BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(An Autonomous Institution affiliated to VTU, Belagavi)
Yelahanka, Bengaluru- 560 119

Bachelor of Engineering (B.E.)

Scheme and Syllabus
of
I & II Semesters 2025 Scheme

AY 2025-26

List of First year Courses for the Academic Year 2025-2026

Sl. No	Course Code	Name of the Course
Applied Mathematics I & II Course (Program Specific)		
1.	1BMATCS101	Calculus and Linear Algebra
2.	1BMATEC101	Differential Calculus, Ordinary Differential Equations and Linear Algebra
3.	1BMATME101	Differential Calculus and Linear Algebra
4.	1BMATCV101	Linear Algebra, Differential Calculus and Ordinary Differential Equations
5.	1BMATCS201	Ordinary Differential Equations and Numerical Methods
6.	1BMATEC201	Calculus, Numerical Methods and Laplace Transforms
7.	1BMATME201	Multivariate Calculus and Numerical Methods
8.	1BMATCV201	Calculus and Numerical Methods
Applied Physics Course (Program Specific)		
9.	1BPHYCS102/202	Physics of Quantum Computing and Applications
10.	1BPHYEC102/202	Quantum Physics and Optoelectronics
11.	1BPHYEE102/202	Physics of Electrical Engineering Materials
12.	1BPHYME102/202	Physics of Materials
13.	1BPHYCV102/202	Physics of Structural Materials
Applied Chemistry Course (Program Specific)		
14.	1BCHECS102/202	Chemistry of Smart Material and Devices
15.	1BCHEEC102/202	Smart Materials for Energy Applications
16.	1BCHEME102/202	Advanced Metal Protection and Sustainable Energy Systems
17.	1BCHECV102/202	Structural Materials and Sustainable Technologies
Computer Aided Engineering Drawing (Program Specific)		
18.	1BCEDCS103/203	Computer Aided Engineering Drawing for CSE Stream
19.	1BCEDEC103/203	Computer Aided Engineering Drawing for ECE Stream
20.	1BCEDEE103/203	Computer Aided Engineering Drawing for EEE Stream
21.	1BCEDME103/203	Computer Aided Engineering Drawing for ME Stream
22.	1BCEDCV103/203	Computer Aided Engineering Drawing for CV Stream
Emerging Technology Course		
23.	1BAI103/203	Introduction to AI and Applications
Engineering Science Course - I (ESC I)		
24.	1BESC104A/204A	Essentials of Information Technology
25.	1BESC104B/204B	Introduction to Electronics Engineering
26.	1BESC104C/204C	Introduction to Electrical Engineering
27.	1BESC104D/204D	Introduction to Mechanical Engineering
28.	1BESC104E/204E	Building Science and Mechanics
Programming Language Course (PLC)		
29.	1BPLC105A/205A	Introduction to C Programming
30.	1BPLC105B/205B	Python Programming

Program Specific Course (PSC)		
31.	1BPIC105/205	Programming in C
32.	1BBEE105/205	Basic Electronics
33.	1BEEE105/205	Elements of Electrical Engineering
34.	1BEME105/205	Elements of Mechanical Engineering
35.	1BEMM105/205	Engineering Mechanics
Program Specific Course Laboratory (PSCL)		
36.	1BPICL106/206	C Programming Laboratory
37.	1BBEEL106/206	Basic Electronics Laboratory
38.	1BEEEL106/206	Basic Electrical Engineering Laboratory
39.	1BEMEL106/206	Basic Mechanical Engineering Laboratory
40.	1BEMML106/206	Mechanics and Materials Laboratory
AEC, AEC NCMC & HSMC		
41.	1BSS107	Soft Skills
42.	1BIDTL108	Innovation and Design Thinking
43.	1BSK109/1BBK109	Samskrutika Kannada /Balake Kannada
44.	1BPECL206	Professional English Communication
45.	1BIC207	Indian Constitution and Engineering Ethics
46.	1BPRJ208	Interdisciplinary Project

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

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Scheme of Teaching and Examinations – 2025 Scheme

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26 onwards)

I Semester (PHYSICS CYCLE)

