



# 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**



***ELECTRICAL AND ELECTRONICS ENGINEERING  
FOR***

**B.TECH. FOUR YEAR DEGREE COURSE**

***(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)

<b>PEO-1</b>	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
<b>PEO-2</b>	Pursue lifelong learning through professional development courses, higher education, or certifications to adapt to rapidly evolving technologies and global challenges
<b>PEO-3</b>	Demonstrate leadership, ethical responsibility, and the ability to work effectively in multidisciplinary teams to deliver engineering solutions for real-world problems
<b>PEO-4</b>	Innovate and contribute to the development of sustainable solutions addressing societal, environmental, and economic challenges through responsible engineering practices.

**PROGRAM OUTCOMES (POs)**

<b>PO-1</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering and technology to the solution of complex electrical and electronics engineering problems.
<b>PO-2</b>	<b>Problem analysis:</b> Identify, formulate, review existing literature, and analyze complex engineering problems to reach substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO-3</b>	<b>Design/Development of solutions:</b> 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.
<b>PO-4</b>	<b>Conduct investigations of complex problems:</b> 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.
<b>PO-5</b>	<b>Modern tool usage:</b> 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.
<b>PO-6</b>	<b>The engineer and society:</b> 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.
<b>PO-7</b>	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO-8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO-9</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO-10</b>	<b>Communication:</b> 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.
<b>PO-11</b>	<b>Project management and finance:</b> 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.
<b>PO-12</b>	<b>Life-long learning:</b> 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.

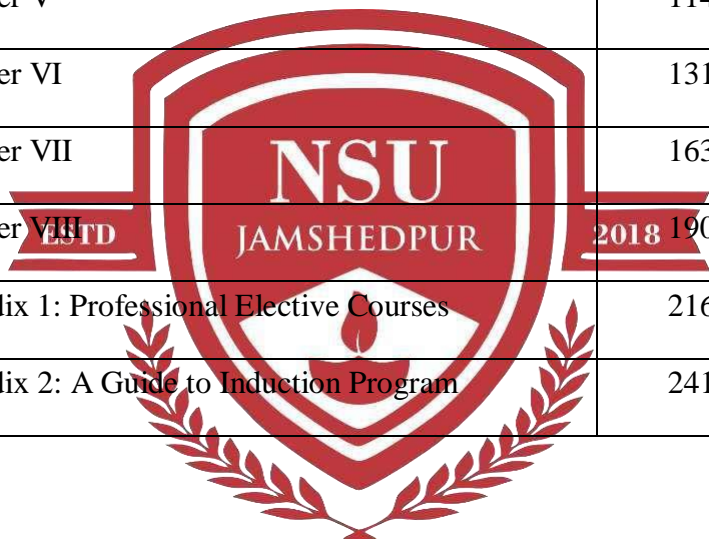
### **PROGRAM SPECIFIC OUTCOMES (PSOs)**

<b>PSO-1</b>	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.
<b>PSO-2</b>	Design and implement electronic circuits, embedded systems, and control systems for applications in automation, instrumentation, and consumer electronics.
<b>PSO-3</b>	Use modern tools, simulation software, and programming languages for modeling, analysis, and optimization of electrical and electronics systems while considering energy efficiency and sustainability.



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**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)
<b>Total</b>		<b>160*</b>

*\*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 &amp; 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
<b>Total Credits:</b>				<b>12</b>

**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
<b>Total Credits:</b>				<b>29</b>

**ENGINEERING SCIENCE COURSE [ESC] (Total 8)**

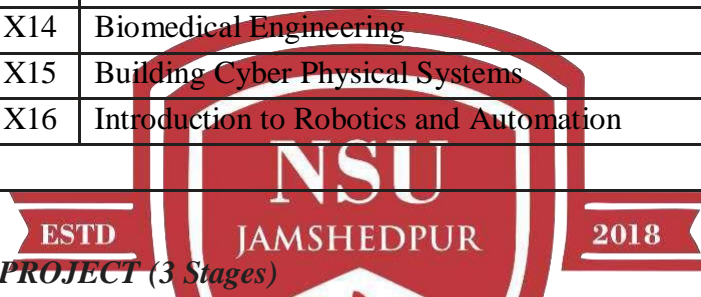
Sl.	Code No.	Subject	Semester	Credits
1	ESC 101	Basic Electrical Engineering	1	2:1:2=4
2	ESC 102	Engineering Graphics & Design	1	1:0:4=3
3	ESC 103	Design Thinking + Idea Lab (Audit)	1	0:0:2=1
4	ESC 104	Programming for Problem Solving	2	2:0:4=4
5	ESC 105	Manufacturing Practice Workshop	2	0:0:4=2
6	ESC 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
			<b>Total Credits:</b>	<b>27</b>

