of ray and wave optics.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Students should be able to define and describe different types of waves (e.g., longitudinal, transverse) and understand their fundamental properties (wavelength, frequency, speed).	K ₁
CO2	Students should comprehend how waves interact with matter, including concepts like reflection, refraction, diffraction, and interference	K ₂
CO3	Analyze the operation of lenses and prisms based on the principles of ray and wave optics.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO(Average)	3	1	2	3			1		1				1	

3 –High; 2 –Medium; 1 –Low

MATHEMATICS-3 (PDE, PROB/STAT)

Subject Code: -	BTBSC302	IA Marks	40
Number of Lecture Hours/Week:-	04	Term End Exam Marks	60
Total Number of Lecture Hours: -	60	CREDITS	04

Course Objectives: To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering. To provide an overview of probability and statistics to engineers.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes

Textbooks/References:

1. AICTE Prescribed Textbook: Mathematics – II (Probability and Statistics), ISBN: 978-93-91505 41-7
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.

4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010. 81 AICTE revised Model Curriculum for UG Degree Course in Mechanical Engineering
6. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint)
7. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

COURSE OUTCOME:

Students will be able to solve PDEs, apply probability distributions, and analyze statistical data.

The students will learn:

- CO 1.** Understand basic concepts of PDE, probability, and statistics
- CO 2.** Apply intermediate techniques in PDE, probability distributions, correlation, and regression.
- CO 3.** Apply advanced statistical methods and solve real-world problems using PDE.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Understand basic concepts of PDE, probability, and statistics	K ₁
CO2	Apply intermediate techniques in PDE, probability distributions, correlation, and regression	K ₂
CO3	Apply advanced statistical methods and solve real-world problems using PDE.	K ₃

KL- Bloom’s Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO(Average)	3	1	2	3			1		1				1	

3 –High; 2 –Medium; 1 –Low

ENVIRONMENT SCIENCE (AUDIT)

Subject Code: -	BTBSC304	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	60	CREDITS	02

Course Objectives: Develop a comprehensive understanding of environmental issues: This includes learning about pollution, resource management, and the impact of human activities on the environment.

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:**MODULE – I**

Natural Resources: A)Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people. Water resources - Use and over utilization of surface and ground water –Floods, drought, conflicts over water, dams - benefits and problems. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. B)Energy resources: Renewable and non-renewable resources-Natural resources and associated problems Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Mineral resources: Use and exploitation problems, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Organic Farming, Bio fertilizers and Bio-pesticides

MODULE – II

Ecosystems: Definition, Scope and importance, Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem -Ecological succession. - Food chains, food webs and ecological pyramids, Flow of energy, Bio-geochemical cycles, Bio-magnification, Ecosystem values, Services and

carrying capacity. B) Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India, India as a mega-diversity nation, Hot-spots of biodiversity, Value of biodiversity, consumptive use, productive use, social, ethical, aesthetic, option values and ecosystem service values. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

MODULE – III

Environmental Pollution: Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards B)Solid waste Management:. - classification and characters of solid waste, factors affecting waste generation, collection and disposal of solid waste. E- waste and management. Role of an individual in prevention of pollution. – Pollution case studies.

MODULE – IV

Global Environmental problems and Global efforts: Green house effect, Green house gasses, Global warming, Climate change and their impacts on human environment, ozone layer depletion. International conventions / protocols: Earth summit, Kyoto protocol & Montreal protocol. Towards Sustainable Future: From Unsustainable to Sustainable development, Population and its explosion, Urban problems related to energy, Consumerism and waste products, Role of IT in Environment and human health. Value Education. HIV/AIDS, Environmental ethics ,Concept of green buildings and Clean Development Mechanism.

MODULE - V

Environmental Impact Assessment & Management plans, Environmental Law: Definition of impact, Classification of impacts, Impacts of different components such as: human health, resources, air, water, flora & fauna. Environment management plans (EMP): Technological solutions for pollution.

Text Books/ Reference Books:

1. Text of Environmnet studies by Anubha Kaushik, New age publishers, 4th Edition.
2. Erach Bharucha, 2010 “Text Book of Environmental Studies”, University Grants Commission, Universities Press (India) Pvt.Ltd., Hyderabad
3. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
4. Text Book of Environmental Science and Engineering by G.Tyler Miller Jr,2006 Cengage learning
5. Text Book of Environmental Sciences and Technology by M. Anji Reddy, BS Publications.

e-Learning Resources:

1. <http://nptel.ac.in/courses.php>
2. <http://jntuk-coeerd.in/>

COURSE OUTCOME:

Students will be able to solve PDEs, apply probability distributions, and analyze statistical data.

The students will learn:

- CO 1.** Comprehending the structure and function of ecosystems, including biogeochemical cycles and their role in maintaining environmental balance.
- CO 2.** Identifying and analyzing various environmental problems like air, water, and soil pollution, solid waste management, and their causes and impacts.
- CO 3.** Understanding the ways human activities affect the environment, including population growth, resource consumption, and pollution.
- CO 4.** Developing skills in monitoring and assessing pollution levels, identifying pollution sources, and implementing control measures.
- CO 5.** Applying environmental management techniques for various resources like water, air, and land, and for waste management.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Comprehending the structure and function of ecosystems, including biogeochemical cycles and their role in maintaining environmental balance.	K ₁
CO2	Identifying and analyzing various environmental problems like air, water, and soil pollution, solid waste management, and their causes and impacts.	K ₂
CO3	Understanding the ways human activities affect the environment, including population growth, resource consumption, and pollution.	K ₃
CO4	Developing skills in monitoring and assessing pollution levels, identifying pollution sources, and implementing control measures.	K ₂
CO5	Applying environmental management techniques for various resources like water, air, and land, and for waste management.	K ₂

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1									1				
CO2		2			1									
CO3			2				1				1			
CO4								2				1		
CO5				1									1	
CO(Average)	1	2	2	1	1		1	2			1	1	1	

3 –High; 2 –Medium; 1 –Low

BASIC ELECTRONICS ENGINEERING

Subject Code: -	BTESC301	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	60	CREDITS	04

Course Objectives: Provide students with a foundational understanding of electronic devices, circuits, and systems. They typically cover topics like Ohm's Law, Kirchhoff's laws, diodes, transistors, amplifiers, and basic digital logic, enabling students to analyze and design simple circuits.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:

Module I: Semiconductor Devices and Applications Introduction to P-N Junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

Module II: Operational amplifier and its applications Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

Module III: Timing Circuits and Oscillators RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

Module IV: Digital Electronics Fundamentals Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Module V: Electronic Communication Systems The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Text /Reference Books:

1. Floyd, Electronic Devices| Pearson Education 9th edition, 2012.
2. R.P. Jain, —Modern Digital Electronics|, Tata Mc Graw Hill, 3rd Edition, 2007.
3. A.K. Maini & Nakul Maini - All-in-One Electronics Simplified, Khanna Book Publishing, 2021.
4. Frenzel, —Communication Electronics: Principles and Applications|, Tata Mc Graw Hill, 3rd Edition, 2001
5. Mittel, Basic Electrical Engineering, Tata McGraw Hill.

Course Outcomes:

The students will learn:

- CO 1.** Understand the principles of semiconductor devices and their applications.
- CO 2.** Design an application using Operational amplifier.
- CO 3.** Understand the working of timing circuits and oscillators.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Understand the principles of semiconductor devices and their applications	K ₁
CO2	Design an application using Operational amplifier.	K ₂
CO3	Understand the working of timing circuits and oscillators.	K ₃

KL- Bloom’s Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO(Average)	3	1	2	3			1		1				1	

3 –High; 2 –Medium; 1 –Low

NETWORK ANALYSIS

Subject Code: -	BTESC302	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course Objectives:

Mathematics fundamental necessary to formulate, solve and analyse engineering problems.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including Medical leaves.	

Module-I

Overview of network analysis techniques (nodal analysis, mesh analysis). Network theorems.

Module-II

Transient and steady-state sinusoidal response. Network graphs and their applications in network analysis.

Module–III

Two-port networks, Examples of Two-Port networks. Z, Y, h, g, and transmission matrices. Combining two ports in various configurations.

Module– IV

Analysis of transmission lines to motivate the scattering matrix. Scattering matrix and its applications in network analysis.

Module– V

Network functions, positive real functions, and network synthesis.

Text /Reference Books:

1. M. E. Van Valkenburg, Network Analysis. Prentice-Hall of India.
2. Kuo, Franklin. Network analysis and synthesis. John Wiley & Sons, 2006.

Course outcomes:

Attending of the course, the students will learn

CO1: Apply mesh/nodal analysis and theorems to solve circuits.

CO2: Apply graph theory principles to analyze circuits.

CO3: Evaluate network transients.

CO4: Analyze resonance and frequency response.

CO5: Model and analyze two-port networks

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Analyze Electrical Circuits: Apply basic laws (KVL, KCL, Ohm's Law) and network theorems (Superposition, Thevenin's, Norton's) to solve DC and AC circuits	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅
CO2	Analyze Transient Behavior: Determine the response of RL, RC, and RLC circuits under transient conditions (first and second-order circuits) using differential equations or Laplace transforms	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅
CO3	Evaluate Frequency Response: Analyze series and parallel resonance, compute Q-factors, bandwidth, and understand the frequency response of networks	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅
CO4	Understand Network Topology: Analyze complex networks using graph theory concepts such as trees, links, tieset, and cutset matrices	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅
CO5	Analyze Two-Port Networks: Determine parameters (Z, Y, H, ABCD) and characterize two-port networks	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix:(Mapping of Cos with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1									1				
CO2		2			1									
CO3			2				1				1			
CO4							2					1		
CO5				1									1	
CO(Average)	1	2	2	1	1		1	2			1	1	1	

3 –High; 2 –Medium; 1 –Low

MATERIAL SCIENCE

Subject Code: -	BTESC303	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course Objective:

At the end of the course, the students will be able to:

- To gain knowledge in applications properties strengthening mechanisms in structural steels and super alloys and stainless steels
- To develop a fundamental understanding of various electrical and electronic materials
- To be able to understand and importance of bio materials.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including Medical leaves.	

Module-I

Conductivity of Metal: Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, emission of electrons from metals, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects. **Hours-10**

Module-II

Dielectric Properties: Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, significance of the loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, Ferro electricity, piezoelectricity. **Hours-10**

Module-III

Magnetic properties of Materials: Introduction, Classification of magnetic materials, diamagnetism, Para magnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance. **Hours-5**

Module-IV

Semiconductors: energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials. **Hours-5**

Module-V

Insulators-properties – visual – electrical – mechanical- thermal - chemical properties - Classification based on operating temperature as per IS. Properties and application of fibrous material-impregnated fibrous-bitumen-wax-insulating liquid-enamel-varnish-ceramics-mica-asbestos-glass-rubber-synthetic resin-thermoplastics resin-Polyethylene-Teflon-PVC-Gas Insulating materials- air-Nitrogen-SF₆ - Dielectric materials - Polarization-applications-capacitors. **Hours-10**

Module-VI

Ceramics: properties, application to conductors, insulators & capacitors Plastics: Thermoplastics, rubber, thermostats, properties. Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, and sintered alloys for breaker and switch contacts. **Hours-10**

Textbooks/References:

1. C.S.Indulkar and S. Thiruvengadam, S., “An Introduction to Electrical Engineering
2. Kenneth G. Budinski, “Engineering Materials: Prentice Hall of India, New Delhi
3. Superalloys-II edited by C.T. SIMS, N.S. Stoloff and W.C. Hagel A Wiley-Inter science publication John Wiley and sons, New York, 1972.

Course outcomes:

Attending of the course, the students will learn

CO1: To select and design components based on their properties and requirements.

CO2: Awareness about the electrical and electronic materials

CO3: Knowledge about bio materials like, titanium and stainless steel based.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Describe Electrical Properties: Analyze conductivity, resistivity, and classification (conductors, semiconductors, insulators) based on atomic structure and energy bands	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅
CO2	Identify Material Types & Applications: Differentiate between low/high resistivity materials (e.g., copper vs. nichrome) and select appropriate materials for specific electrical engineering applications	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅
CO3	Evaluate Magnetic and Dielectric Materials: Analyze magnetic properties (ferromagnetism, hysteresis) and dielectric materials for capacitance, polarization, and insulation strength	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix :(Mapping of Cos with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1									1				
CO2		2			1									
CO3			2	1			1	2			1	1	1	
CO(Average)	1	2	2	1	1		1	2			1	1	1	

3 –High; 2 –Medium; 1 –Low

BASIC ELECTRONICS ENGINEERING LAB

Subject Code: -	BTESC301P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

LABORATORY

1. Study of CRO & Measurement of Voltage Amplitude & Frequency
2. Study of Zener Diode Characteristics
3. Characteristics of BJT in Common Emitter Configuration
4. Characteristics of JFET in Common source Configuration
5. Study of Half Wave and Full Wave Rectifier without Filter
6. Study of Common Emitter BJT Amplifier.
7. To study the operation of Hartley & Colpitts oscillator circuits and to determine their frequency of oscillations.

Laboratory Outcomes:

Develop practical skills in analyzing and building electronic circuits, including diodes, transistors, and amplifiers. They learn to verify circuit characteristics, implement designs, and understand the underlying principles of electronics.