Sl. No.	Course Category	Course Code	Course Name	Teaching Department	Credits Distribution Summary				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (Hours)	
1	BSC	1BMATXX101	Applied Mathematics I Course (Stream Specific)	Maths	3	1	0	4	50	50	100	3	5
2	BSC (IC)	1BPHYXX102	Applied Physics Course (Stream Specific)	Physics	3	0	1	4	50	50	100	3	5
3	ESC	1BCEDXX103	Computer Aided Engineering Drawing (Stream Specific)	ME	2	0	1	3	50	50	100	3	4
4	ESC	1BESC104X	Engineering Science Course I	Concerned Department	3	0	0	3	50	50	100	3	3
5	PSC	1BXXX105	Program Specific Course	Concerned Department	3	0	0	3	50	50	100	3	3
6	PSC	1BXXXL106	Program Specific Course Laboratory	Concerned Department	0	0	1	1	50	50	100	3	2
7	AEC (NCMC)	1BSS107	Soft Skills	Humanities	0	0	0	0	100	-	100	-	2
8	AEC	1BIDTL108	Innovation and Design Thinking	Any Department	0	0	1	1	50	50	100	2	2
9	HSMC	1BSK109/ 1BBK109	Samskrutika Kannada / Balake Kannada	Humanities	1	0	0	1	50	50	100	1	1
TOTAL					**15**	**1**	**4**	**20**	**500**	**400**	**900**		**27**

BSC- Basic Science Course. **IC**- Integrated Course (Practical course integrated with theory course). **PSC**- Program Specific Course, **ESC**- Engineering Science Course. **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course. **HSMC**- Humanities, Social Sciences, and Management Courses, **NCMC**- Non Credit Mandatory Course. **PLC**- Programming language Course, **CIE** - Continuous Internal Evaluation. **SEE**- Semester End Examination.

Credit Definition: 1-hour Lecture (L) per week = 1 Credit	04-Credit courses are designed for 50 hours of Teaching-Learning Session.
2-hoursTutorial (T) per week = 1 Credit	04-Credit (IC) is designed for 40 hours' theory and 10-12 practical sessions of 2 hours
2-hours Practical (P) / Drawing (P) / Project Work (PW) per week = 1 Credit	03-Credit courses are designed for 40 hours of Teaching-Learning Session
	02- Credit courses are designed for 25 hours of Teaching-Learning Session
	01-Credit courses are to be designed for 15 hours of Teaching-Learning sessions

Applied Mathematics I Course (Program Specific)						Applied Physics Course (Program Specific)					
Sl. No.	Course Code	Course Name	Teaching Hours			Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P				L	T	P
1	1BMATCS101	Calculus and Linear Algebra (CSE and allied programs)	3	2	0	1	1BPHYCS102	Physics of Quantum Computing and Applications (CSE and allied programs)	3	0	2
2	1BMATEC101	Differential Calculus, Ordinary Differential Equations and Linear Algebra (ECE and EEE programs)	3	2	0	2	1BPHYEC102	Quantum Physics and Optoelectronics (ECE program)	3	0	2
3	1BMATME101	Differential Calculus and Linear Algebra (ME program)	3	2	0	3	1BPHYEE102	Physics of Electrical Engineering Materials (EEE programs)	3	0	2
4	1BMATCV101	Linear Algebra, Differential Calculus and Ordinary Differential Equations (CV program)	3	2	0	4	1BPHYME102	Physics of Materials (ME program)	3	0	2
						5	1BPHYCV102	Physics of Structural Materials (CV program)	3	0	2

Computer Aided Engineering Drawing (Program Specific)						Engineering Science Course - I (ESC I)					
Sl. No.	Course Code	Course Name	Teaching Hours			Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P				L	T	P
1	1BCEDCS103	Computer Aided Engineering Drawing for CSE Stream	2	0	2	1	1BESC104A	Essentials of Information Technology	3	0	0
2	1BCEDEC103	Computer Aided Engineering Drawing for ECE Program	2	0	2	2	1BESC104B	Introduction to Electronics Engineering	3	0	0
3	1BCEDEE103	Computer Aided Engineering Drawing for EEE Program	2	0	2	3	1BESC104C	Introduction to Electrical Engineering	3	0	0
4	1BCEDME103	Computer Aided Engineering Drawing for ME Stream	2	0	2	4	1BESC104D	Introduction to Mechanical Engineering	3	0	0
5	1BCEDCV103	Computer Aided Engineering Drawing for CV Stream	2	0	2	5	1BESC104E	Building Science and Mechanics	3	0	0