**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
<b>TOTAL</b>				<b>58</b>

**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
			<b>Total Credits:</b>	<b>12</b>

**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
			<b>Total Credits:</b>	<b>16</b>


**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
			<b>Total Credits:</b>	<b>6</b>

**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%20Induction%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"> <li>• Physical activity</li> <li>• Creative Arts</li> <li>• Universal Human Values</li> <li>• Literary</li> <li>• Proficiency Modules</li> <li>• Lectures by Eminent People</li> <li>• Visits to local Areas</li> <li>• Familiarization to Dept./Branch &amp; Innovations</li> </ul>

**Mandatory Visits/ Workshop/Expert Lectures:**

- It is mandatory to arrange one industrial visit every semester for the students of each branch.
- It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.
- 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.**

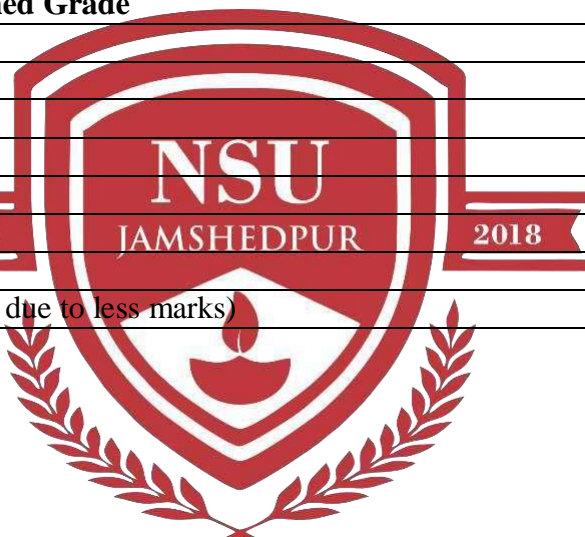
Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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 <sup>+</sup>
81-90	A
71-80	B <sup>+</sup>
61-70	B
51-60	C <sup>+</sup>
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
<b>Practical</b>										
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	-	-	-
<b>Total</b>				<b>13</b>	<b>2</b>	<b>12</b>	<b>20</b>	<b>320</b>	<b>380</b>	<b>700</b>

**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
<b>Practical</b>										
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
<b>Total</b>				<b>12</b>	<b>2</b>	<b>12</b>	<b>20</b>	<b>320</b>	<b>380</b>	<b>700</b>



**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
<b>Practical</b>										
7	BTEESC 301P	ESC	Basic Electronics Engineering Lab	-	-	2	1	30	20	50
8	BTEE401P	PCC	Network Analysis Lab	-	-	2	1	30	20	50
<b>Total</b>				<b>17</b>	<b>5</b>	<b>4</b>	<b>22</b>	<b>250</b>	<b>450</b>	<b>700</b>

**SEMESTER-IV**

Sl. No.	Code No.	Category	Name of the Subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTEEE 401	PCC	ESAP 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
<b>Practical</b>										
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
<b>Total</b>				<b>18</b>	<b>3</b>	<b>6</b>	<b>24</b>	<b>330</b>	<b>420</b>	<b>750</b>