- CO 1.** Diode and Transistor Characteristics: Students learn to understand the V-I characteristics of diodes (forward and reverse bias), Zener diodes, and transistors (CB, CE, CC configurations).
- CO 2.** Students apply these characteristics to analyze the performance of basic circuits containing diodes and transistors, including rectifiers, amplifiers, and biasing circuits
- CO 3.** Students design and implement half-wave and full-wave rectifier circuits with and without filters, learning how to convert AC to DC voltage.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Diode and Transistor Characteristics: Students learn to understand the V-I characteristics of diodes (forward and reverse bias), Zener diodes, and transistors (CB, CE, CC configurations).	K ₁
CO2	Students apply these characteristics to analyze the performance of basic circuits containing diodes and transistors, including rectifiers, amplifiers, and biasing circuits	K ₂
CO3	Students design and implement half-wave and full-wave rectifier circuits with and without filters, learning how to convert AC to DC voltage.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1										1		1	
CO2		2			1									
CO3			2				1				1			1
CO(Average)	1	2	2		1		1				1		1	1

3 –High; 2 –Medium; 1 –Low

NETWORK ANALYSIS LAB

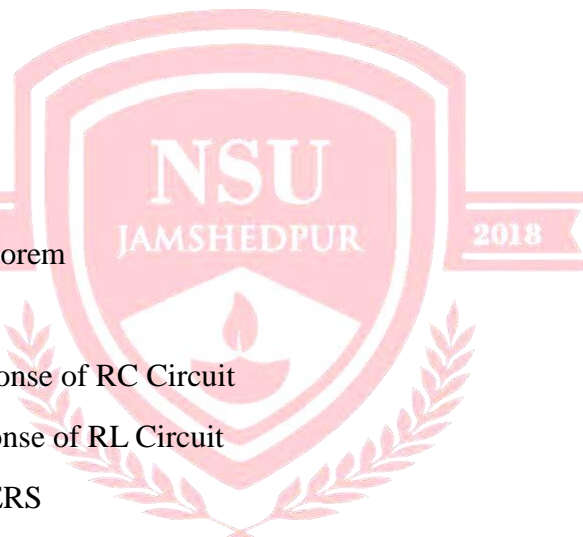
Subject Code: -	BTEE401P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

LABORATORY

1. Verify Thevenin Theorem
2. Verify Norton Theorem
3. Verify Superposition Theorem
4. Study of Z parameters
5. Study of Transient Response of RC Circuit
6. Study of Transient Response of RL Circuit
7. Study of ACTIVE FILTERS

**Laboratory Outcomes:**

Develop practical skills in analyzing and testing circuits, including resistor, inductor and capacitor. They learn to verify circuit characteristics, and principles of network theory.

CO 1. Analyze Linear Electrical Networks Apply fundamental circuit laws (Ohm's Law, Kirchhoff's Voltage and Current Laws) and network theorems (Thevenin, Norton, Superposition, Maximum Power Transfer) to solve for voltage, current, and power in DC and AC circuits.

CO 2. Evaluate Transient and Steady-State Responses Model and solve first-order and second-order RC, RL, and RLC circuits to determine transient behaviour (natural and step responses) and steady-state AC response using phasor and Laplace transform

CO 3. Determine Network Parameters and Functions Compute two-port network parameters (z , y , h , ABCD) and derive network functions (transfer functions, impedance, admittance) to characterize the input-output behaviour of interconnected electrical systems.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Apply fundamental circuit laws (Ohm's Law, Kirchhoff's Voltage and Current Laws) and network theorems (Thevenin, Norton, Superposition, Maximum Power Transfer) to solve for voltage, current, and power in DC and AC circuits.	K ₁
CO2	Model and solve first-order and second-order RC, RL, and RLC circuits to determine transient behaviour (natural and step responses) and steady-state AC response using phasor and Laplace transform	K ₂
CO3	Compute two-port network parameters (z, y, h, ABCD) and derive network functions (transfer functions, impedance, admittance) to characterize the input-output behaviour of interconnected electrical systems.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1										1		1	
CO2		2			1									
CO3			2				1				1			1
CO(Average)	1	2	2		1		1				1		1	1

3 –High; 2 –Medium; 1 –Low

SEMESTER-IV



ANALOG ELECTRONICS

Subject Code:	BTEEE401	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	04

Course Objectives:

- To understand the concepts of analog and digital circuits.
- To impart knowledge on signal generation and measuring equipment.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all Types of leaves including Medical leaves.	

Course Contents:**MODULE I - ANALOG DEVICE 9 Hours**

Review of analog devices – Rectifier circuits - Wave shaping circuits - Clippers and Clampers – Regulators - Zener and op-amp based regulator circuits - Introduction to switched mode power supplies.

MODULE II – BIASING CIRCUIT AND MODELING 9 Hours

Different biasing circuit of BJT and FETs. R_e model and hybrid model of BJT amplifiers

MODULE III - OSCILLATORS & SIGNAL GENERATOR CIRCUITS 9 Hours

Function generator circuit - Pulse generator circuit - AM/FM signal generator circuit – Qualitative analysis.

MODULE IV - DISPLAY UNIT and OPAMPS 9 Hours

Display Units - optoelectronic devices – Seven-segment displays - LCD and LED display units and applications. Basics of Opamps

MODULE V - SPECIAL ELECTRONIC CIRCUIT**9 Hours**

UJT Saw tooth generator circuit – Schmitt trigger – Analog-to-digital converter – Digital-to-analog converter circuits using Opamps

TEXT/REFERENCE BOOKS:

1. David A Bell, 'Fundamentals of Electronic Devices and Circuits', Oxford University Press, Incorporated, 25- Jun-2009.
2. Bouwens A. J., 'Digital Instrumentation', Tata McGraw Hill Publications, 16th Reprint (2008).
3. R.L.Boylested -Electronic Devices and Circuits, PHI 2007

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Analog Electronics	Prof. S. R. M. Prasanna	IIT Madras
2	Analog Circuits	Prof. G. K. Bansal	IIT Roorkee

COURSE OUTCOMES:

- CO1.** Design cascade amplifiers and sweep circuits
CO2. Design the transistor Amplifiers using its small signal model.
CO3. Evaluate the performance analysis of large signal amplifier.
CO4. Design the feedback amplifiers and analyze frequency response.
CO5. Design oscillators for different types of signal generation

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Design cascade amplifiers and sweep circuits	K ₁
CO2	Design the transistor Amplifiers using its small signal model.	K ₂
CO3	Evaluate the performance analysis of large signal amplifier.	K ₃
CO4	Design the feedback amplifiers and analyze frequency response	K ₄
CO5	Design oscillators for different types of signal generation	K ₁

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix: (Mapping of Cos with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3	1			2									1	
CO4					2					2				
CO5											2			
CO(Average)	2	1	2	2	2		1		1				1	

3–High;2–Medium;1–Low

ELECTRICAL MACHINES - I

Subject Code: -	BTEEE402	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course Objectives:

This course aims to teach the fundamental principles and analytical tools for evaluating electrical machines. Students will learn to model transformers and DC motors, compute performance parameters like regulation and efficiency, perform essential tests (OC/SC, Sumpner), and implement speed control and braking methods for DC machines.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Module-I

General introduction to electrical machines: Magnetic circuits, Concepts of reluctance and permeance, Faraday's law of electromagnetic induction, Lenz's Law and Fleming's rules. Principle of operation of generators and motors. Magnetic curves and their relevance.

Module–II

Transformers: Constructional features; Ideal transformer and practical transformer, name plate rating, phasor diagrams, equivalent circuit and determination of its parameters from O.C and S.C tests; per unit parameter values and its importance; Regulation, efficiency and all day efficiency expressions and calculations. Sumpner Test.

Module–III

3-phase Transformer: As a single unit with name plate rating and as a bank of three single phase transformers; Vector groups for various connections; Per phase analysis; Qualitative explanation for origin of harmonic current and voltage and its suppression tertiary winding. Parallel operation conditions and load sharing. Autotransformer: Basic constructional features; VA conducted magnetically and electrically. Comparative study with two winding transformer.

Module– IV

D.C Machines: Constructional features, armature windings - simple lap and wave winding; armature voltage and torque equations. D.C generators: Classifications, performance characteristics; Losses, efficiency and power flow diagram. D.C. motors: Classifications, torque/speed characteristics of different types; Losses, efficiency and power flow diagram. Starting, speed control and braking. Testing and efficiency.

Module– V

Universal series motor: constructional features and performance characteristics.

Text /Reference Books:

1. Sen, P.C., (2007), Principles of Electric Machines and Power Electronics, 2nd Edition, Wiley
2. Fitzgerald, A.E., Kingsley, C. Jr., Umans, S.D., (2003), Electrical Machinery, 6th Edition, Tata McGraw-Hill AC Machines: Puchstein, Lloyd & Hunter
3. Electrical Machinery: P. S. Bimbhra
4. Electric Machines: I. J. Nagrath & D. P. Kothari.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Electrical M/C-1	Prof. Tapas Kumar Bhattacharya	IIT KGP
2	Electrical M/C-1	Prof. Debaprasad Kastha	IIT KGP

Course outcomes:

Attending of the course, the students will learn

CO 1. Explain the fundamental principles of electromechanical energy conversion, including magnetic circuits, Faraday's Law, Lenz's Law, and Fleming's rules, and analyze the relevance of magnetization curves in generators and motors.

- CO 2.** Analyze the performance of single-phase transformers by drawing phasor diagrams, determining equivalent circuit parameters from OC and SC tests, and calculating regulation, efficiency, and all-day efficiency.
- CO 3.** Evaluate the operation of three-phase transformers, including vector groups, harmonic suppression using tertiary windings, parallel operation conditions, load sharing, and compare autotransformers with two-winding transformers.
- CO 4.** Analyze DC machines by developing armature windings (lap and wave), deriving voltage and torque equations, and evaluating the performance characteristics, efficiency, starting, speed control, and braking of DC generators and motors.
- CO 5.** Describe the constructional features and interpret the performance characteristics of a universal series motor.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Explain magnetic circuits, Faraday's Law, Lenz's Law, Fleming's rules, and magnetization curves in electrical machines	K ₁
CO2	Analyze single-phase transformers using phasor diagrams, equivalent circuits, OC/SC tests, regulation, and efficiency calculations.	K ₂
CO3	Evaluate three-phase transformers for vector groups, harmonics, tertiary windings, parallel operation, and autotransformers.	K ₃
CO4	Analyze DC machines including armature windings, voltage/torque equations, generator/motor characteristics, starting, speed control, and braking.	K ₄
CO5	Describe the construction and performance characteristics of a universal series motor	K ₁

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix:(Mapping of Cos with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3	1			2									1	
CO4					2					2				
CO5											2			1
CO(Average)	2	1	2	2	2		1		1				1	1

3-High;2-Medium;1-Low

ELECTRICAL MEASUREMENT AND INSTRUMENTATION

Subject Code: -	BTEEE403	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course Objectives:

This course **covers** the fundamentals of electrical measurement and instrumentation, including instrument types, calibration, and error compensation. Students will **learn to** measure voltage, current, power, and energy using devices like wattmeter's, energy meters, potentiometers, and instrument transformers (CT/VT), while also **exploring** ADC techniques and digital instrumentation

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including Medical leaves.	

Module-I**5hrs**

Basics of Measurement and Instrumentation, Instrument Examples: Galvanometer, Accelerometer etc; calibration methods.

Module-II**6hrs**

Voltage and Current Measurements; Theory, calibration, application.

Module-III**10hrs**

Errors and compensation. Power and Energy Measurement and its errors, Methods of correction, LPF wattmeter, Phantom loading.

Module-IV**10hrs**

Induction type KWH meter; Calibration of wattmeter, energy meter. Potentiometer and Instrument Transformer: DC and AC potentiometer, C.T. and V.T. construction, theory, operation, characteristics.

Module-V**5hrs**

Analog-to-Digital Conversion (ADC), Staircase Ramp Compensation, Integrator-based ADC, Delta-Pulse-Modulation-based ADC. Digital Instrumentation.

Text /Reference Books:

1. E. A. Doebelin, 'Measurement Systems - Applications and Design', Tata McGraw Hill, New York, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurement and Instrumentation', Dhanpat Rai and Co (P) Ltd., 2004.
3. E. W. Golding and F. C. Widdis, 'Electrical Measurements & Measuring Instruments', A. H. Wheeler & Co, 1994.
4. A. J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Electrical Instrumentation and Measurement	Prof. Avishek Chatterjee	IIT KGP
2	Electrical Instrumentation and Measurement	Prof. Ravindra Kumar Jha	NPTEL

Course outcomes:

Attending of the course, the students will learn

- CO 1.** Explain the basics of measurement systems, instruments (galvanometer, accelerometer), and calibration methods.
- CO 2.** Analyze the theory, calibration, and application of voltage and current measurement instruments.
- CO 3.** Identify errors in power and energy measurements and apply correction methods including LPF wattmeter and phantom loading.
- CO 4.** Evaluate the operation of induction-type KWH meters, potentiometers (DC and AC), and instrument transformers (CT and VT).
- CO 5.** Describe ADC techniques (staircase ramp, integrator-based, delta-pulse-modulation) and principles of digital instrumentation

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Explain measurement basics, instruments like galvanometer and accelerometer, and calibration methods.	K ₁
CO2	Analyze voltage and current measurement instruments for theory, calibration, and application.	K ₂ , K ₃
CO3	Identify errors in power/energy measurements and apply correction techniques including LPF wattmeter and phantom loading.	K ₃
CO4	Evaluate induction KWH meters, DC/AC potentiometers, and CT/VT instrument transformers.	K ₃ , K ₄
CO5	Describe ADC techniques (staircase ramp, integrator-based, delta-pulse-modulation) and digital instrumentation principles.	K ₁

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix:(Mapping of Cos with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3				2		1		1					
CO2		1	2											
CO3	1			2									1	
CO4					2					2				
CO5					2						2		1	1
CO(Average)	2	1	2	2	2		1		1				1	1

3–High;2–Medium;1–Low

ELECTROMAGNETIC FIELD THEORY

Subject Code: -	BTEEE404	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course objective:

This course introduces vector fields and provides knowledge of electrostatics (electric potential, energy density), magnetostatics (magnetic flux density, scalar/vector potential), Faraday's law, induced emf, Maxwell's equations, and concludes with electromagnetic waves and transmission lines.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including Medical leaves.	