Program Specific Course (PSC)						Program Specific Course Laboratory (PSCL)					
Sl. No.	Course Code	Course Name	Teaching Hours			Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P				L	T	P
1	1BPIC105	Programming in C	3	0	0	1	1BPICL106	C Programming Laboratory	0	0	2
2	1BBEE105	Basic Electronics	3	0	0	2	1BBEEL106	Basic Electronics Laboratory	0	0	2
3	1BEEE105	Elements of Electrical Engineering	3	0	0	3	1BEEEL106	Basic Electrical Engineering Laboratory	0	0	2
4	1BEME105	Elements of Mechanical Engineering	3	0	0	4	1BEMEL106	Basic Mechanical Engineering Laboratory	0	0	2
5	1BEMM105	Engineering Mechanics	3	0	0	5	1BEMML106	Mechanics and Materials Laboratory	0	0	2

Integrated courses (IC), combining theory with practical components:

(i) Theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.

(ii) Theory components shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).

(iii) The practical component shall be assessed only through CIE.

The Mathematics / Physics courses shall be taught by a single faculty member per session, with no sharing of the course modules. Tutorial sessions for Mathematics will be conducted to strengthen students' problem-solving skills.

Programme Specific Courses (PSC): Programme Specific Courses (PSC) are a set of core courses tailored to a specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in the chosen field. Students must select and complete the course from this group that corresponds to their admitted program stream. Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the **Programme Specific Courses Laboratory (PSCL) group.**

Computer-Aided Engineering Drawing: The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.

Engineering Sciences Courses-I (ESC-I): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other stream courses. Students are required to select and complete two courses that are not belong to their admitted program stream. For example, a student admitted to Mechanical Engineering program should not select 'Introduction to Mechanical Engineering' but to select any other two courses. One course shall be selected under ESC-I and another course under ESC-II. The two courses must be different from the other.

The Student Induction Programme (SIP), initiated by the All India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, Proficiency Modules. Lectures shall be by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions.

AICTE Activity Points Requirement for BE/B.Tech. Programmes

As per AICTE guidelines (refer Chapter 6 – AICTE Activity Point Program, Model Internship Guidelines), in addition to academic requirements, students must earn a specified number of Activity Points to be eligible for the award of their degree.

- Regular students admitted to a 4-year degree program must earn **100 Activity Points.**
- Lateral entry students (joining from the second year) must earn **75 Activity Points.**
- Students transferred from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into the Institution.

These Activity Points are non-credit and will not be considered for the SGPA/CGPA or be used for vertical progression. However, they are mandatory for the award of the degree, and the points earned will be reflected on the eighth semester Grade Card. The hours spent for earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity. If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released.

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Scheme of Teaching and Examinations – 2025 Scheme

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26 onwards)

II Semester (For the students who have studied Physics cycle courses in the I semester)

Sl. No.	Course Category	Course Code	Course Name	Teaching Department	Credits Distribution Summary				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (Hours)	
1	BSC	1BMATXX201	Applied Mathematics II Course (Stream Specific)	Maths	3	1	0	4	50	50	100	3	5
2	BSC (IC)	1BCHEXX202	Applied Chemistry Course (Stream Specific)	Chemistry	3	0	1	4	50	50	100	3	5
3	ETC	1BAI203	Introduction to AI and Applications	CSE and Allied Departments	3	0	0	3	50	50	100	3	3
4	ESC	1BESC204X	Engineering Science Course II	Concerned Department	3	0	0	3	50	50	100	3	3
5	PLC (IC)	1BPLC205X	Programing Language Course	CSE and Allied departments	3	0	1	4	50	50	100	3	5
6	AEC	1BPECL206	Professional English Communication	Humanities	0	0	1	1	50	50	100	2	2
7	HSMC (NCMC)	1BIC207	Indian Constitution and Engineering Ethics	Humanities	0	0	0	0	100	-	100	1	1
8	AEC	1BPRJ208	Interdisciplinary Project	Any Department	0	0	1	1	50	50	100	2	2
TOTAL					**15**	**1**	**4**	**20**	**450**	**350**	**800**		**26**

BSC- Basic Science Course, **IC**- Integrated Course (Practical course integrated with theory course), **PSC**- Program Specific Course, **ESC**- Engineering Science Course, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSMC**- Humanities, Social Sciences, and Management Courses, **NCMC**- Non Credit Mandatory Course, **PLC**- Programming language Course, **CIE** - Continuous Internal Evaluation, **SEE**- Semester End Examination.