**SEMESTER-V**

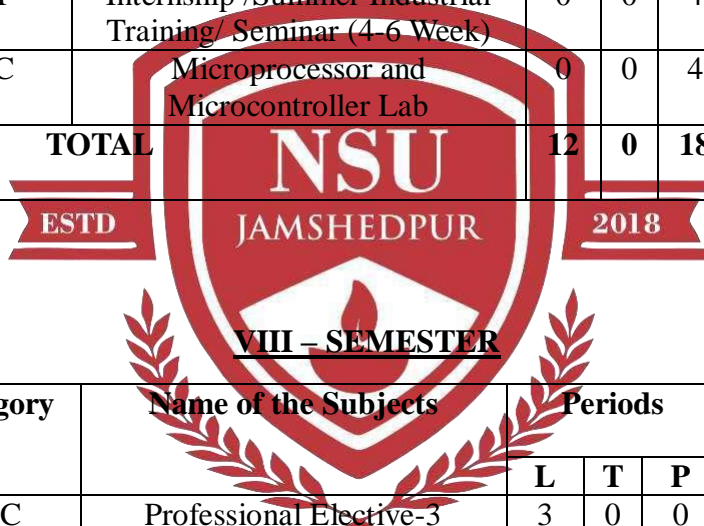
S. NO	Code No	Category	Name of the subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTECE501	PCC	Digital Electronics	3	1	0	4	40	60	100
2	BTECE502	PCC	Electrical Machines - II	3	1	0	4	40	60	100
3	BTECE504	PCC	Elements of Power System	3	0	0	3	40	60	100
4	BTECE505	PCC	Digital Signal Processing	3	0	0	3	40	60	100
5	BTHSMC506	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
<b>Practical</b>										
7	BTEEEE501P	PCC	Digital Electronics Lab	0	0	2	1	30	20	50
8	BTEEEE502P	PCC	Electrical Machines – II Lab	0	0	2	1	30	20	50
9	BTEEEE503P	PCC	Analog Electronics Lab	0	0	2	1	30	20	50
<b>TOTAL</b>				<b>15</b>	<b>2</b>	<b>8</b>	<b>21</b>	<b>330</b>	<b>420</b>	<b>750</b>

**SEMESTER-VI**

S. NO	Code No	Category	Name of the subjects	Periods			Credits	Marks		
				L	T	P		IA	TE	TM
1	BTEEEE601	PCC	Control Systems	3	0	0	3	40	60	100
2	BTEEEE602	PCC	Power System Analysis	3	1	0	4	40	60	100
3	BTEEEE603	PCC	Power Electronics	3	0	0	3	40	60	100
4	BTEEEE604	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	BTEEEEC606	EEC	Employment Enhancement Course – II	3	0	0	0	40	60	100
<b>Practical</b>										
8	BTEEEE602P	PCC	Power System Simulation Lab	0	0	2	1	30	20	50
9	BTEEEE603P	PCC	Power Electronics Lab	0	0	2	1	30	20	50
10	BTEEEE607P	EEC	Summer Internship - II	-	-	4	2	30	20	50
11	BTEEEE608P	EEC	Control System Lab	0	0	4	2	30	20	50
<b>TOTAL</b>				<b>18</b>	<b>1</b>	<b>8</b>	<b>27</b>	<b>360</b>	<b>440</b>	<b>800</b>

**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
<b>Practical</b>										
7	BTEEE 705P	PROJ	Engg. Project – 2 (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 706P	PCC	Microprocessor and Microcontroller Lab	0	0	4	2	30	20	50
<b>TOTAL</b>				<b>12</b>	<b>0</b>	<b>18</b>	<b>21</b>	<b>280</b>	<b>320</b>	<b>600</b>

**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
<b>Practical</b>										
3	BTEEE 803P	PROJ	Engineering Project-3 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
<b>Total</b>				<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>	<b>230</b>	<b>220</b>	<b>450</b>

**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	Microwave Engineering	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	Renewable Energy Systems	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	<b>01</b>
2	EEEC	Employment Enhancement Course-II	6	<b>01</b>
3	EEEC	Internship / Summer Industrial Training/ Seminar (4-6 Week)	5/7	<b>04</b>
4	EEEC	Engg Project – I/II/III	6/7/8	<b>15</b>



# SEMESTER –I



**ENGINEERING MATHEMATICS-I**

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

**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
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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)
<b>CO1</b>	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 <sub>1</sub>
<b>CO2</b>	The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.	K <sub>2</sub>
<b>CO3</b>	The tool of power series and Fourier series for learning advanced Engineering Mathematics.	K <sub>3</sub>
<b>CO4</b>	To deal with functions of several variables that are essential in most branches of engineering.	K <sub>2</sub>
<b>CO5</b>	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.	K <sub>2</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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)**

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

**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
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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 <sub>1</sub>