Module-I

Introduction: Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's

Stoke's and Helmholtz theorems. Electrostatics: Electric field vectors-electric field intensity, flux density & polarization. Electric field due to various charge configurations. The potential functions and displacement vector Gauss's law, Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field mappings and concept of field cells. **10 Hours-**

Module-II

Magneto statics: Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Magnetic scalar and vector potential, self & mutual inductance Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cells **15 Hour**

Module-III

Time Varying Fields: Faraday's law, Displacement currents and equation of continuity Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations reflections, refraction & polarization of Upstanding wave ratio. Pointing vector and power considerations **15 Hours**

Module-IV

Transmission Lines: The high-frequency circuit. LCR ladder model. The transmission Line equation. Solution for loss-less lines Wave velocity and wave impedance. Reflection and Transmission coefficients at junctions. VSWR. **05 Hours**

Textbooks/References:

1. Hayt: Engineering Electromagnetics, 7/e, (With CD), MGH
2. Matthew N. O. Sadiku: Principles of Electromagnetics, 4th ed., Oxford
3. G. S. N. Raju: Electromagnetic Field Theory and Transmission Lines, Pearson.
4. J. D. Kraus: Electromagnetic. 5th edition, MGH. 1999
5. S. Baskaran and K. Malathi: Electromagnetic Field and Waves, Scitech Pub.
6. R. S. Kshetrimayum, Electromagnetic Field Theory, Cengage Learning.
7. V.V. Sarwate: Electromagnetic Field and Waves, Willey Eastern Ltd.
8. Bhag Guru: Electromagnetic Field Theory Fundamentals, Cambridge Uni. Press

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Electromagnetic Fields	Prof. Harishankar Ramchandaran	IIT Madras
2	Electromagnetic Theory	Prof. D. K. Ghosh	IIT BOMBAY

Course Outcome:

CO1-Understand the basic mathematical concepts related to electromagnetic vector fields.

CO2- Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.

CO3 -Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.

CO4-Understand the concepts related to Faraday's law, induced emf and Maxwell's equations.

CO5-Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Understand the basic mathematical concepts related to electromagnetic vector fields	K ₁
CO2	Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density. .	K ₂ , K ₃
CO3	Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.	K ₃
CO4	Understand the concepts related to Faraday's law, induced emf and Maxwell's equations.	K ₃ , K ₄
CO5	Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.	K ₁

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix:(Mapping of Cos with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3				2		1		1					
CO2		1	2											
CO3	1			2		1							1	
CO4					2					2				
CO5					2						2		1	1
CO(Average)	2	1	2	2	2	1	1		1				1	1

3-High;2-Medium;1-Low

SIGNALS AND SYSTEMS

Subject Code: - -	BTEEE405	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course Objectives:

This course covers signal and system characterization (continuous/discrete, LTI properties), Fourier series/transform for periodic signal analysis, and Laplace/Z-transforms with pole-zero plots. Students will learn convolution, system representations (direct/cascade/parallel), and key transform properties for analyzing both continuous and discrete systems.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including Medical leaves.	

Module–I

Signals and Systems: signal characterization: discrete and continuous, energy, power, periodicity, finite duration. system characterization: linearity, time invariance, stability, causality, memory, inevitability.

Module–II

Linear Time-Invariant systems: delta functions, unit step functions, impulse response, convolution, impulse response characterization with respect to system properties such as causality.

Module–III

Fourier Series Representation: Eigen function of the LTI system, Fourier series representation of periodic signals (continuous and discrete), properties of Fourier series: linearity, time shifting, time scaling, conjugation, multiplication, convolution. Parseval's relation.

Module– IV

Fourier Transform: convergence of Fourier transform, representation of a periodic signals (continuous and discrete) with Fourier transform, representation of periodic signals (continuous and discrete) with Fourier transform, properties of Fourier transforms: linearity, differentiation in time and frequency, convolution, multiplication, time and frequency shifting, Parseval's relation.

Module– V

Laplace Transform: Notion of complex frequency, Laplace transform, region of convergence, pole-zero (s-plane) plots, properties of Laplace transforms. Unilateral Laplace transforms, Initial and Final value theorems, differential equations, system representations: direct,

cascade, parallel forms. Z-Transform: discrete system and notion of complex frequency, z-transform, region of convergence, pole-zero plots (z-plane),

Text /Reference Books:

1. Signals and Systems, Oppenheim, Alan V.; Willsky, Alan S.; Nawab, Hamid; with S. Hamid. Pearson Education (1998).
2. Digital Signal Processing, Sanjit K Mitra, Mc Graw Hill, 2008, Third Edition
3. Digital Signal Processing (Principles, Algorithms, and Applications), John G. Proakis, Dmitri G. Manolakis, Prentice Hall International Inc., 1996, Third Edition

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Signals and Systems	Dr. S.C.Dutta Roy	IIT KGP
2	Signals and Systems	Prof. Aditya K. Jagannatham	IIT Kanpur

Course outcomes:

Attending of the course, the students will learn

- CO 1.** Characterize continuous and discrete signals (energy, power, and periodicity) and systems (linearity, time invariance, stability, causality, memory).
- CO 2.** Analyze LTI systems using impulse response, convolution, and delta/unit step functions to determine system properties like causality.
- CO 3.** Represent periodic signals using Fourier series and apply its properties (linearity, time shifting/scaling, convolution, Parseval's relation).
- CO 4.** Apply Fourier transform to periodic and periodic signals and utilize its properties (differentiation, convolution, shifting, and Parseval's relation).
- CO 5.** Analyze systems using Laplace transform (ROC, pole-zero plots, initial/final value theorems) and Z-transform (ROC, pole-zero plots) with various system representations.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Characterize continuous and discrete signals (energy, power, and periodicity) and systems (linearity, time invariance, stability, causality, memory).	K ₁
CO2	Analyze LTI systems using impulse response, convolution, and delta/unit step functions to determine system properties like causality.	K ₁ , K
CO3	Represent periodic signals using Fourier series and apply its properties (linearity, time shifting/scaling, convolution, Parseval's relation)	K ₄ , K ₅

CO4	Apply Fourier transform to periodic and periodic signals and utilize its properties (differentiation, convolution, shifting, and Parseval's relation)	K ₁ ,K ₂ ,K ₃ ,K ₄ ,K ₅ ,K ₆
CO5	Analyze systems using Laplace transform (ROC, pole-zero plots, initial/final value theorems) and Z-transform (ROC, pole-zero plots) with various system representations	K ₁ ,K ₂ ,K ₃

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix :(Mapping of Cos with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3				2		1		1					
CO2		1	2											
CO3	1			2		1							1	
CO4					2					2				
CO5					2						2		1	1
CO(Average)	2	1	2	2	2	1	1		1				1	1

3-High;2-Medium;1-Low

COMMUNICATION SYSTEM

Subject Code: - -	BTEEE406	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours:-	60	CREDITS	04

Course Objectives:

To provide a rigorous foundation in the analysis of analog and digital communication systems, encompassing the statistical characterization of signals and noise (AWGN), performance evaluation of analog modulation (AM/FM) with respect to noise and threshold effects, and the design of digital transmission schemes—including baseband signaling (PCM, line codes, Nyquist criterion for ISI elimination) and passband modulations (QAM, optimal correlator receivers, BER trade-offs)—for bandwidth and power efficiency.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including Medical leaves.	

Module–I

Introduction to Communication Systems: Basic building blocks of communication systems, Review of probability and random process, Gaussian and white noise characteristics, power spectral density of noise, noise through LTI systems.

Module–II

Analog Modulation: Need for modulation, Amplitude Modulation (AM), frequency division multiplexing, spectrum of AM, Angle Modulation, spectrum of angle modulated signal, Noise in AM and FM systems, Pre-emphasis and De-emphasis, Threshold effect in angle modulation

Module–III

Pulse Modulation: Sampling theorem and time-division multiplexing, Pulse modulation techniques, generation and detection of pulse modulation

Module– IV

Digital Transmission at Baseband: Quantization, pulse code modulation, line codes, spectral characteristics of line codes, Matched filter receiver, inter-symbol interference, eye-patterns, Nyquist's criterion for ISI free transmission, equalization.

Module– V

Digital Transmission at Passband: Binary digital modulation, QAM, signal constellation, spectral characteristics of digital modulated signals, digital receiver design - correlator receiver, optimal detectors, bit error rate performance analysis over AWGN channels, power and bandwidth efficiency

Text /Reference Books:

1. Communication Systems, S. Haykin and M. Moher, Wiley Press, 2009, Fifth Edition
2. Modern Digital and Analog Communication Systems, B. P. Lathi, Z. Ding and H. M. Gupta, Oxford University Press, 2017, Fourth Edition.
3. Fundamentals of Digital Communication, U. Madhow, Cambridge University Press, 2008, First Edition.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Principal of Communication Systems-1	Prof. Aditya K. Jagannatham	IIT Kanpur
2	Principal of Communication Systems-2	Prof. Aditya K. Jagannatham	IIT Kanpur

Course outcomes:

Attending of the course, the students will learn

- CO 1.** Explain the basic building blocks of communication systems and analyze noise characteristics (Gaussian, white noise, PSD) through LTI systems.
- CO 2.** Analyze analog modulation techniques (AM and FM) including spectra, noise performance, pre-emphasis/de-emphasis, and threshold effect.
- CO 3.** Apply sampling theorem and analyze pulse modulation techniques (generation and detection) with time-division multiplexing.
- CO 4.** Evaluate digital baseband transmission including quantization, PCM, line codes, matched filter receiver, ISI, eye patterns, Nyquist criterion, and equalization.
- CO 5.** Analyze digital passband modulation (binary modulation, QAM, signal constellations) and evaluate digital receiver design, BER performance over AWGN channels, and power/bandwidth efficiency.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Explain communication system building blocks and analyze noise characteristics through LTI systems.	K ₁
CO2	Analyze AM and FM modulation techniques including spectra, noise performance, and threshold effect.	K ₁ , K ₃
CO3	Apply sampling theorem and analyze pulse modulation techniques with time-division multiplexing.	K ₄ , K ₅
CO4	Evaluate digital baseband transmission including PCM, line codes, matched filter, ISI, eye patterns, and equalization.	K ₁ , K ₂ , K ₃ , K ₄ , K ₅
CO5	Analyze digital passband modulation, receiver design, BER performance, and power/bandwidth efficiency over AWGN channels.	K ₁ , K ₂ , K ₃ , K ₆

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix:(Mapping of Cos with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3				2		1		1					
CO2		1	2											
CO3	1	1		2		1							1	
CO4					2					2				
CO5			2		2						2		1	1
CO(Average)	2	1	2	2	2	1	1		1				1	1

3–High;2–Medium;1–Low

ELECTRICAL MACHINE-I LAB

Subject Code: -	BTEEE402P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

LABORATORY

1. Study Speed Control of DC Shunt Machine
2. Study Speed Control of DC Compound Machine
3. Study OPEN circuit test of transformer
4. Study SHORT circuit test of transformer
5. Study SHORT circuit test of transformer
6. Study of POLARITY circuit test of transformer

7. To study the operation three phase transformer under loading condition

Laboratory Outcomes:

Develop practical skills in analyzing and building electrical circuits, using machines. They learn to verify machine characteristics, implement designs, and understand the underlying principles of electrical machines.

CO 1. Demonstrate speed control techniques of DC shunt and compound machines using different methods.

CO 2. Perform OC, SC, and polarity tests on single-phase transformers to determine equivalent circuit parameters and polarity.

CO 3. Analyze the operation of a three-phase transformer under various loading conditions.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Demonstrate speed control techniques of DC shunt and compound machines using different methods.	K ₁
CO2	Perform OC, SC, and polarity tests on single-phase transformers to determine equivalent circuit parameters and polarity.	K ₂
CO3	Analyze the operation of a three-phase transformer under various loading conditions.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1		1								1		1	
CO2		2			1									
CO3			2				1				1			1
CO(Average)	1	2	1.5		1		1				1		1	1

3 –High; 2 –Medium; 1 –Low

**ELECTRICAL MEASUREMENTS
AND
INSTRUMENTATION LAB**

Subject Code: -	BTEEE403P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

LABORATORY

1. Familiarization of lab instruments (Oscilloscope, Function Generator, DMM, DC Power Supply)
2. Energy measurement using watt-hour meter for household wiring
3. Measurement of low resistance using Kelvin's double bridge
4. Design of temperature transmitter using RTD
5. Characteristics of LVDT (Linear Variable Differential Transformer)

Laboratory Outcomes:

Develop practical skills in analyzing and measure electrical quantities, using instruments. They learn to verify instrument characteristics, implement designs, and understand the underlying principles of electrical instruments.

- CO 1.** Demonstrate proficiency in using basic lab instruments (oscilloscope, function generator, DMM, DC power supply) and measure energy consumption using a watt-hour meter.
- CO 2.** Measure low resistance accurately using Kelvin's double bridge.
- CO 3.** Design a temperature transmitter using RTD and analyze the characteristics of an LVDT.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Demonstrate proficiency in using basic lab instruments (oscilloscope, function generator, DMM, DC power supply) and measure energy consumption using a watt-hour meter.	K ₁
CO2	Measure low resistance accurately using Kelvin's double bridge.	K ₂
CO3	Design a temperature transmitter using RTD and analyze the characteristics of an LVDT.	K ₃ , K ₄ , K ₅ , K ₆

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1		1								1		1	
CO2		2			1									
CO3			2				1				1			1
CO(Avg)	1	2	1.5		1		1				1		1	1

3 –High; 2 –Medium; 1 –Low

SEMESTER V



DIGITAL ELECTRONICS

Subject Code: -	BTECE501	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	04

Course Objectives:

- To understand the concepts of analog and digital circuits.
- To impart knowledge on signal generation and measuring equipment.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all Types of leaves including Medical leaves.	

Course Contents:**MODULE I - NUMBER SYSTEM AND LOGIC FAMILIES** **9 Hours**

Review of number systems, binary codes, error detection and correction codes. Digital Logic Families – Introduction to RTL, DTL, TTL, ECL and MOSL families – wired and operation, characteristics of digital logic family – comparison of different logic families.

MODULE II - COMBINATIONAL LOGIC **9 Hours**

Representation of logic functions – SOP and POS forms, K-map representations – minimization using K-maps- simplification and implementation of combinational logic – multiplexers and demultiplexers – code converters, adders, subtractors.

MODULE III - SEQUENTIAL LOGIC **9 Hours**

SR, JK, D and T flip-flops – level triggering and edge triggering – counters – Pulse forming circuits - asynchronous and synchronous type – Modulo counters – Shift registers – Ring counters.

MODULE IV - SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS **9 Hours**

State table and excitation tables - state diagrams - Moore and Mealy models - design of counters - analysis of synchronous sequential logic circuits - state reduction and state assignment.