Credit Definition: 1-hour Lecture (L) per week = 1 Credit	04-Credit courses are designed for 50 hours of Teaching-Learning Session.
2-hoursTutorial (T) per week = 1 Credit	04-Credit (IC) is designed for 40 hours' theory and 10-12 practical sessions of 2 hours
2-hours Practical (P) / Drawing (P) / Project Work (PW) per week = 1 Credit	03-Credit courses are designed for 40 hours of Teaching-Learning Session
	02- Credit courses are designed for 25 hours of Teaching-Learning Session
	01-Credit courses are to be designed for 15 hours of Teaching-Learning sessions

Applied Mathematics II Course (Program Specific)					
Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P
1	1BMATCS201	Ordinary Differential Equations and Numerical Methods (CSE and allied programs)	3	2	0
2	1BMATEC201	Calculus, Numerical Methods and Laplace Transforms (ECE and EEE programs)	3	2	0
3	1BMATME201	Multivariate Calculus and Numerical Methods (ME program)	3	2	0
4	1BMATCV201	Calculus and Numerical Methods (CV program)	3	2	0

Applied Chemistry Course (Program Specific)					
Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P
1	1BCHECS202	Chemistry of Smart Materials and Devices (CSE and allied programs)	3	0	2
2	1BCHEEC202	Smart Materials for Energy Applications (ECE and EEE programs)	3	0	2
3	1BCHEME202	Advanced Metal Protection and Sustainable Energy Systems (ME program)	3	0	2
4	1BCHECV202	Structural Materials and Sustainable Technologies (CV program)	3	0	2

Engineering Science Course II (ESC II)					
Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P
1	1BESC204A	Essentials of Information Technology	3	0	0
2	1BESC204B	Introduction to Electronics Engineering	3	0	0
3	1BESC204C	Introduction to Electrical Engineering	3	0	0
4	1BESC204D	Introduction to Mechanical Engineering	3	0	0
5	1BESC204E	Building Science and Mechanics	3	0	0

Programing Language Course (PLC)					
Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P
1	1BPLC205A	Introduction to C Programming (For ECE, EEE, ME and CV Programs)	3	0	2
2	1BPLC205B	Python Programming (For CSE and Allied Programs)	3	0	2

Integrated courses (IC), combining theory with practical components:

i. Theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.
ii. Theory components shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
iii. The practical component shall be assessed only through CIE.

The Mathematics / Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course modules. Tutorial sessions for Mathematics will be conducted to strengthen students' problem-solving skills.

Professional English Communication course shall be conducted in a laboratory environment with 1 hour of teaching followed by another 1 hour of laboratory session.

Engineering Sciences Courses-II (ESC-II): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete a course under ESC-II that does not belong to their admitted program stream. Students should select a course other than that was selected under ESC-I and other than course not belonging to their stream.

For the course **Interdisciplinary Project**, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering, and Computer Science and Engineering, working collaboratively to design and implement the project.

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Scheme of Teaching and Examinations – 2025 Scheme

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26 onwards)

I Semester (CHEMISTRY CYCLE)

Sl. No.	Course Category	Course Code	Course Name	Teaching Department	Credits Distribution Summary				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (Hours)	
1	BSC	1BMATXX101	Applied Mathematics I Course (Stream Specific)	Maths	3	1	0	4	50	50	100	3	5
2	BSC (IC)	1BCHEXX102	Applied Chemistry Course (Stream Specific)	Chemistry	3	0	1	4	50	50	100	3	5
3	ETC	1BAI103	Introduction to AI and Applications	CSE and Allied Departments	3	0	0	3	50	50	100	3	3
4	ESC	1BESC104X	Engineering Science Course I	Concerned Department	3	0	0	3	50	50	100	3	3
5	PLC (IC)	1BPLC105X	Programming Language Course	CSE and Allied Departments	3	0	1	4	50	50	100	3	5
6	AEC	1BPECL106	Professional English Communication	Humanities	0	0	1	1	50	50	100	2	2
7	HSMC (NCMC)	1BIC107	Indian Constitution and Engineering Ethics	Humanities	0	0	0	0	100	-	100	-	1
8	AEC	1BIDTL108	Innovation and Design Thinking	Any Department	0	0	1	1	50	50	100	2	2
TOTAL					**15**	**1**	**4**	**20**	**450**	**350**	**800**		**26**

BSC- Basic Science Course, **IC**- Integrated Course (Practical course integrated with theory course), **PSC**- Program Specific Course, **ESC**- Engineering Science Course, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSMC**- Humanities, Social Sciences, and Management Courses, **NCMC**- Non Credit Mandatory Course, **PLC**- Programming language Course, **CIE** - Continuous Internal Evaluation, **SEE**- Semester End Examination.