CO2	Use basic concepts to analyse and design a wide range of semiconductor devices.	K <sub>2</sub>
CO3	Understand & solve different types of wave equations.	K <sub>3</sub>
CO4	Use the principles of optics to solve various complex engineering problems.	K <sub>3</sub>
CO5	Use fundamental laws and relations to solve problems in electricity, electromagnetism.	K <sub>4</sub>

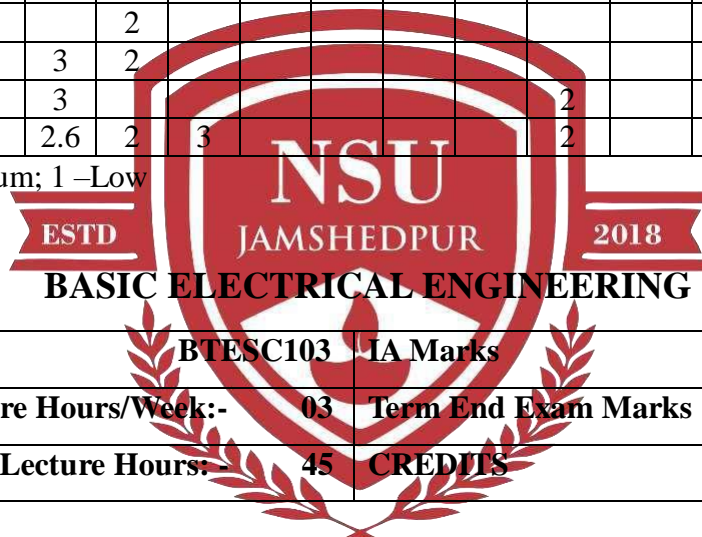
KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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			1

3 –High; 2 –Medium; 1 –Low



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

### 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
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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)**

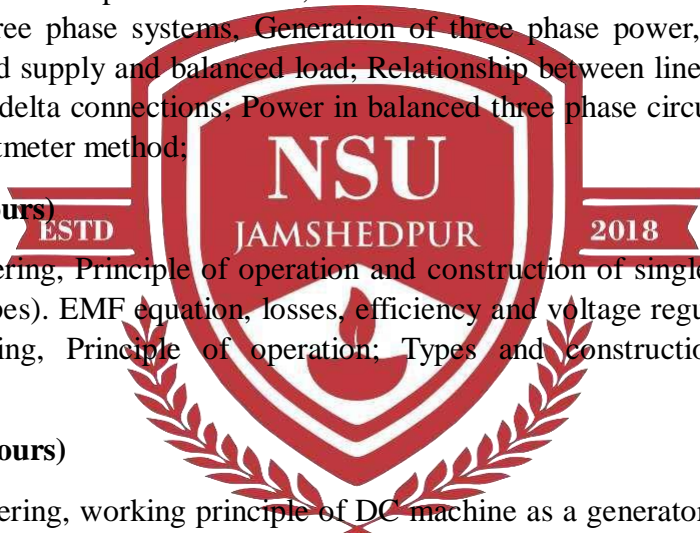
DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its 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 <sub>1</sub>
CO2	Use basic concepts to analyse and design a wide range of semiconductor devices.	K <sub>2</sub>
CO3	Understand & solve different types of wave equations.	K <sub>3</sub>
CO4	Use the principles of optics to solve various complex engineering problems.	K <sub>3</sub>
CO5	Use fundamental laws and relations to solve problems in electricity, electromagnetism.	K <sub>4</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- Create

**Course Articulation Matrix: (Mapping of COs with POs)**

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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**

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

**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
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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 <sub>1</sub>
CO2	To discuss the visual aspects of engineering design.	K <sub>2</sub>
CO3	To use engineering graphics standards.	K <sub>3</sub>
CO4	To illustrate solid modelling.	K <sub>2</sub>
CO5	To use computer-aided geometric design.	K <sub>3</sub>
CO6	To design creating, working, drawings.	K <sub>6</sub>
CO7	To inspect engineering communication.	K <sub>5</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- Create

**Course Articulation Matrix: (Mapping of COs with POs)**

CO	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

**Indian Knowledge System**

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

**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
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60

<b>Total</b>	100
<b>Attendance</b>	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 <sub>1</sub>
CO2	Introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care systems.	K <sub>2</sub>
CO3	Focuses on Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.	K <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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											
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