MODULE V - ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS **9 Hours**

Transition table, flow table – race conditions – circuits with latches, analysis of asynchronous sequential logic circuits – implication table – hazards.

TEXT/REFERENCE BOOKS:

1. Ciletti, Michael D., and M. Morris Mano. Digital design. Hoboken: Prentice-Hall, 2007.
2. Floyd, Thomas L. Digital fundamentals, 10/e. Pearson Education India, 2011.
3. Jain, R. P. Modern digital electronics. Vol. 1. No. 10. Tata McGraw-Hill Education, New Delhi, 2003.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Digital Circuits and Systems	Prof. B. S. Rajan	Indian Institute of Technology (IIT) Madras
2	Digital Electronics	Prof. K. A. S. Kumar	IIT Kharagpur

COURSE OUTCOMES:

The student will learn following through lectures:

CO1- Interpret, convert and represent different number systems.

CO2 - Manipulate and examine Boolean algebra, logic operations, Boolean functions and their simplification.

CO3- Design and analyze combinational and sequential logic circuits.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Interpret, convert and represent different number systems	K ₁
CO2	Manipulate and examine Boolean algebra, logic operations, Boolean functions and their simplification.	K ₂
CO3	Design and analyze combinational and sequential logic circuits	K ₃

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix: (Mapping of Cos with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					1
CO2		1	2											
CO3	1			2									1	
CO(Average)	2	1	2	2	2		1		1				1	1

ELECTRICAL MACHINES II

Subject Code: -	BTEEE502	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	04

Course Objectives:

To deal with the detailed analysis of poly phase induction motors & Synchronous Generators and motors To understand operation, construction and types of single phase motors and their applications in house hold appliances and control systems. To introduce the concept of parallel operation of synchronous generators . To introduce the concept of regulation and its calculations.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all Types of leaves including Medical leaves.	

Course Contents:

MODULE 1

Polyphase Induction Motors: Constructional details of cage and wound rotor machines production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation.

MODULE 2

Characteristics of Induction Motors: Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic – equivalent circuit - phasor diagram -crawling and cogging -.No-load Test and Blocked rotor test – Predetermination of performance Methods of starting and starting current and Torque calculations. Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator principle of operation.

MODULE 3

Construction, Principle of operation, Characteristics & Regulation of Synchronous Generator: Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics –armature reaction – leakage reactance – synchronous reactance and impedance – experimental determination – phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis Phasor diagrams – Regulation of salient pole alternators.

MODULE 4

Parallel Operation of Synchronous Generator: Synchronizing alternators with infinite bus bars –synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance's. Synchronous Motors – Principle of Operation: Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed .- hunting and its suppression – Methods of starting – synchronous induction motor.

MODULE 5

Single Phase Motors & Special Motors:: Single phase induction motor – Constructional features-Double revolving field theory – split-phase motors – shaded pole motor.

TEXT/REFERENCE BOOKS:

1. "I. J. Nagrath & D. P. Kothari", "Electric Machines", Tata Mc Graw Hill, 7th Edition, 2009
2. "PS Bhimbra", "Electrical machines", Khanna Publishers, 2014.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Electrical Machines II	Prof. B. S. Rajan	IIT Madras
2	Electrical Machine Design	Prof. R. K. Aggarwal	IIT Delhi

COURSE OUTCOMES:

The student will learn following through lectures:

- CO1.** Analyse both the transient and steady state performance of different electrical machines
- CO2.** Analyse both the transient and steady state performance of some of the special electrical machines.
- CO3.** Select various electric machines for field applications
- CO4.** Analyze performance of different electrical machines

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Analyse both the transient and steady state performance of different electrical machines	K ₁
CO2	Analyse both the transient and steady state performance of some of the special electrical machines	K ₂
CO3	Select various electric machines for field applications	K ₃
CO4	Analyze performance of different electrical machines	K ₄

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix: (Mapping of Cos with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2
CO1	3						1		1					1
CO2		1	2											
CO3	1			2									1	
CO4					2					2				

CO(Average)	2	1	2	2	2		1		1				1	1
--------------------	---	---	---	---	---	--	---	--	---	--	--	--	---	---

3–High;2–Medium;1–Low

ELEMENTS OF POWER SYSTEM

Subject Code: -	BTEEE504	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	04

Course Objectives:

To impart knowledge on power generation, transmission, distribution and protection systems, and overview of power system economics and regulations.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all Types of leaves including Medical leaves.	

Course Contents:**MODULE I - OVERVIEW OF GENERATION SYSTEMS****9 Hours**

Sources of Energy, Steam, Diesel, Nuclear and Hydro power plants – site selection - Layout – essential components and operation.

MODULE II- MODES OF TRANSMISSION AND DISTRIBUTION**9 Hours**

HVAC and HVDC Transmission system – overhead lines – towers, conductors and insulators, underground cables – types – laying methods and fault location, comparison of over-head and underground systems, distribution system – classification – components, power factor correction.

MODULE III - BASIC PROTECTION AND SWITCHGEARS**9 Hours**

System faults and abnormal conditions, system grounding, need for protection system, overview of apparatus protection, switch gear mechanisms – fuse, switch, isolator and circuit breakers.

MODULE IV- ECONOMICS ON POWER SYSTEMS**9 Hours**

Factors affecting cost of generation – load curve – load factor – diversity, base load and peak load stations – reduction of generation cost by interconnection of stations, price of electricity – types of tariff for HT and LT consumers.

MODULE V - REGULATION / ELECTRICITY ACT**9 Hours**

Evolution of Indian electricity act – regulator commissions, grid code, Introduction to restructuring of power system – Gen Co, Trans Co and Dis Co, Independent power producers, Introduction to smart grid.

TEXT/REFERENCE BOOKS:

1. R K Rajput, 'Power System Engineering', Laxmi Publications Ltd., 2006.
2. A Chakrabarti, M L Soni, P V Gupta and U S Bhatnagar, 'Power System Engineering', Dhanpat Rai & Co., Ltd., 2010.
3. S N Singh. 'Electric Power Generation, Transmission and Distribution', PHI Publications, 2008.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Power System Analysis	Prof. A. K. Singh	IIT Kharagpur

COURSE OUTCOMES:

- CO1.** Ability to model the power system under steady state operating condition.
- CO2** Ability to understand and apply iterative techniques for power flow analysis
- CO3.** Ability to model and carry out short circuit studies on power system
- CO4.** Ability to acquire knowledge on Fault analysis.
- CO5.** Ability to model and analyze stability problems in power system.

Course Outcome	Statement	Knowledge Level (KL)
CO1	Ability to model the power system under steady state operating condition	K ₁
CO2	Ability to understand and apply iterative techniques for power flow analysis	K ₂

CO3	Ability to model and carry out short circuit studies on power system	K ₃
CO4	Ability to acquire knowledge on Fault analysis.	K ₄
CO5	Ability to model and analyze stability problems in power system	K ₁

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix: (Mapping of Cos with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2
CO1	3						1		1					1
CO2		1	2											
CO3	1		2										1	
CO4					2					2				
CO5											2			
CO(Average)	2	1	2	2	2		1		1				1	1

3-High;2-Medium;1-Low

Digital Signal Processing

Subject Code: -	BTECE505	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	04

Course Objective: This course introduces the basics concepts of Discrete fourier transform, digital filter design and application of digital signal processing. The design of IIR and FIR filter, their structure and implementation is also addressed in this course. DSP processor is also discussed in this course.

Module -I

12hrs

Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation

Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution, Additional DFT properties. Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long data Sequences, Fast-Fourier-Transform (FFT) algorithms, Efficient Computation of the DFT: Radix- 2 FFT algorithms for the computation of DFT and IDFT decimation in-time and decimation-in-frequency algorithms.

Module-II**12 hrs**

Aperture and Reflector Antennas: Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas, Monopole antenna

Module-III**2 hrs**

IIR Filter Design: Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Low pass prototype transformation. Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT. Realization of IIR Filters in Direct form I and II.

Module-IV**10 hrs**

Digital Signal Processors: DSP Architecture, DSP Hardware Modules, Fixed point format, Floating point Format, Fixed Point digital signal processors, Floating point processors. Application of Digital Signal Processors.

Text/Reference Books:

1. Proakis & Manolakis, "Digital Signal Processing- Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317- 1000-9.
2. Oppenheim & Schaffer, "Discrete Time Signal Processing, PHI, 2003.
3. Sanjit K Mitra, "Digital Signal Processing, A Computer Based Approach", 4th Edition. McGraw Hill Education, 2013.
4. D.Ganesh Rao and Vineeth P Gejji, "Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Digital Signal Processing	Prof S.C.DuttaRoy	IIT Kharagpur
2	Digital Signal Processing and Applications	Prof. V. M. Gadre	IIT Madras

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

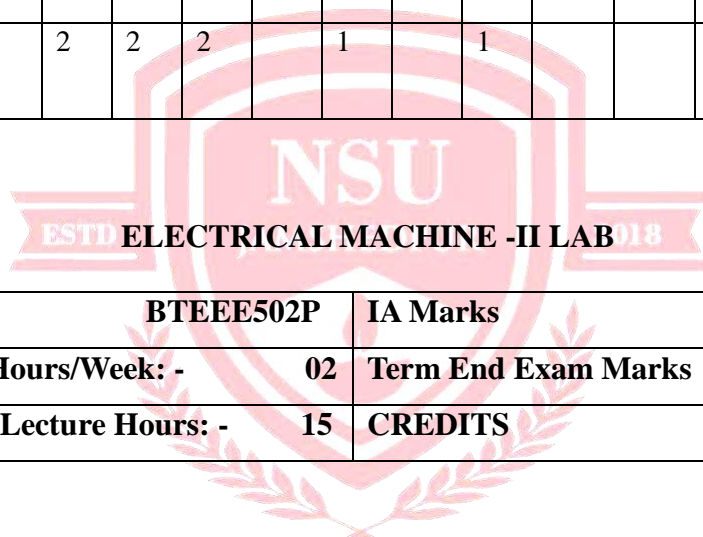
CO1: Analyze and study discrete fourier transform (DFT) and their implementation.

CO2: Analyze and implementation of IIR and FIR filters and their implementation.

CO3: Application and introduction to digital signal processors

Course Articulation Matrix: (Mapping of Cos with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											1
CO3	1			2									1	
CO4					2					2				
CO5											2			
CO(Average)	2	1	2	2	2		1		1				1	1



Subject Code: -	BTEEE502P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

ELECTRICAL MACHINES – II LABORATORY

Laboratory Experiments

1. Study of open circuit and short circuit test on single phase transformer.

2. Load test on single phase transformer and determination of efficiency and regulation.
3. Parallel operation of single phase transformers.
4. Study of three phase transformer connections and polarity test.
5. Load test on three phase induction motor.
6. Speed control of DC shunt motor.
7. Study of slip ring induction motor and starter operation.
8. Determination of efficiency of alternator by load test.
9. Synchronization of alternator with infinite bus bars.
10. Study of various starters and protection devices used in electrical machines.

Laboratory Outcomes

Students develop practical skills in testing, operating, and analyzing electrical machines such as transformers, induction motors, DC motors, and alternators. They learn machine characteristics, performance evaluation, and industrial applications of electrical machines.

Course Objective Statements

CO1. Students understand the construction, operation, and performance characteristics of transformers, induction motors, DC motors, and alternators.

CO2 regulation, speed characteristics, losses, and power factor through experimental observations.

CO3. Students perform testing, speed control, synchronization, and load analysis of electrical machines while understanding practical industrial applications and safety procedures.

Course Outcome Table

Outcome No	Statement	Knowledge Level (KL)
CO1	Students understand the construction, operation, and performance characteristics of transformers, induction motors, DC motors, and alternators.	K1
CO2	Students analyze machine parameters such as efficiency, voltage regulation, speed characteristics, losses, and power factor through experimental observations.	K2
CO3	Students perform testing, speed control, synchronization, and load analysis of electrical machines while understanding practical industrial applications and safety procedures.	K3

ANALOG ELECTRONICS LAB

Subject Code: -	BTEEE503P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

ANALOG ELECTRONICS LABORATORY

Laboratory Experiments

1. Study of different semiconductor diodes and their V-I characteristics.
2. Characteristics of BJT in Common Emitter (CE) configuration.
3. Characteristics of JFET in Common Source configuration.
4. Study of Half Wave Rectifier with and without filter.
5. Study of Full Wave Rectifier with and without filter.
6. Design and analysis of RC coupled CE amplifier.
7. Study of feedback amplifier circuits.
8. Study of Hartley and Colpitts oscillator circuits and determination of frequency of oscillation.
9. Study of clipping and clamping circuits.
10. Verification of truth tables of logic gates using ICs.

Laboratory Outcomes

Students develop practical skills in analyzing, designing, and testing analog electronic circuits using semiconductor devices such as diodes, transistors, and FETs. They learn circuit implementation, measurement techniques, waveform analysis, and performance evaluation of amplifiers, rectifiers, oscillators, and feedback circuits.

Course Objective Statements

CO1. Students understand the characteristics and operation of semiconductor devices including diodes, BJTs, and JFETs used in analog electronic circuits

CO2. Students analyze the performance of rectifiers, amplifiers, oscillators, and feedback circuits through experimental observations and measurements.

CO3. Students design and implement basic analog electronic circuits and verify their practical applications using laboratory instruments

Course Outcome Table

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Students understand the characteristics and operation of semiconductor devices including diodes, BJTs, and JFETs used in analog electronic circuits.	K1
CO2	Students analyze the performance of rectifiers, amplifiers, oscillators, and feedback circuits through experimental observations and measurements.	K2
CO3	Students design and implement basic analog electronic circuits and verify their practical applications using laboratory instruments and ICs.	K3

DIGITAL ELECTRONICS LAB

Subject Code: -	BTEEE501P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

LABORATORY

1. Study of different gates and its corresponding ICs
2. Study of Boolean operation
3. Characteristics of BJT in Common Emitter Configuration
4. Characteristics of JFET in Common source Configuration
5. Study of Half Wave and Full Wave Rectifier without Filter
6. Study of Common Emitter BJT Amplifier.
7. To study the operation of Hartley & Colpitts oscillator circuits and to determine their frequency of oscillations.