Credit Definition: 1-hour Lecture (L) per week = 1 Credit	04-Credit courses are designed for 50 hours of Teaching-Learning Session.
2-hoursTutorial (T) per week = 1 Credit	04-Credit (IC) is designed for 40 hours' theory and 10-12 practical sessions of 2 hours
2-hours Practical (P) / Drawing (P) / Project Work (PW) per week = 1 Credit	03-Credit courses are designed for 40 hours of Teaching-Learning Session
	02- Credit courses are designed for 25 hours of Teaching-Learning Session
	01-Credit courses are to be designed for 15 hours of Teaching-Learning sessions

Applied Mathematics I Course (Program Specific)						Applied Chemistry Course (Program Specific)					
Sl. No.	Course Code	Course Name	Teaching Hours			Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P				L	T	P
1	1BMATCS101	Calculus and Linear Algebra (CSE and allied programs)	3	2	0	1	1BCHECS102	Chemistry of Smart Materials and Devices (CSE and allied programs)	3	0	2
2	1BMATEC101	Differential Calculus, Ordinary Differential Equations and Linear Algebra (ECE and EEE programs)	3	2	0	2	1BCHEEC102	Smart Materials for Energy Applications (ECE and EEE programs)	3	0	2
3	1BMATME101	Differential Calculus and Linear Algebra (ME program)	3	2	0	3	1BCHEME102	Advanced Metal Protection and Sustainable Energy Systems (ME program)	3	0	2
4	1BMATCV101	Linear Algebra, Differential Calculus and Ordinary Differential Equations (CV program)	3	2	0	4	1BCHECV102	Structural Materials and Sustainable Technologies (CV program)	3	0	2

Engineering Science Course I (ESC I)						Programing Language Course (PLC)					
Sl. No.	Course Code	Course Name	Teaching Hours			Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P				L	T	P
1	1BESC104A	Essentials of Information Technology	3	0	0	1	1BPLC105A	Introduction to C Programming (For ECE, EEE, ME and CV Programs)	3	0	2
2	1BESC104B	Introduction to Electronics Engineering	3	0	0	2	1BPLC105B	Python Programming (For CSE and Allied Programs)	3	0	2
3	1BESC104C	Introduction to Electrical Engineering	3	0	0						
4	1BESC104D	Introduction to Mechanical Engineering	3	0	0						
5	1BESC104E	Building Science and Mechanics	3	0	0						

Integrated courses (IC), combining theory with practical components:

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iii. The practical component shall be assessed only through CIE.

The Mathematics / Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course modules. Tutorial sessions for Mathematics will be conducted to strengthen students' problem-solving skills.

Engineering Sciences Courses-I (ESC-I): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other stream courses. Students are required to select and complete two courses that are not belong to their admitted program stream. For example, a student admitted to Mechanical Engineering program should not select 'Introduction to Mechanical Engineering' but to select any other two courses. One course shall be selected under ESC-I and another course under ESC-II. The two courses must be different from the other.

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AICTE Activity Points Requirement for BE/B.Tech. Programmes

As per AICTE guidelines (refer Chapter 6 – AICTE Activity Point Program, Model Internship Guidelines), in addition to academic requirements, students must earn a specified number of Activity Points to be eligible for the award of their degree.

- Regular students admitted to a 4-year degree program must earn **100 Activity Points.**
- Lateral entry students (joining from the second year) must earn **75 Activity Points.**
- Students transferred from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into the Institution.

These Activity Points are non-credit and will not be considered for the SGPA/CGPA or be used for vertical progression. However, they are mandatory for the award of the degree, and the points earned will be reflected on the eighth semester Grade Card. The hours spent for earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity. If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released.