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

#### 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
<b>Internal Assessment (IA)</b>	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	20

<b>Total</b>	50
<b>Attendance</b>	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 <sub>1</sub>
CO2	Calculate thermal conductivity of poor conductors	K <sub>2</sub>
CO3	Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current	K <sub>3</sub>
CO4	Study the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance.	K <sub>2</sub>
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 <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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

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

### 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
<b>Internal Assessment (IA)</b>	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	20
<b>Total</b>		50
<b>Attendance</b>	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 <sub>1</sub>
CO2	Study the linear and nonlinear characteristics of different	K <sub>2</sub>

	types of loads experimentally.	
CO3	Design and experiment potential divider circuits	K <sub>3</sub>
CO4	Experimentally verify the basic circuit theorems.	K <sub>2</sub>
CO5	Measure power and power factor in ac circuits.	K <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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													
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: -	ESTD	BTESC104P	IA Marks	2018	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
<b>Internal Assessment (IA)</b>	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	20
<b>Total</b>		50
<b>Attendance</b>	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 lines 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 <sub>1</sub>
CO2	Understanding of architectural and engineering scales will increase.	K <sub>2</sub>
CO3	Able to draw orthographic projections and sections.	K <sub>3</sub>
CO4	Ability to produce engineered drawings will improve.	K <sub>2</sub>
CO5	Become familiar with office practice and standards.	K <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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(Average)	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.	<p>Electronic component familiarization, Understanding electronic system design flow. Schematic design and PCB layout and Gerber creation using EagleCAD. Documentation using Doxygen, Google Docs, Overleaf.</p> <p>Version control tools - GIT and GitHub.</p> <p>Basic 2D and 3D designing using CAD tools such as FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT.</p>	<p>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</p> <p>Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits,</p>
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).	

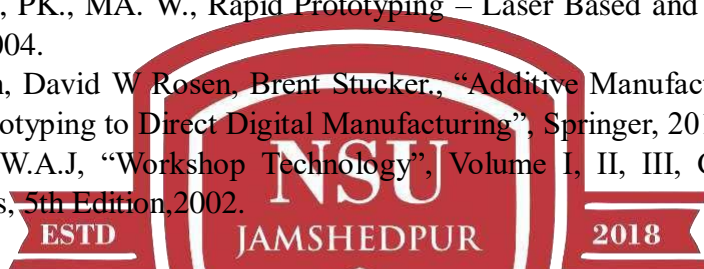
**Laboratory Activities:**

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 <sub>1</sub>
CO2	Analyse emotional experience and inspect emotional expressions to better understand users while designing innovative products.	K <sub>3</sub>
CO3	Develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.	K <sub>4</sub>
CO4	Propose real-time innovative engineering product designs and choose appropriate frameworks, strategies, techniques during prototype development.	K <sub>4</sub>
CO5	Perceive individual differences and its impact on everyday decisions and further Create a better customer experience.	K <sub>3</sub>

KL- Bloom’s Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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											
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

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

### 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, Dhyanchand 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 <sub>1</sub>
CO2	To learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.	K <sub>3</sub>
CO3	To learn breathing exercises and healthy fitness activities	K <sub>4</sub>
CO4	To understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.	K <sub>4</sub>
CO5	To perform yoga movements in various combination and forms.	K <sub>3</sub>
CO6	To assess current personal fitness levels.	K <sub>4</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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													
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**

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

**Course Objective:**

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

**Assessment Plan:**

Criteria	Description	Maximum Marks
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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 <sub>1</sub>
CO2	The effective mathematical tools for the solutions of differential equations that model physical processes.	K <sub>2</sub>
CO3	The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.	K <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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(Average)	3	1	2	3			1		1				1	