Laboratory Outcomes:

Develop practical skills in analyzing and building electronic circuits, including diodes, transistors, and amplifiers. They learn to verify circuit characteristics, implement designs, and understand the underlying principles of electronics.

- CO 1. Diode and Transistor Characteristics:** Students learn to understand the V-I characteristics of diodes (forward and reverse bias), Zener diodes, and transistors (CB, CE, CC configurations).
- CO 2.** Students apply these characteristics to analyze the performance of basic circuits containing diodes and transistors, including rectifiers, amplifiers, and biasing circuits
- CO 3.** Students design and implement half-wave and full-wave rectifier circuits with and without filters, learning how to convert AC to DC voltage.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Diode and Transistor Characteristics: Students learn to understand the V-I characteristics of diodes (forward and reverse bias), Zener diodes, and transistors (CB, CE, CC configurations).	K ₁
CO2	Students apply these characteristics to analyze the performance of basic circuits containing diodes and transistors, including rectifiers, amplifiers, and biasing circuits	K ₂
CO3	Students design and implement half-wave and full-wave rectifier circuits with and without filters, learning how to convert AC to DC voltage.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1										1		1	
CO2		2			1									
CO3			2				1				1			1
CO(Average)	1	2	2		1		1				1		1	1

3 –High; 2 –Medium; 1 –Low

EMPLOYMENT ENHANCEMENT COURSE – I

Subject Code: -	BTEEEEC 506	IA Marks	40
Number of Lecture Hours/Week:-	02	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	01

Course objectives:

1. Employment Enhancement Course-I is aimed to developing key employability skills.
2. It develops the leadership, planning, and organizational skills.
3. The course aims to bridge the gap between skills possessed by individuals and those sought by employers.

Assessment plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Contents:**MODULE 1: EMPLOYABILITY SKILLS**

Communication Skills: This module focuses on enhancing verbal and non-verbal communication, including effective listening, clear expression, and adapting communication styles.

Corporate Etiquette and Soft Skills: Students learn professional conduct, workplace manners, teamwork, and time management.

Resume Building and Interview Skills: This module equips students to craft resumes and develop confidence for interviews, including body language and mock interview practice.

MODULE 2: APTITUDE AND REASONING SKILLS

Analytical Skills: logical reasoning, quantitative aptitude, data interpretation, and problem-solving, which are frequently tested in job applications and interviews.

Reasoning Skills: Similar to analytical skills, this module focuses on developing critical thinking, pattern recognition, and deductive reasoning abilities,

MODULE 3: COMPUTER AND TECHNICAL SKILLS

Basic Computer Knowledge: This module often covers essential computer skills, including working with MS Office applications (like Word, Excel, and PowerPoint) and navigating the internet.

Technical Skill Building: Some programs may include modules offering basic technical skills relevant to the students' fields of study (e.g., programming, networking, content writing)

MODULE 4: DEVELOPING KEY TRAITS

Leadership and Management: Understanding different leadership styles, motivating teams, delegating tasks, and taking initiative.

Time Management: Prioritizing tasks, setting goals, managing time effectively, and meeting deadlines.

Adaptability: Adjusting to changing circumstances, embracing new challenges, and remaining flexible in the workplace.

Work Ethics: Understanding professional conduct, demonstrating responsibility, and maintaining a positive attitude.

MODULE 5: PRACTICAL APPLICATIONS AND CAREER PLANNING

Resume and Cover Letter Writing: Crafting compelling resumes and cover letters that highlight relevant skills and experience.

Interview Skills: Practicing interview techniques, preparing for different types of interviews, and effectively showcasing qualifications.

Networking: Building professional connections, attending industry events, and leveraging social media for career advancement.

Career Planning: Setting career goals, identifying career paths, and developing a plan for achieving career aspirations.

Course outcomes:

CO1. Upon completing the course, students are expected to possess improved communication skills.

CO2. It enhanced analytical and reasoning abilities.

CO3. It builds self-confidence, better teamwork skills.

CO4. It creates a stronger foundation for entering the workforce.

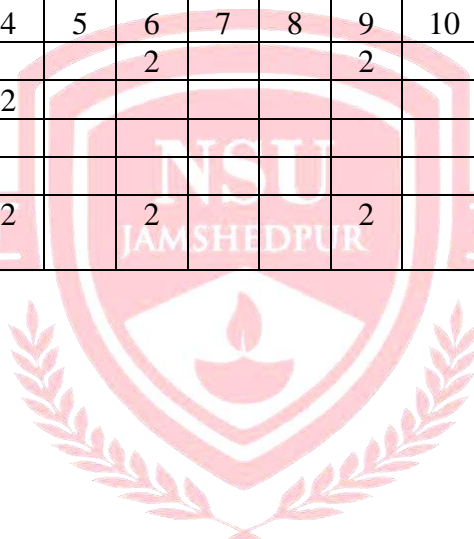
Course Outcome No	Statement	Knowledge Level (KL)
CO1	Upon completing the course, students are expected to possess improved communication skills.	K ₁
CO2	It enhanced analytical and reasoning abilities.	K ₂
CO3	It builds self-confidence, better teamwork skills.	K ₃
CO4	It creates a stronger foundation for entering the workforce.	K ₆

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	3				2			2				1	1
CO2	1			2							1			
CO3	1	2												
CO4														
CO(Average)	1.3	2.5		2		2			2		1		1	1



SEMESTER-VI



CONTROL SYSTEM

Subject Code: -	BTEEE601	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	04

Course Objective:

1. To introduce the elements of control system and their modeling using various techniques.
 2. To introduce methods for analyzing the time response, the frequency response and the stability of systems.
 3. To understand the compensation technique that can be used to stabilize the control system.
- To introduce the state variable analysis method.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Module -I**10 hrs**

Control Systems and Components: Systems and their representation: Basic elements in control systems, open and closed loop systems, Electrical analogy of mechanical Systems, Transfer function, Block diagram reduction techniques, Signal flow graphs- AC and DC servomotor, synchro-, stepper motor.

Module-II**12 hours****Time Response Analysis and Design Specifications:**

Time response: Time domain specifications, Types of test input, I and II order system response, Error coefficients, Generalized error series, Steady state error, P, PI, PD and PID compensation.

Module-III**12 hours**

Frequency Response Analysis: Frequency response: Bode plot, Polar plot, frequency domain specifications, Correlation between frequency domain and time domain specifications, Introduction to the design of lead, lag and lag-lead compensators.

Module-IV**10 hours****Concepts of Stability:**

Stability Analysis: Characteristics equation, Location of roots in S plane for stability, Routh Hurwitz criterion, Root locus diagram and its application, Dominant poles-Nyquist stability criterion, relative stability.

Text/Reference Books:

1. Norman S. Nise, "Control Systems Engineering", 4th Ed, John Wiley, New Delhi, 2007.
2. K. Ogata, "Modern Control Engineering", 4th Ed, PHI, New Delhi, 2002.
3. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
4. Benjamin C. Kuo, "Automatic Control Systems", Pearson Education, New Delhi, 2003.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Control System	Prof. M. Gopal	IIT Delhi
2	Control System	Prof. Ramakrishna Pasumarthy	IIT Madras

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

CO1: Perform time domain and frequency domain analysis of control systems required for stability analysis.

CO2: Design of compensators that can be used to stabilize the control systems.

CO3: Demonstrate the ability to apply Laplace transform, transfer functions, and block diagrams for simulation and control.

CO4: Identify, evaluate and solve control engineering problems

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Perform time domain and frequency domain analysis of control systems required for stability analysis.	K ₁
CO2	Design of compensators that can be used to stabilize the control systems.	K ₂ , K ₃
CO3	Demonstrate the ability to apply Laplace transform, transfer functions, and block diagrams for simulation and control.	K ₃
CO4	Identify, evaluate and solve control engineering problems	K ₃ , K ₄

KL-Bloom's Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix: (Mapping of Cos with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2
CO1	3						1		1					1
CO2		1	2											
CO3	1			2									1	
CO4					2					2				
CO(Average)	2	1	2	2	2		1		1				1	1

.POWER SYSTEM ANALYSIS

Subject Code: -	BTEEE602	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	04

Course Objectives:

1. Provide advanced understanding of operation and performance of various components of the modern power system
2. Give exposure to modeling and control of various aspects of power system.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all Types of leaves including Medical leaves.	

Course contents:

MODULE I

12 Hours

Power System Performance, Basic concept of active and reactive power control of Synchronous generator. Interdependence of active power with frequency and reactive power with voltage and concept of decoupling. Speed Governing System: Description of Speed Governor, Speed changer and main components of speed governing system, principle of operation matrices for network changes - Z bus Building algorithm.

MODULE II

9 Hours

Load frequency control Representation of speed governing system, effect of governor droop on Load sharing among generators, dependence of load on frequency, system inertia. Modelling and analysis of single area load frequency control, supplementary control, concept of control area

MODULE III

12 Hours

Power system stability: steady state and transient stability, swing equation and its numerical solution. Equal area criterion for transient stability, improvement of transient stability. Reactive power control: Role of excitation system, main & pilot exciters, description of different types of excitation systems. Per-Unit representation of Power system– Selection of base quantities, percent and per unit values, advantage of per unit system

MODULE IV

10 Hours

AC Transmission – Power flow through a line, power circle diagram, line charts, active power flow and voltage control in transmission system. Line load ability and voltage dependence. Power flow in interconnected systems and load flow analysis – Gauss –Seidel method. Symmetrical fault analysis.

MODULE V

7 Hours

Elements of HVDC Power transmission Economic operation of power plant – cost curves, heat rate, incremental rate, economic load sharing among generating units.

TEXT REFERENCE BOOKS

1. Power System Analysis: J. J. Grainger & W. D. Stevenson, McGraw Hill.
2. Power System Engineering: I. J. Nagrath & D. P. Kothari, Tata McGraw Hill
- Electric Energy System Theory: O. I. Elgerd, Tata McGraw Hill
3. Elements of Power System Analysis: W. D. Stevenson, McGraw Hill.
4. Power System Analysis: A. R. Bergen & V. Vittal, Pearson Education
5. Power System Analysis Operation and Control: Chakrabarti & Halder, PHI Learning Pvt. Limited.
6. Electrical Power Systems: Ashfaq Husain, CBS Publishers & Distributors Pvt. Ltd.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Power System Analysis	Prof. Debapriya Das	IIT KGP
2	Power System Analysis	Prof. Biswarup Das	IIT Roorkee

Course Outcomes

CO1: Analyze the performance of power systems, explain the interdependence of active power with frequency and reactive power with voltage, and describe the operation of speed governing systems and Z-bus building algorithms.

CO2: Develop mathematical models for Load Frequency Control (LFC) of a single-area power system, including governor droop, system inertia, and supplementary control, to analyze frequency regulation.

CO3: Evaluate power system stability (steady-state and transient) using the swing equation and equal area criterion, and explain reactive power control through excitation systems and per-unit representation.

CO4: Perform load flow analysis using the Gauss-Seidel method, analyze active power flow and voltage control in AC transmission, and compute symmetrical fault parameters.

CO5: Describe the basic elements of HVDC transmission and apply economic dispatch principles, including cost curves, heat rate, and incremental rate, for optimal load sharing among generating units.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Explain active/reactive power control, speed governing systems, and Z-bus building algorithm.	K ₁
CO2	Model and analyze single-area load frequency control with governor droop and supplementary control	K ₂
CO3	Apply swing equation and equal area criterion for stability analysis, and explain excitation systems with per-unit representation.	K ₃
CO4	Perform load flow using Gauss-Seidel method, analyze power flow/voltage control, and compute symmetrical faults.	K ₆
CO5	Describe HVDC basics and apply economic load sharing using cost curves and incremental rate.	K ₁ , K ₂ , K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of Cos with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					1
CO2		1	2											
CO3	1			2									1	
CO4					2					2				
CO5											2			
CO(Average)	2	1	2	2	2		1		1				1	1

POWER ELECTRONICS

Subject Code: -	BTEEE603	IA Marks	40
Number of Lecture Hours/Week: -	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objectives:

1. To explain about the operations, switching characteristics of power semiconductor devices
2. To study the operations and performance parameters of controlled Rectifiers.
3. To analyse the operation and performance of dC to dc converters.
4. To impart knowledge on different control techniques for inverters.
5. To familiarize the principle of operation of AC voltage controllers and cycloconverters

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100

Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all Types of leaves including Medical leaves.
-------------------	---

Course contents:

MODULE-I 10 Hours

Introduction: Need for power conversion with efficient, high frequency, lightweight converters; Power electronics converters: Classifications and scope. Power semiconductor switches: power/fast diodes, SCR, and transistors (BJT, MOSFET and IGBT) Ratings, static and dynamic characteristics, drive and switching aid circuits and cooling; isolation; protection

MODULE-II 9 Hours

DC to DC conversion: Choppers: non-isolated: Buck, Boost and Buck- Boost converters; circuit configuration and analysis with; continuous and discontinuous loads; H-bridge converter multi- quadrant operation; isolated: forward, fly-back converters; example of a typical drive circuit

MODULE-III 9 Hours

AC to DC conversion: Rectifiers: controlled/half-controlled/uncontrolled: single phase and three phase operation, Operation with R, R-L, back emf load; power factor, harmonics and effect of source inductance; Cascade operation; dual converters; a typical trigger / drive circuit;

MODULE-IV 8 Hours

DC to AC conversion: Inverters: current source and voltage source inverters, active and reactive power handling; single phase and three phase voltage source and PWM inverters; PWM techniques; active front-end rectifier; a typical trigger / drive circuit

MODULE-V 5 Hours

AC to AC conversion: Single phase AC static switches; transient-free switching of inductive loads; voltage regulators; cycloconverters

TEXT/REFERENCE BOOKS:

1. Rashid, M. H., (2004), Power Electronics Circuits, Devices, and Applications, 3rd Edition, Pearson Education Inc.
2. Hart, D. W., (2011), Power Electronics, Tata McGraw-Hill Education Private Limited.
3. Mohan, N., (2007), First Course on Power Electronics and Drives, MNPERE
4. P. S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi, 6th Edition, 2018.
5. Cyril W. Lander, "Power Electronics", McGraw Hill Book Company, Singapore, 1993

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	POWER ELECTRONICS	Prof. B.G. Fernandes & Prof. Kishore Chatterjee	IIT Bombay
2	POWER ELECTRONICS	Prof. Avik Bhattacharya	IIT Roorkee

Course Outcome

CO1: Classify power electronics converters and explain the ratings, static/dynamic characteristics, drive circuits, and protection of power semiconductor switches.