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Scheme of Teaching and Examinations – 2025 Scheme

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26 onwards)

II Semester (For the students who have studied Chemistry cycle courses in the I semester)

Sl. No.	Course Category	Course Code	Course Name	Teaching Department	Credits Distribution Summary				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (Hours)	
1	BSC	1BMATXX201	Applied Mathematics II Course (Stream Specific)	Maths	3	1	0	4	50	50	100	3	5
2	BSC (IC)	1BPHYXX202	Applied Physics Course (Stream Specific)	Physics	3	0	1	4	50	50	100	3	5
3	ESC	1BCEDXX203	Computer Aided Engineering Drawing (Stream Specific)	ME	2	0	1	3	50	50	100	3	4
4	ESC	1BESC204X	Engineering Science Course II	Concerned Department	3	0	0	3	50	50	100	3	3
5	PSC	1BXXX205	Program Specific Course	Concerned Department	3	0	0	3	50	50	100	3	3
6	PSC	1BXXXL206	Program Specific Course Laboratory	Concerned Department	0	0	1	1	50	50	100	3	2
7	AEC (NCMC)	1BSS207	Soft Skills	Humanities	0	0	0	0	100	-	100	-	2
8	AEC	1BPRJ208	Interdisciplinary Project	Any Department	0	0	1	1	50	50	100	2	2
9	HSMC	1BSK209/ 1BBK209	Samskrutika Kannada / Balake Kannada	Humanities	1	0	0	1	50	50	100	1	1
TOTAL					**15**	**1**	**4**	**20**	**500**	**400**	**900**		27

BSC- Basic Science Course, **IC**- Integrated Course (Practical course integrated with theory course), **PSC**- Program Specific Course, **ESC**- Engineering Science Course, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSMC**- Humanities, Social Sciences, and Management Courses, **NCMC**- Non Credit Mandatory Course, **PLC**- Programming language Course, **CIE** - Continuous Internal Evaluation, **SEE**- Semester End Examination.

Credit Definition: 1-hour Lecture (L) per week = 1 Credit 2-hoursTutorial (T) per week = 1 Credit 2-hours Practical (P) / Drawing (P) / Project Work (PW) per week = 1 Credit	04-Credit courses are designed for 50 hours of Teaching-Learning Session. 04-Credit (IC) is designed for 40 hours' theory and 10-12 practical sessions of 2 hours 03-Credit courses are designed for 40 hours of Teaching-Learning Session 02- Credit courses are designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning sessions

Applied Mathematics II Course (Program Specific)						Applied Physics Course (Program Specific)					
Sl. No.	Course Code	Course Name	Teaching Hours			Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P				L	T	P
1	1BMATCS201	Ordinary Differential Equations and Numerical Methods (CSE and allied programs)	3	2	0	1	1BPHYCS202	Physics of Quantum Computing and Applications (CSE and allied programs)	3	0	2
2	1BMATEC201	Calculus, Numerical Methods and Laplace Transforms (ECE and EEE programs)	3	2	0	2	1BPHYEC202	Quantum Physics and Optoelectronics (ECE program)	3	0	2
3	1BMATME201	Multivariate Calculus and Numerical Methods (ME program)	3	2	0	3	1BPHYEE202	Physics of Electrical Engineering Materials (EEE programs)	3	0	2
4	1BMATCV201	Calculus and Numerical Methods (CV program)	3	2	0	4	1BPHYME202	Physics of Materials (ME program)	3	0	2
						5	1BPHYCV202	Physics of Structural Materials (CV program)	3	0	2

Computer Aided Engineering Drawing (Program Specific)						Engineering Science Course - II (ESC II)					
Sl. No.	Course Code	Course Name	Teaching Hours			Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P				L	T	P
1	1BCEDCS203	Computer Aided Engineering Drawing for CSE Stream	2	0	2	1	1BESC204A	Essentials of Information Technology	3	0	0
2	1BCEDEC203	Computer Aided Engineering Drawing for ECE Program	2	0	2	2	1BESC204B	Introduction to Electronics Engineering	3	0	0
3	1BCEDEE203	Computer Aided Engineering Drawing for EEE Program	2	0	2	3	1BESC204C	Introduction to Electrical Engineering	3	0	0
4	1BCEDME203	Computer Aided Engineering Drawing for ME Stream	2	0	2	4	1BESC204D	Introduction to Mechanical Engineering	3	0	0
5	1BCEDCV203	Computer Aided Engineering Drawing for CV Stream	2	0	2	5	1BESC204E	Building Science and Mechanics	3	0	0