3 –High; 2 –Medium; 1 –Low

## ENGINEERING CHEMISTRY

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

### 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
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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 H<sub>3</sub>, H<sub>2</sub>F 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. Vollhardt 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)
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1	Determination of surface tension and viscosity.	<a href="http://pcv-au.vlabs.ac.in/physical-chemistry/Determination%20of%20Viscosity%20of%20Organic%20Solvents/">http://pcv-au.vlabs.ac.in/physical-chemistry/Determination of Viscosity of Organic Solvents/</a>
2	Ion exchange column for removal of hardness of water.	<a href="http://icv-au.vlabs.ac.in/inorganic-chemistry/Water%20Analysis%20Determination%20of%20Chemical%20Parameters/">http://icv-au.vlabs.ac.in/inorganic-chemistry/Water Analysis Determination of Chemical Parameters/</a>
3	Determination of chloride content of water.	<a href="http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental%20Engineering%201/experiments/determination-of-chloride-nitk/simulation.html">http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental Engineering 1/experiments/determination-of-chloride-nitk/simulation.html</a>
4	Colligative properties using freezing point depression.	<a href="http://pcv-au.vlabs.ac.in/physical-chemistry/Cryoscopy/">http://pcv-au.vlabs.ac.in/physical-chemistry/Cryoscopy/</a>
5	Determination of the rate constant of a reaction.	<a href="http://pcv-au.vlabs.ac.in/physical-chemistry/EMF%20Measurement/">http://pcv-au.vlabs.ac.in/physical-chemistry/EMF Measurement/</a>
6	Determination of cell constant and conductance of solutions.	<a href="http://icv-au.vlabs.ac.in/inorganic-chemistry/Water%20Analysis%20Determination%20of%20Physical%20Parameters/">http://icv-au.vlabs.ac.in/inorganic-chemistry/Water Analysis Determination of Physical Parameters/</a>
7	Potentiometry - determination of redox potentials and EMFs.	<a href="http://pcv-au.vlabs.ac.in/physical-chemistry/EMF%20Measurement/">http://pcv-au.vlabs.ac.in/physical-chemistry/EMF Measurement/</a>
8	Saponification/acid value of an oil.	<a href="http://biotech01.vlabs.ac.in/bio-chemistry/Estimation%20of%20Saponification%20Value%20of%20Fats%20or%20Oils/">http://biotech01.vlabs.ac.in/bio-chemistry/Estimation of Saponification Value of Fats or Oils/</a>

**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 <sub>1</sub>
CO2	To rationalise bulk properties and processes using thermodynamic considerations.	K <sub>2</sub>
CO3	To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	K <sub>3</sub>
CO4	To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.	K <sub>3</sub>
CO5	To list major chemical reactions that are used in the synthesis of molecules.	K <sub>4</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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

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

### Course Objective:

- 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
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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 vocalics 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 <sub>1</sub>
CO2	Understanding verbal and non-verbal modes of communication effectively in practical situations	K <sub>2</sub>
CO3	Analyzing vocalics and basic grammar.	K <sub>3</sub>
CO4	Creating competence in reading and writing.	K <sub>6</sub>
CO5	Evaluation of speaking process.	K <sub>5</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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 \(ISBN: 978-93-91505-219\)](#)

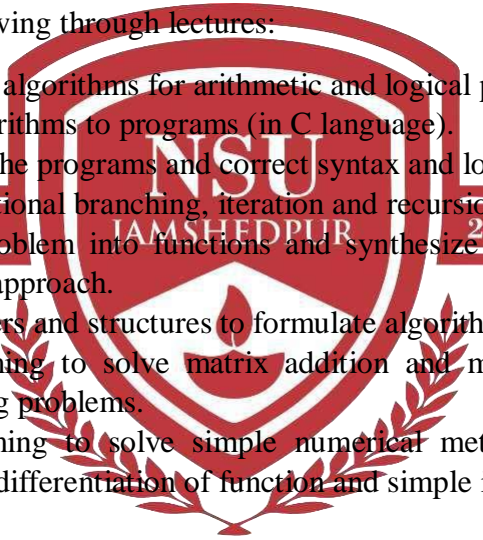
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

**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 <sub>1</sub>
CO2	To translate the algorithms to programs (in C language).	K <sub>2</sub>
CO3	To test and execute the programs and correct syntax and logical errors.	K <sub>3</sub>
CO4	To implement conditional branching, iteration and recursion.	K <sub>4</sub>
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.	K <sub>1</sub>
CO6	To use arrays, pointers and structures to formulate algorithms and programs.	K <sub>3</sub>
CO7	To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.	K <sub>3</sub>
CO8	To apply programming to solve simple numerical method	K <sub>3</sub>

	problems, namely rot finding of function, differentiation of function and simple integration.	
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KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	1			2									1	
CO4					2					2				
CO5											2			
CO6	3													
CO7	1		2				1							
CO8														
CO(Average)	2	1	2	2	2	2	1		1				1	