CO2: Analyze non-isolated (Buck, Boost, Buck-Boost) and isolated (Forward, Fly-back) DC-DC converters under continuous and discontinuous load conditions, including H-bridge multi-quadrant operation.

CO3: Evaluate single-phase and three-phase controlled, half-controlled, and uncontrolled rectifiers with various loads, including the effects of source inductance, power factor, harmonics, and dual converters.

CO4: Design and analyze voltage source inverters (single and three-phase), PWM inverters, PWM techniques, active front-end rectifiers, and explain active/reactive power handling.

CO5: Explain the operation of single-phase AC static switches, transient-free switching for inductive loads, voltage regulators, and cycloconverters.

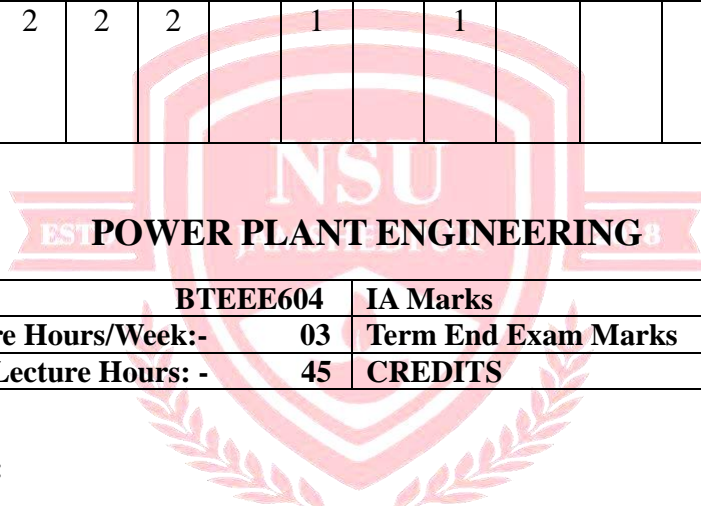
Course Outcome No	Statement	Knowledge Level (KL)
CO1	Explain the characteristics, drive circuits, and protection of power semiconductor switches (diodes, SCR, BJT, MOSFET, IGBT).	K ₁
CO2	Analyze non-isolated (Buck, Boost, Buck-Boost) and isolated (Forward, Fly-back) DC-DC converters with continuous/discontinuous loads and H-bridge operation.	K ₂
CO3	Evaluate single/three-phase controlled and uncontrolled rectifiers with R, R-L, and back emf loads, including power factor, harmonics, source inductance effects, and dual converters.	K ₃
CO4	Design and analyze single/three-phase voltage source inverters, PWM inverters, PWM techniques, and active front-end rectifiers for active/reactive power control.	K ₆
CO5	Explain the operation of single-phase AC static switches, transient-free inductive load switching, voltage regulators, and cycloconverters.	K ₁ , K ₂ , K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of Cos with Pos & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					1
CO2		1	2											
CO3	1			2									1	
CO4					2					2				
CO5											2			
CO(Average)	2	1	2	2	2		1		1				1	1



Subject Code: -	BTEEE604	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objective:

1. To provide an overview of power plants and the associated energy conversion issues.
2. Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:

Module I

12 Hours

Introduction: Power plants – types and classification based on energy sources. Coal based Thermal Power Plants: Basic Rankine cycle and its modifications; Layout of modern coal power plant; Super critical boilers, FBC boilers; Turbines, condensers, steam and heating rates; Subsystems of thermal power plants; Fuel and ash handling; Draught system; Feed water treatment; Binary cycles and cogeneration systems.

Module II

6 Hours

Gas Turbine and Combined Cycle Power Plants: Brayton cycle analysis and optimization; Components of gas turbine power plants; Combined cycle power plants; Integrated Gasifier based Combined Cycle (IGCC) systems.

Module III

8 Hours

Nuclear Power Plants: Basics of nuclear energy conversion; Layout and subsystems of nuclear power plants; Boiling Water Reactor (BWR); Pressurized Water Reactor (PWR); CANDU Reactor; Pressurized Heavy Water Reactor (PHWR); Fast Breeder Reactors (FBR); Gas cooled and liquid metal cooled reactors; Safety measures for nuclear power plants.

Module IV

5 Hours

Hydroelectric Power Plants: Classification; Typical layout and components. **Renewable Power Systems:** Principles of wind, tidal, solar photo-voltaic, solar thermal, geothermal, biogas and fuel cell power systems.

Module V

5 Hours

Energy Economics and Environment: Economic and environmental issues; Power tariffs; Load distribution parameters; Load curve; Capital and operating cost of different power plants; Pollution control technologies including waste disposal options for coal and nuclear plants.

Text /Reference Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_me73/preview

Course Outcomes:

At the end of this course students will demonstrate the ability

- CO1.** Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.

- CO2.** Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts.
- CO3.** Combine concepts of previously learnt courses to define the working principle of diesel power plant, its layout, safety principles and compare it with plants of other types.
- CO4.** Describe the working principle and basic components of the nuclear power plant and the economic and safety principles involved with it.
- CO5.** Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

Course Outcome No	Statement	Knowledge Level (K _L)
CO1	Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.	K ₁
CO2	Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts.	K ₂
CO3	Combine concepts of previously learnt courses to define the working principle of diesel power plant, its layout, safety principles and compare it with plants of other types.	K ₃
CO4	Describe the working principle and basic components of the nuclear power plant and the economic and safety principles involved with it.	K ₃
CO5	Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO(Average)	3	1	2	3			1		1				1	

3 –High; 2 –Medium; 1 –Low

POWER SYSTEM SIMULATION LAB

Subject Code: -	BTEEE602P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

POWER SYSTEM SIMULATION LABORATORY**Laboratory Experiments**

1. Study of power system simulation software and modeling techniques.
2. Formation of bus admittance matrix and load flow analysis using simulation software.
3. Load flow analysis using Gauss-Seidel method.
4. Load flow analysis using Newton-Raphson method.
5. Economic load dispatch problem using simulation tools.
6. Transient stability analysis of a single machine infinite bus system.
7. Fault analysis of symmetrical faults in power systems.
8. Simulation of transmission line parameters and performance.
9. Study of reactive power compensation using capacitor banks.
10. Simulation of power system protection schemes and relay coordination.

Laboratory Outcomes

Students develop practical skills in modelling, simulating, and analyzing electrical power systems using modern software tools. They learn load flow studies, fault analysis, stability analysis, and economic operation of power systems for real-time engineering applications.

CO Statements

- CO1. Students understand the modelling and simulation of electrical power system components such as generators, transmission lines, transformers, and loads.
- CO2. Students analyze load flow, fault conditions, stability, and economic operation of power systems using simulation software tools.
- CO3. Students perform simulation-based studies for power system operation, protection, and control while interpreting results for practical engineering applications.

Course Outcome Table		
Course Outcome No	Statement	Knowledge Level (KL)
CO1	Students understand the modelling and simulation of electrical power system components such as generators, transmission lines, transformers, and loads.	K1
CO2	Students analyze load flow, fault conditions, stability, and economic operation of power systems using simulation software tools.	K2
CO3	Students perform simulation-based studies for power system operation, protection, and control while interpreting results for practical engineering applications.	K3

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO(Average)	3	1	2	3			1		1				1	

POWER ELECTRONICS LABORATORY

Subject Code: -	BTEEE603P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

POWER ELECTRONICS LABORATORY**Laboratory Experiments**

1. Study of power semiconductor devices such as SCR, TRIAC, DIAC, MOSFET, and IGBT.
2. V-I characteristics of SCR and TRIAC.
3. Study of single phase half wave controlled rectifier using SCR.
4. Study of single phase full wave controlled rectifier using SCR.
5. Study of single phase AC voltage controller using TRIAC.
6. Study of DC-DC chopper circuit and its performance characteristics.
7. Study of single phase inverter circuit using MOSFET/IGBT.
8. Speed control of DC motor using chopper circuit.
9. Study of PWM techniques for inverter circuits.
10. Simulation and analysis of power electronic converters using software tools.

Laboratory Outcomes

Students develop practical skills in analyzing, designing, and testing power electronic circuits and converters using semiconductor switching devices. They learn the operation, control, and applications of rectifiers, choppers, inverters, and motor control circuits used in industrial power systems.

CO Statements

- CO1. Students understand the characteristics and operation of power semiconductor devices such as SCR, TRIAC, MOSFET, and IGBT used in power electronic circuits.
- CO2. Students analyze the performance of controlled rectifiers, choppers, inverters, and AC voltage controllers through experimental observations and measurements.
- CO3. Students design and implement power electronic converters and motor control circuits for practical industrial applications using hardware and simulation tools.

Course Outcome Table		
Course Outcome No	Statement	Knowledge Level (KL)
CO1	Students understand the characteristics and operation of power semiconductor devices such as SCR, TRIAC, MOSFET, and IGBT used in power electronic circuits.	K1
CO2	Students analyze the performance of controlled rectifiers, choppers, inverters, and AC voltage controllers through experimental observations and measurements.	K2
CO3	Students design and implement power electronic converters and motor control circuits for practical industrial applications using hardware and simulation tools.	K3

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO (Avg)	3	1	2	3			1		1				1	

CONTROL SYSTEM LABORATORY

Subject Code: -	BTEEE608P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

CONTROL SYSTEM LABORATORY**Laboratory Experiments**

1. Study of open loop and closed loop control systems.
2. Determination of transfer function of DC motor.
3. Time response analysis of first order and second order systems.
4. Study of stability analysis using Routh-Hurwitz criterion.
5. Study of root locus technique for control systems.
6. Frequency response analysis using Bode plot.
7. Frequency response analysis using Nyquist plot.
8. Study of PID controller characteristics and tuning methods.
9. Simulation of control systems using MATLAB/Simulink.
10. Study of servo motor and synchro system characteristics.

Laboratory Outcomes

Students develop practical skills in analyzing, designing, and simulating control systems using hardware setups and software tools. They learn system modelling, stability analysis, time and frequency response analysis, and controller design techniques for engineering applications.

CO Statements

- CO1. Students understand the fundamentals of control systems, transfer functions, stability concepts, and system response characteristics.
- CO2. Students analyze the performance of control systems using time response, frequency response, and stability analysis techniques.
- CO3. Students design and simulate control systems and PID controllers using modern software tools for practical engineering applications.

Course Outcome Table		
Course Outcome No	Statement	Knowledge Level (KL)
CO1	Students understand the fundamentals of control systems, transfer functions, stability concepts, and system response characteristics.	K1
CO2	Students analyze the performance of control systems using time response, frequency response, and stability analysis techniques.	K2
CO3	Students design and simulate control systems and PID controllers using modern software tools for practical engineering applications.	K3

KL- Bloom’s Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO (Avg)	3	1	2	3			1		1				1	

EMPLOYMENT ENHANCEMENT COURSE – II

Subject Code: -	BTEEC606	IA Marks	40
Number of Lecture Hours/Week:-	02	Term End Exam Marks	60
Total Number of Lecture Hours: -	30	CREDITS	01

Course objectives:

1. The Employment Enhancement Course - II (EEC-II) is designed to equip students with crucial skills for securing employment or pursuing entrepreneurship.
2. The course is structured around various modules, each focusing on specific skill development.

CONTENTS**MODULE 1: COMMUNICATION AND SOFT SKILLS**

Learn good communication and soft skills. Practicing formal introductions and understanding the importance of communication. Interpersonal communication, including giving and receiving feedback effectively. Developing verbal and non-verbal communication skills. Enhancing listening skills and practicing gender sensitivity. Workplace communication with peers, superiors, and juniors.

MODULE 2: COMPUTER BASICS AND DIGITAL LITERACY

Understanding and recalling essential elements of computer basics and technology. Basic computer operations, including MS-Word and Excel basics. Web browsing and using search engines efficiently. Creating and using email accounts, including attaching documents and professional email etiquette. Exploring mobile applications relevant to the workplace. Understanding concepts like file conversion, cloud computing, and language translation.

MODULE 3: EMPLOYMENT AND SELF-EMPLOYMENT ENHANCEMENT

Resume writing and preparation for interviews. Practicing technical evaluations and aptitude tests. Developing interview etiquette, including communication, body language, and answering questions confidently. Understanding and applying for apprenticeships and internships. Registering on government job portals and exploring job search strategies. Learning about career planning, exploring career pathways within a chosen sector, and anticipating challenges.

MODULE 4: ENTREPRENEURSHIP SKILLS

Introducing students to the basics of entrepreneurship and fostering an entrepreneurial mindset.

COURSE OUTCOMES:

- CO1.** Developing an entrepreneurial mindset and identifying opportunities.
- CO2.** Learning about market research, developing a Unique Value Proposition (UVP), and being resourceful.
- CO3.** Understanding the ease of doing business, including statutory compliances and government schemes.
- CO4.** Managing resources, including human resources, finance, and infrastructure.

CO5. Importance of mentorship and continuous learning in entrepreneurship.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Developing an entrepreneurial mindset and identifying opportunities.	K ₁
CO2	Learning about market research, developing a Unique Value Proposition (UVP), and being resourceful.	K ₂
CO3	Understanding the ease of doing business, including statutory compliances and government schemes.	K ₃
CO4	Managing resources, including human resources, finance, and infrastructure.	K ₅
CO5	Importance of mentorship and continuous learning in entrepreneurship.	K ₂

K_L- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES											CORRELATION WITH PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2
CO1	2	3				2			2				1	1
CO2	1			2							1			
CO3	1	2												
CO4														
CO5														
CO(Average)	1.3	2.5		2		2			2		1		1	1

3 –High; 2 –Medium; 1 –Low

SEMESTER-VII



MICROPROCESSORS & MICROCONTROLLER (BTEEE701)

Subject Code	BTEEE701	IA Marks	40
Number of Lecture Hours/Week	04	Term End Exam Marks	60
Total Number of Lecture Hours	45	CREDITS	03

Course Objective:

To understand the concepts of Architecture of 8086 microprocessor, and understand the design aspects of I/O and Memory Interfacing circuits also understand the architecture and programming of ARM processor

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Module-I

THE 8086 MICROPROCESSOR - Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation. **-8 Hours**

Module-II

8086 SYSTEM BUS STRUCTURE - 8086 signals – Basic configurations – System bus timing – System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors. -

8 Hours**Module-III**

MICROCONTROLLER - Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Programming 8051 Timers – Interfacing Microcontroller - Serial Port Programming - Interrupts Programming – LCD & Keyboard - External Memory Interface- Stepper Motor **9 Hours**

-Module-IV

INTRODUCTION TO EMBEDDED SYSTEMS - Complex systems and microprocessors– Embedded system design process – Instruction sets preliminaries - ARM Processor – CPU: programming input and output supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance. **-10 Hours**

Module-V

EMBEDDED COMPUTING PLATFORM DESIGN AND OPTIMIZATION The CPU - Bus-Memory devices and systems–Designing with computing platforms – platform level performance analysis - Components for embedded programs-Models of programs Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Analysis and optimization of program size- Program validation and testing. **10 Hours**

Textbooks/References:

1. Yu-Cheng Liu, Glenn A. Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinley, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, 2 nd Edition, Pearson Education, 2011
3. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, 3rd Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012

Course outcome:

CO1-Ability to design and implement programs on 8086 microprocessor

CO2-Ability to design I/O circuits and Memory Interfacing circuits

CO3-Ability to design and develop components of ARM processor

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Ability to design and implement programs on 8086 microprocessor	K ₁
CO2	Ability to design I/O circuits and Memory Interfacing circuits	K ₂ , K ₃
CO3	Ability to design and develop components of ARM processor	K ₃

KL-Bloom’s Knowledge Level(K₁,K₂,K₃,K₄,K₅,K₆)

K₁-Remember,K₂-Understand,K₃-Apply,K₄-Analyze,K₅-Evaluate,K₆- Create

Course Articulation Matrix: (Mapping of Cos with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3				2		1		1					
CO2		1	2											
CO3	1			2		1							1	
CO(Average)	2	1	2	2	2	1	1		1				1	1

3–High; 2–Medium; 1–Low

RENEWABLE ENERGY ENGINEERING

Subject Code: -	BTEEE702	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objective:

1. To acquire knowledge of technical competency combined with research to generate innovative solutions in Energy engineering.
2. To be acquainted with a variety of options in energy sources.
3. To prepare the students to exhibit a high level of professionalism, integrity, environmental and social responsibility, and life-long independent learning ability with environment in mind.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:**Module I**

Introduction: Basic concepts of energy; Introduction to Renewable Energy Technologies; Energy and Environment – global warming, acid rains, depletion of ozone layer; Global and Indian Scenario of renewable energy sources; Energy storage - necessity and energy

storage methods.

Module II

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data. **Solar Thermal Systems:** Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems. **Solar Photovoltaic Systems:** Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems.

Module III

Wind Energy: Introduction; Origin and nature of winds; Wind turbine siting; Basics of fluid mechanics; Wind turbine aerodynamics; wind turbine types and their construction; Wind energy conversion systems.

Module IV

Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics. **Biomass Energy:** Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Module V

Other forms of Energy: Introduction: Nuclear, ocean and geothermal energy applications; Origin and their types; Working principles.

Text /Reference Books:

1. O.P. Gupta, "Energy Technology", Khanna Book Publishing, New Delhi.
2. V.V.N. Kishore, "Renewable Energy Engineering and Technology: Principles and Practice," Routledge, 1st Edition, 2019.
3. N. Jenkins and J. Ekanayake, "Renewable Energy Engineering," Cambridge University Press, 1st Edition, 2017.
4. G. Boyle, "Renewable Energy," OUP Oxford, 2nd Edition, 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ph44/preview
2. https://onlinecourses.swayam2.ac.in/nou22_ge71/preview

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1. Acquire, apply and share in depth knowledge in the area of Energy Engineering and Management.

CO2. An ability to apply engineering and scientific principles for the effective

management of energy systems.

CO3. Explain the basic principles of energy conversion processes and devices used therein

CO4. Identify suitable renewable source and technology for a given requirement.

CO5. Undertake field projects in these areas

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Acquire, apply and share in depth knowledge in the area of Energy Engineering and Management.	K ₁
CO2	An ability to apply engineering and scientific principles for the effective management of energy systems.	K ₂
CO3	Explain the basic principles of energy conversion processes and devices used therein	K ₃
CO4	Identify suitable renewable source and technology for a given requirement.	K ₂
CO5	Undertake field projects in these areas	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO4														
CO5	2	3		3										
CO(Average)	2.5	2	2	3			1		1				1	

3 –High; 2 –Medium; 1 –Low

SWITCHGEAR & PROTECTION (BTEEE703)

Subject Code	BTEEE703	IA Marks	40
Number of Lecture Hours/Week	04	Term End Exam Marks	60
Total Number of Lecture Hours	45	CREDITS	03

Course objective:

- Understand the various types of faults that can occur in power systems (such as short circuit, open circuit, earth fault).
- Explore the construction and components of protective relays used for transmission line protection.
- Study the design and components of protective relays dedicated to transformer and Busbar protection.
- Investigate the protection requirements and mechanisms for alternators and motors in power systems. Compare and contrast the features, applications, and advantages/disadvantages of various circuit breaker types to facilitate informed selection and usage in power systems

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Assessment**Module-I**

Introduction to Power System Protection: This topic covers different types of faults and their causes, along with normal and abnormal operating conditions in power systems. It includes the requirements of protective systems, different protection zones, and the concepts of primary and backup protection. The function of a protective relay, basic tripping mechanism of a relay, and relay operating criteria are discussed. Important definitions of protective relaying such as PSM (Plug Setting Multiplier) and TSM (Time Setting Multiplier) are explained. The topic also covers different types of relays, instrument transformers, and finally introduces static and digital relays.

-8 Hours

Module-II Protection of transmission lines, overcurrent protection including protecting elements such as fuses, thermal relays, and overcurrent relays. It explains the protection of lines using overcurrent relays, different types of relay characteristics, relay coordination, and both non-

directional and directional overcurrent relays along with their limitations. Feeder protection using definite time and IDMT overcurrent relays is discussed. The module then introduces distance protection, covering impedance, reactance, and MHO relays, and their performance during normal load and power swing conditions. A comparison of distance relays and the distance protection of transmission lines is provided, including reasons for inaccuracy of distance relay reach, the effect of arc resistance on reach, three-step protection, trip contact configuration, three-step protection of double-end-fed lines, carrier-aided protection of transmission lines, elements of carrier-aided protection, and numerical protection of transmission line
(Hours: 10)

Module-III focuses on transformer and bus-bar protection. Topics include faults in transformers, zones of protection, overcurrent protection, simple differential protection, percentage differential protection, restricted earth fault (REF) protection, inter-turn faults, incipient faults, the Buchholz relay, and the over-fluxing phenomenon. For bus-bar protection, the module covers bus-zone protection, faults in bus bars, protection of bus bars using backup relays, differential protection of bus bars, and protection of three-phase bus bars.
(Hours: 5)

Module-IV deals with generator and induction motor protection. For induction motor protection, it covers faults and abnormal conditions, as well as protection methods for both small and large induction motors, including numerical protection. For generator protection, the module explains faults and abnormal conditions in generators, differential protection, Merz-Price protection, stator earth fault and rotor earth fault protection, field failure, overload, overvoltage, reverse power, under-frequency and over-frequency conditions, and miscellaneous protection schemes.
(Hours: 7)

Module-V examines conventional and modern circuit breakers. It begins with the theory of circuit interruption, fault clearing and current interruption, the phenomenon of the arc, essential properties of the arc, arc interruption theory, losses from plasma, circuit constants and circuit conditions, restriking voltage transient characteristics of restriking voltage, current chopping, and duties of switchgear. The module then covers classification of switchgear, including air circuit breakers (ACB), air blast circuit breakers (ABCB), oil circuit breakers (both bulk oil and minimum oil), the arc quenching system in oil circuit breakers, recent developments in circuit breakers, modern trends, vacuum circuit breakers, SF₆ circuit breakers, DC circuit breakers, rating of circuit breakers, and testing of MCB, ELCB, and circuit breakers.
(Hours: 10)

Course Outcomes:

At the end of this course students will demonstrate the ability to

Textbooks/References:

- Switchgear And Protection– S. S. Rao, Khanna publication, 2008.
- Power System Protection- Static Relays by T.S.M. Rao Tata McGraw Hill,1993.
- Fundamentals Of Power System Protection-Y. G. Parithankar and S. R. Bhide by PHI,2003.
- Power system protection and switchgear by Oza, Nair, Mehta, Makwana,2010.
- Protection of power systems by Blackburn,2014.
- Power System Protection & Switchgear by B. Ram, McGraw Hill,2011.

- Modern Power System Protection– Divyesh Oza, TMH Publication,2020

CO1. Identify different types of faults, their causes, normal and abnormal operating conditions, protection zones, primary and backup protection, and explain the need for protective systems along with basic relay operating criteria, PSM, TSM, and instrument transformers.

CO2. Explain the construction, working, and characteristics of different types of protective relays used for transmission line protection, including overcurrent relays (non-directional and directional), distance relays (impedance, reactance, MHO), carrier-aided protection, and numerical protection schemes.

CO3. Explain the construction, working, and application of protective relays for transformer and bus-bar protection, including overcurrent protection, simple and percentage differential protection, REF protection, Buchholz relay, over-fluxing phenomenon, and bus-zone differential protection.

CO4. Explain the protection schemes for alternators (generators) and induction motors, including differential protection (Merz-Price), stator and rotor earth fault protection, field failure, overload, overvoltage, reverse power, frequency protection, and protection for small and large induction motors.

CO5. Explain the theory of circuit interruption, arc phenomenon, restriking voltage, current chopping, and compare conventional and modern circuit breakers including ACB, ABCB, oil circuit breakers (bulk oil and minimum oil), vacuum circuit breakers, SF6 circuit breakers, and DC circuit breakers, along with their ratings and testing

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Identify various faults, protection zones, and basic relay operating criteria including PSM and TSM.	K ₁
CO2	Explain overcurrent and distance relays (impedance, reactance, MHO) for transmission line protection with carrier-aided and numerical schemes.	K ₂
CO3	Explain transformer and bus-bar protection using differential, REF, Buchholz relay, and bus-zone differential schemes	K ₃
CO4	Explain generator and induction motor protection including differential, earth fault, field failure, overload, and frequency protection.	K ₂
CO5	Explain circuit interruption theory, arc phenomena, and modern circuit breakers (ACB, ABCB, oil, vacuum, SF6, DC) with ratings and testing.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3				1		1		1					
CO2		1	2											
CO3				3									1	
CO4														
CO5	2	3		3	1									
CO(Average)	2.5	2	2	3	1		1		1				1	

3 –High; 2 –Medium; 1 –Low

INTRODUCTION TO VLSI DESIGN (BTEEE704)

Subject Code	BTEEE704	IA Marks	30
Number of Lecture Hours/Week	04	Term End Exam Marks	70
Total Number of Lecture Hours	50	CREDITS	04

Assessment

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Objective:

- To learn basic CMOS Circuits.
- To learn CMOS process technology.
- To learn techniques of chip design using programmable devices.
- To learn the concepts of designing VLSI Subsystems.

MODULE-1

Introduction: Review of MOSFET characteristics, scaling and small-geometry effects, and MOSFET capacitances. MOS resistor, MOS current source, current mirror circuits. MOS voltage source, linear voltage and current converters. **Hours-10**

MODULE-2

CMOS operational amplifier (OPAMP) design: Differential amplifier, level shifter, source follower, output stage voltage and power amplifiers. Cascade OP-AMP. Compensation techniques. Analog Filters: Switched capacitor (SC) fundamentals, first order SC circuits, second-order SC circuits and cascade design. Analog to digital and digital to analog converters, speed of conversion and over sampling issues. VLSI Interconnects: Distributed RC model, transmission line model. Future interconnect technologies. **Hours-15**

MODULE-3

Digital VLSI Circuit Design: MOS inverters, CMOS inverter, state characteristics, switching characteristics, power dissipation issues. CMOS logic gates: NAND, NOR, XOR, CMOS logic design of half and full adders. CMOS transmission gates, pseudo-nMOS, domino logic gates. **Hours-15**

MODULE-4

Sequential MOS Logic Circuits: The SR latch circuit, clocked latch and flip-flop, CMOS D-latch and edge-triggered circuits, Schmitt trigger circuit, Comparator. Dynamic Logic Circuits: Pass transistor logic, synchronous dynamic circuit techniques. **Hours-05**

MODULE-5

Semiconductor Memories: ROM circuits, SRAM circuits, DRAM circuits, drivers and buffers, Buffer scaling and design issues. **Hours-05**

Course Outcome:

CO1: Explain MOSFET characteristics, scaling effects, capacitances, and design MOS resistors, current sources, current mirrors, voltage sources, and linear voltage/current converters.

CO2: Design CMOS operational amplifiers including differential amplifiers, level shifters, source followers, output stages, cascade OP-AMPs, compensation techniques, analog filters (switched capacitor circuits), and understand ADC/DAC converters with interconnect modeling.

CO3: Analyze digital VLSI circuits including MOS and CMOS inverters (static and switching characteristics, power dissipation), and design CMOS logic gates (NAND, NOR, XOR, half/full adders, transmission gates, pseudo-nMOS, domino logic).

CO4: Explain sequential MOS logic circuits (SR latch, clocked latch, flip-flops, CMOS D-latch, edge-triggered circuits, Schmitt trigger, comparator) and dynamic logic circuits (pass transistor logic, synchronous dynamic circuit techniques).