3 –High; 2 –Medium; 1 –Low

UNIVERSAL HUMAN VALUES

<b>Subject Code: -</b>	<b>BTHSMC 205</b>	<b>IA Marks</b>	<b>40</b>
<b>Number of Lecture Hours/ Week: -</b>	<b>03</b>	<b>Term End Exam Marks</b>	<b>60</b>
<b>Total Number of Lecture Hours: -</b>	<b>45</b>	<b>CREDITS</b>	<b>03</b>

### 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.

- 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.

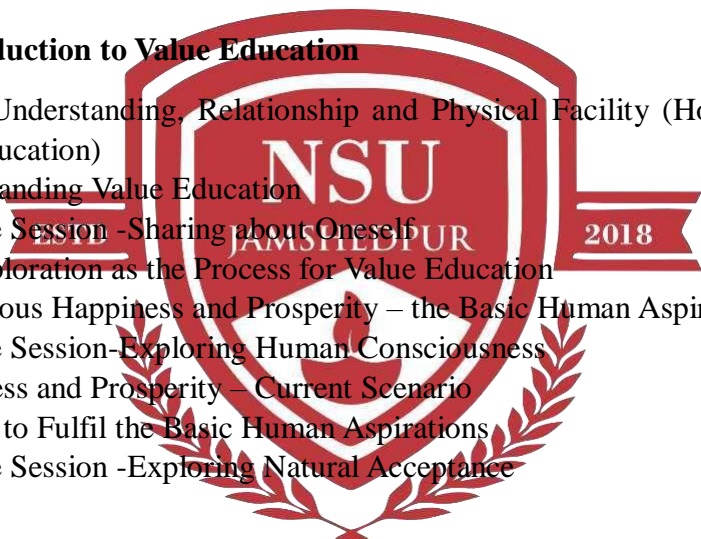
**Assessment Plan:**

Criteria	Description	Maximum Marks
<b>Internal Assessment (IA)</b>	Internal Examination	30
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	60
<b>Total</b>		100
<b>Attendance</b>	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 <sub>1</sub>
CO2	Analyze harmony in self, family, society, and nature for ethical and responsible living.	K <sub>4</sub>
CO3	Apply human values and ethics in professional and personal life for a value-based society.	K <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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
<b>Internal Assessment (IA)</b>	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	20
<b>Total</b>		50
<b>Attendance</b>	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 <sub>1</sub>
CO2	To measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.	K <sub>2</sub>
CO3	To synthesize a small drug molecule and analyze a salt sample.	K <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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
<b>Terminal Examination (TE)</b>	Terminal Examination	20
<b>Total</b>		50
<b>Attendance</b>	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

1. 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 <sub>1</sub>
CO2	Make effective oral presentations by interpreting and analysing data, pictures and videos and participate in Group Discussion on general topics	K <sub>2</sub>
CO3	Make meaningful conversations and follow logical flow of thought; answer questions on key concepts after listening to extended passages.	K <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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:

- 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
<b>Internal Assessment (IA)</b>	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	20
<b>Total</b>		50
<b>Attendance</b>	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:**