CO5: Describe semiconductor memory circuits including ROM, SRAM, DRAM, drivers, buffers, and analyze buffer scaling and design issues.

Textbook/References:

1. Sung-Mo Kang, Yusuf Leblebici Charl wood Kim, Digital Integrated Circuits: Analysis and Design, 4th Edition, McGraw Hill Education, 2016.
2. Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2nd Edition, McGraw Hill Education, 2016.
3. Jan M RABAEY, Digital Integrated Circuits, 2nd Edition, Pearson Education, 2003.
4. Neil H.E. Weste and David Harris, CMOS VLSI Design: A circuits and systems perspective, 4th Edition, Pearson Education, 2015.

Course Outcome No	Statement	Knowledge Level (K _L)
CO1	Analyze MOSFET characteristics, scaling effects, and design MOS resistors, current sources, mirrors, and voltage converters.	K ₁
CO2	Describe semiconductor memory circuits (ROM, SRAM, DRAM) along with drivers, buffers, and buffer scaling issues.	K ₂
CO3	Analyze CMOS inverters (static/switching characteristics, power dissipation) and design CMOS logic gates including NAND, NOR, XOR, half/full adders, transmission gates, pseudo-nMOS, and domino logic.	K ₃
CO4	Explain sequential MOS logic circuits (SR latch, clocked latch, D-latch, flip-flops, Schmitt trigger, comparator) and dynamic logic circuits (pass transistor logic, synchronous dynamic techniques).	K ₂
CO5	Design CMOS OP-AMPS, differential amplifiers, level shifters, cascade OP-AMPS, switched capacitor filters, ADC/DAC converters, and VLSI interconnects.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3				1		1		1					
CO2		1	2											
CO3				3									1	
CO4														
CO5	2	3		3	1									
CO(Average)	2.5	2	2	3	1		1		1				1	

3 –High; 2 –Medium; 1 –Low

**MICROPROCESSOR
AND
MICROCONTROLLER LAB**

Subject Code: -	BTEEE707P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

LABORATORY

1. Familiarization of with 8085 training KIT
2. Addition of two numbers in 8085
3. Multiplication of two numbers in 8085
4. Find greater in between two numbers in 8085
5. Find 1's and 2's complement of 8-bit/16-bit numbers.

Laboratory Outcomes:

After completing these experiments, students will be able to confidently operate the 8085 training kit for memory navigation, code entry, and program execution, while writing assembly programs to perform addition with carry handling, multiplication by repeated addition, comparison to find the greater number, and calculation of 1's and 2's complements for both 8-bit and 16-bit numbers. They will also learn to analyze flag register status, verify results in memory and registers, and troubleshoot common programming errors. These foundational microprocessor programming skills prepare students for more advanced embedded system design and low-level computing applications.

- CO 1.** Understand and navigate the 8085 microprocessor training kit, including memory operations, register examination, code entry, and program execution using function keys.
- CO 2.** Develop and execute assembly language programs for arithmetic operations (addition and multiplication) and logical operations (comparison for greater number, 1's and 2's complement) on 8-bit and 16-bit data.
- CO 3.** Analyze flag register status (Carry, Zero, Sign, Parity) and verify program results by examining memory and register contents, while debugging basic programming errors.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Understand and navigate the 8085 microprocessor training kit, including memory operations, register examination, code entry, and program execution using function keys	K ₁
CO2	Develop and execute assembly language programs for arithmetic operations (addition and multiplication) and logical operations (comparison for greater number, 1's and 2's complement) on 8-bit and 16-bit data.	K ₂
CO3	Analyze flag register status (Carry, Zero, Sign, Parity) and verify program results by examining memory and register contents, while debugging basic programming errors	K ₃ , K ₄ , K ₅ , K ₆

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1		1	1							1		1	
CO2		2			1									
CO3			2				1				1			1
CO(Average)	1	2	1.5	1	1		1				1		1	1

3 –High; 2 –Medium; 1 –Low

ENGINEERING PROJECT-1

Subject Code: -	BTEEE705P	IA Marks	40
Number of Lecture Hours/Week:-		Term End Exam Marks	60
Total Number of Lecture Hours: -		CREDITS	03

Course Objective:

Following are the intended objectives of the Project work:

1. To prepare students to use applications of the theory and practical learned during the course.
2. To help students to develop an industry or research oriented project.
3. To help students how to carry out project/studies in the field of interest of the student or as given by the industry

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	40
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including Medical leaves.	

GUIDELINES FOR PROJECT WORK

The Project work should be based on real/ live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Startup and this project to be carried over to next semester.

SUMMER INDUSTRIAL TRAINING

Subject Code: -	BTEEE706P	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objective:

Following are the intended objectives of the Project work:

1. Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
2. Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the „Industrial Internship“ in classroom will be use in classroom discussions.
5. Create conditions conducive to quest for knowledge and its applicability on the job

Assessment Plan:

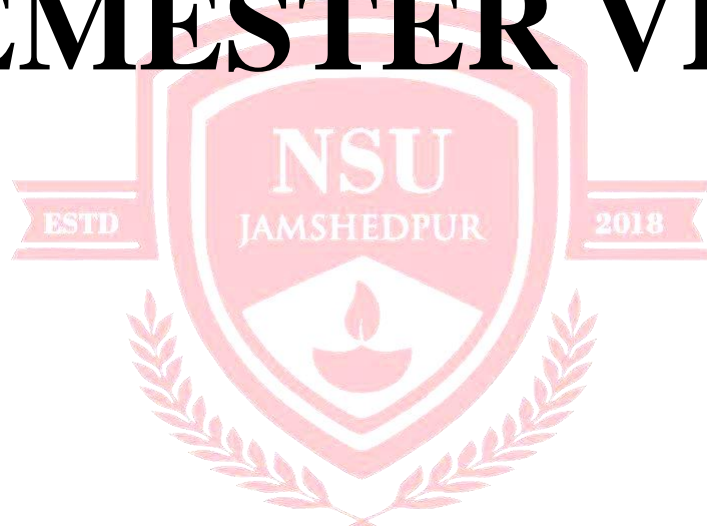
Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	40
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including Medical leaves.	

GUIDELINES FOR INTERNSHIP

Summer Internship –II should be undertaken in an industry only

S.No.	Suggested Schedule	Suggested Duration (In weeks)	Activities
1	Summer/winter vacation after 4th Semester	4-6	Inter/Intra Institutional Activities

SEMESTER VIII



POWER SYSTEM STABILITY AND CONTROL

Subject Code: -	BTEEE802	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objective:

Students will understand the concepts of POWER SYSTEM STABILITY and can apply the concept on standard bus system

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:**Module-I**

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation – real power vs frequency and reactive power vs. voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting - Basics of speed governing mechanisms and modelling - speed load characteristics - regulation of two generators in parallel.

Module-II

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - tie line modelling – block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variability model - integration of economic dispatch control with LFC.

Module-III

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

Module-IV

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem – solution of UC problem using priority list – special aspects of short term and long-term hydrothermal problems.

Module-V

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.

Textbooks/References:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010
2. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.
3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.
4. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.
5. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
6. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

At the end of this course students will demonstrate the ability

CO1: Explain the Indian power scenario, load dispatching centers, requirements of good power system, voltage and frequency regulation, real power vs frequency control, reactive power vs voltage control, load curves, load forecasting, and speed governing mechanisms with parallel generator regulation.

CO2: Analyze Load Frequency Control (LFC) for single and two area systems including static and dynamic analysis, uncontrolled and controlled cases, tie-line modeling, frequency bias control, state variability model, and integration with economic dispatch control.

CO3: Explain generation and absorption of reactive power, Automatic Voltage Regulator (AVR) loop with brushless AC excitation system, static and dynamic analysis, stability compensation, and methods of reactive power injection including tap changing transformers, SVC (TCR+TSC), and STATCOM.

CO4: Solve economic dispatch problems using incremental cost curves, optimal operation of thermal units with and without transmission losses, base point and participation factors method, unit commitment using priority list method, and understand hydrothermal scheduling aspects.

CO5: Explain computer control of power systems including energy control centers, PMU, SCADA and EMS functions, state estimation using weighted least square estimation, measurements and errors, various operating states, and state transition diagrams

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Explain Indian power scenario, load dispatching, voltage/frequency regulation, load curves, forecasting, and speed governing with parallel generator regulation.	K ₁
CO2	Analyze Load Frequency Control for single and two area systems including tie-line modeling, frequency bias control, and integration with economic dispatch.	K ₂
CO3	Explain reactive power control, AVR loop with brushless AC excitation, stability compensation, SVC, and STATCOM for voltage control.	K ₃
CO4	Solve economic dispatch using incremental cost curves, base point method, and unit commitment using priority list with hydrothermal aspects.	K ₃
CO5	Explain computer control of power systems including SCADA, EMS, state estimation using WLS, and various operating states with transition diagrams	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO4		2		1										
CO5											2	2		1
CO(Average)	3	1.5	2	2			1		1		2	2	1	1

3 –High; 2 –Medium; 1 –Low

INTERNET OF THINGS

Subject Code: -	BTEEE801	IA Marks	40
Number of Lecture Hours/Week:-	03	Term End Exam Marks	60
Total Number of Lecture Hours: -	45	CREDITS	03

Course Objective:

Students will understand the concepts of Internet of Things and can able to build IoT applications.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	60
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Course Content:**Module I**

INTRODUCTION TO IOT: Defining IoT, Characteristics of IoT, and Physical design of IoT. Logical design of IoT, Functional blocks of IoT, Communication models & APIs.

Module II

IOT & M2M: Machine to Machine, Difference between IoT and M2M. Software define Network

Module III

NETWORK & COMMUNICATION ASPECTS: Wireless medium access issues, MAC protocol survey. Survey routing protocols, Sensor deployment & Node discovery. Data aggregation & dissemination.

Module IV

CHALLENGES IN IOT: Design challenges, Development challenges. Security challenges, other challenges.

Module V

DOMAIN SPECIFIC APPLICATIONS OF IOT: Home automation, Industry applications. Surveillance applications, Other IoT applications.

Textbook/References:

1. A. Bahga and V. Madiseti, *Internet of Things: A Hands-On Approach*, 1st ed. Hyderabad, India: Universities Press, 2015.
2. I.A. Dhotre, **Internet of Things for SPPU 19 Course (Semester VII - Information Technology)**, 1st ed. Pune, India: Technical Publications, 2021.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Introduction To Internet Of Things	Prof. Sudip Misra	IIT Kharagpur
2	Design for Internet of Things	Prof. T V Prabhakar	IISc Bangalore

Course Outcomes:

At the end of this course students will demonstrate the ability

- CO1. Understand the concepts of Internet of Things
- CO2. Analyze basic protocols in wireless sensor network.
- CO3. Design IoT applications in different domain and be able to analyze their performance.
- CO4. Implement basic IoT applications on embedded platform.
- CO5. Application of IoT in automation of Commercial and Real world examples

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Understand the concepts of Internet of Things	K ₁
CO2	Analyze basic protocols in wireless sensor network.	K ₂
CO3	Design IoT applications in different domain and be able to analyze their performance.	K ₃
CO4	Implement basic IoT applications on embedded platform	K ₃
CO5	Application of IoT in automation of Commercial and Real world examples	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3						1		1					
CO2		1	2											
CO3				3									1	
CO4		2												
CO5											2	2		1
CO(Average)	3	1.5	2	3			1		1		2	2	1	1

3 –High; 2 –Medium; 1 –Low

DIGITAL SIGNAL PROCESSING LAB

Subject Code: -	BTEEE801P	IA Marks	30
Number of Lab Hours/Week: -	02	Term End Exam Marks	20
Total Number of Lecture Hours: -	15	CREDITS	01

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
Terminal Examination (TE)	Terminal Examination	20
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

LABORATORY

1. Familiarization of with MATLAB
2. Sample programming in MATLAB
3. Plot 5 different discrete signals using STEM
4. Find convolution of two signals
5. Find DFT of two discrete signals

6. Find FFT of discrete signal.

Laboratory Outcomes:

This laboratory course introduces students to the fundamentals of digital signal processing using MATLAB as a computational and visualization tool. Students will learn to generate and manipulate discrete signals, perform time-domain and frequency-domain analysis, and implement core signal processing algorithms. Upon completion of this course, students will be equipped with practical programming skills essential for analyzing and designing digital signal processing systems.

CO 1. Familiarize with the MATLAB environment, write and execute sample programs, and generate and plot five different discrete signals (unit impulse, step, ramp, exponential, and sinusoidal) using the STEM function.

CO 2. Compute and plot the linear convolution of two discrete signals to understand time-domain analysis of LTI systems.

CO 3. Compute and plot the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) of discrete signals to perform frequency-domain analysis.

Course Outcome No	Statement	Knowledge Level (KL)
CO1	Familiarize with MATLAB environment, write sample programs, and generate/plot five different discrete signals (impulse, step, ramp, exponential, sinusoidal) using the STEM function.	K ₁
CO2	Compute and plot the linear convolution of two discrete signals for time-domain analysis of LTI systems.	K ₂
CO3	Compute and plot DFT and FFT of discrete signals for frequency-domain analysis.	K ₃ , K ₄ , K ₅ , K ₆

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁-Remember, K₂- Understand, K₃- Apply, K₄- Analyze, K₅- Evaluate, K₆- Create

Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		1	1							1		1	
CO2		2			1									
CO3			2				1				1			1
CO(Average)	1	2	1.5	1	1		1				1		1	1

3 –High; 2 –Medium; 1 –Low

ENGINEERING PROJECT-2

Subject Code: -	BTEEE802P	IAMarks	80
Number of Lecture Hours/Week:-		Term End Exam Marks	120
Total Number of Lecture Hours: -		CREDITS	08

Course Objective:

Following are the intended objectives of the Project work:

The object of Project Work & Dissertation is to enable the student to extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In-depth study of the topic assigned in the light of the Report;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Internal Examination	80
Terminal Examination (TE)	Terminal Examination	120
Total		200
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

GUIDELINES FOR PROJECT WORK

The Project work should be based on real/ live problems of the Industry/Govt./NGO/ MSME/Rural Sector or an innovative idea having the potential of a Startup