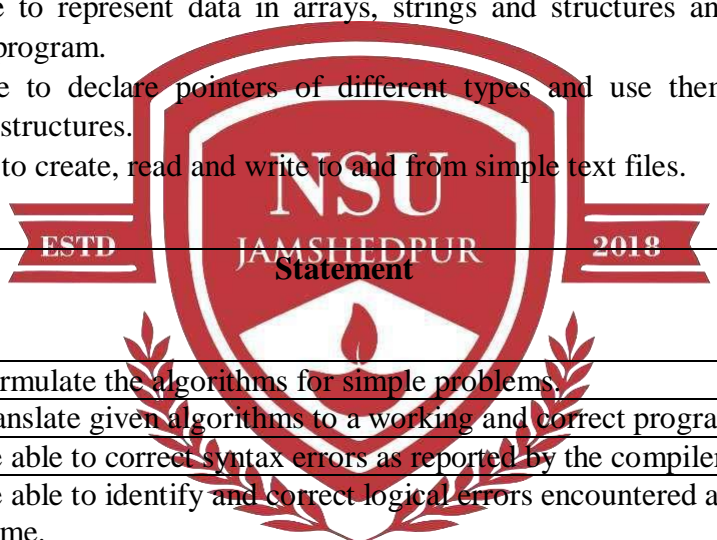
S. No.	Experiment Name	Experiment Link(s)
1	Simple computational problems using arithmetic expressions.	<a href="http://ps-iiith.vlabs.ac.in/exp7/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab">http://ps-iiith.vlabs.ac.in/exp7/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab</a>
2	Iterative problems e.g., sum of series.	<a href="http://ps-iiith.vlabs.ac.in/exp4/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab">http://ps-iiith.vlabs.ac.in/exp4/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab</a>
3	1D Array manipulation.	<a href="http://cse02-iiith.vlabs.ac.in/exp4/index.html">http://cse02-iiith.vlabs.ac.in/exp4/index.html</a>
4	Matrix problems, String operations.	<a href="http://ps-iiith.vlabs.ac.in/exp5/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab">http://ps-iiith.vlabs.ac.in/exp5/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab</a>
5	Simple functions.	<a href="http://cse02-iiith.vlabs.ac.in/exp2/index.html">http://cse02-iiith.vlabs.ac.in/exp2/index.html</a>

6	Programming for solving Numerical methods problems.	<a href="http://ps-iiith.vlabs.ac.in/exp1/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab">http://ps-iiith.vlabs.ac.in/exp1/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab</a>
7	Recursive functions.	<a href="http://ps-iiith.vlabs.ac.in/exp6/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab">http://ps-iiith.vlabs.ac.in/exp6/Introduction.html?domain=Computer%20Science&amp;lab=Problem%20Solving%20Lab</a>

### 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 <sub>1</sub>
CO2	To translate given algorithms to a working and correct program.	K <sub>2</sub>
CO3	To be able to correct syntax errors as reported by the compilers.	K <sub>3</sub>
CO4	To be able to identify and correct logical errors encountered at run time.	K <sub>1</sub>
CO5	To be able to write iterative as well as recursive programs.	K <sub>1</sub>
CO6	To be able to represent data in arrays, strings and structures and manipulate them through a program.	K <sub>2</sub>
CO7	To be able to declare pointers of different types and use them in defining self-referential structures.	K <sub>2</sub>
CO8	To be able to create, read and write to and from simple text files.	K <sub>6</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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

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

#### 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
<b>Internal Assessment (IA)</b>	Internal Examination	20
	Attendance/Discipline	5
	Assignment/ Seminar	5
<b>Terminal Examination (TE)</b>	Terminal Examination	20
<b>Total</b>		50
<b>Attendance</b>	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).	<a href="http://mm-coep.vlabs.ac.in/LaserSpotWelding/Theory.html?domain=Mechanical%20Engineering&amp;lab=Welcome%20to%20Micromachining%20laboratory">http://mm-coep.vlabs.ac.in/LaserSpotWelding/Theory.html?domain=Mechanical%20Engineering&amp;lab=Welcome%20to%20Micromachining%20laboratory</a>

2	Casting	<a href="http://fab-coep.vlabs.ac.in/exp7/Theory.html?domain=Mechanical%20Engineering&amp;lab=Welcome%20to%20FAB%20laboratory">http://fab-coep.vlabs.ac.in/exp7/Theory.html?domain=Mechanical%20Engineering&amp;lab=Welcome%20to%20FAB%20laboratory</a>
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**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 <sub>1</sub>
CO2	To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	K <sub>2</sub>
CO3	To design small devices of their interest by assembling different components.	K <sub>3</sub>

KL- Bloom's Knowledge Level (K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub>, K<sub>4</sub>, K<sub>5</sub>, K<sub>6</sub>)

K<sub>1</sub>-Remember, K<sub>2</sub>- Understand, K<sub>3</sub>- Apply, K<sub>4</sub>- Analyze, K<sub>5</sub>- Evaluate, K<sub>6</sub>- 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	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