Program Specific Course (PSC)						Program Specific Course Laboratory (PSCL)					
Sl. No.	Course Code	Course Name	Teaching Hours			Sl. No.	Course Code	Course Name	Teaching Hours		
			L	T	P				L	T	P
1	1BPIC205	Programming in C	3	0	0	1	1BPICL206	C Programming Laboratory	0	0	2
2	1BBEE205	Basic Electronics	3	0	0	2	1BBEEL206	Basic Electronics Laboratory	0	0	2
3	1BEEE205	Elements of Electrical Engineering	3	0	0	3	1BEEEL206	Basic Electrical Engineering Laboratory	0	0	2
4	1BEME205	Elements of Mechanical Engineering	3	0	0	4	1BEMEL206	Basic Mechanical Engineering Laboratory	0	0	2
5	1BEMM205	Engineering Mechanics	3	0	0	5	1BEMML206	Mechanics and Materials Laboratory	0	0	2

Integrated courses (IC), combining theory with practical components: i. Theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week. ii. Theory components shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). iii. The practical component shall be assessed only through CIE.
The Mathematics / Physics courses shall be taught by a single faculty member per session, with no sharing of the course modules. Tutorial sessions for Mathematics will be conducted to strengthen students' problem-solving skills.
Programme Specific Courses (PSC): Programme Specific Courses (PSC) are a set of core courses tailored to a specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in the chosen field. Students must select and complete the course from this group that corresponds to their admitted program stream. Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the **Programme Specific Courses Laboratory (PSCL) group.**
Computer-Aided Engineering Drawing: The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.
Engineering Sciences Courses-II (ESC-II): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete a course under ESC-II that does not belong to their admitted program stream. Students should select a course other than that was selected under ESC-I and other than course not belonging to their stream.
For the course **Interdisciplinary Project,** it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering, and Computer Science and Engineering, working collaboratively to design and implement the project.

CoE 3/9/2025

Dean Academics 03.09.25

PRINCIPAL 3/9/25

ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮತ್ತು ವ್ಯವಸ್ಥಾಪನಾ ಮಹಾವಿದ್ಯಾಲಯ
BMS Institute of Technology & Management
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560 119

NOTIFICATION

Ref No.: BMSITM/EXAM/2025/352 **Date:** 24.10.2025

CONTINUOUS INTERNAL EVALUATION (CIE) AND SEMESTER END EXAMINATION (SEE) PATTERN

(Applicable only for the 2025 Batch UG students and onwards)

The UG students admitted during the academic year 2025 batch and onwards are hereby informed to note the following regarding Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) pattern:

- The Weightage of CIE is 50% and for SEE is 50%.
- The Minimum passing mark for the CIE is 40% of the Maximum marks (i.e. 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (i.e. 18 out of 50 marks).
- A student will be declared to have passed the course, if they secure a minimum of 40% (i.e. 40 marks out of 100) in the combined total of the CIE and SEE.

The following tables summarize the CIE and SEE Patterns for the courses of various credits:

<table>
<tr><th colspan="6">IPCC COURSES: 4 CREDITS</th></tr>
<tr><th colspan="2">Evaluation Type</th><th>Internal Assessments (IAs)</th><th>Test/ Exam Marks Conducted for</th><th>Marks to be scaled down to</th><th>Min. Marks to be Scored</th><th>Evaluation Details</th></tr>
<tr><td rowspan="3">Theory Component</td><td rowspan="2">CIE – IA Tests</td><td>CIE – Test 1 (1.5 hr)</td><td>40</td><td rowspan="2">25</td><td rowspan="2">-</td><td rowspan="2">The sum of the two internal assessment tests will be 80 Marks and the obtained marks will be scaled down to 25 Marks.</td></tr>
<tr><td>CIE – Test 2 (1.5 hr)</td><td>40</td></tr>
<tr><td colspan="2">Total CIE Theory</td><td></td><td>25</td><td>10</td><td></td></tr>
<tr><td>Practical Component</td><td colspan="2">CIE - Practical</td><td>30</td><td>15</td><td>-</td><td>Each laboratory experiment is to be evaluated for 30 Marks</td></tr>
</table>

					using appropriate rubrics.
	CIE Practical Test	50	10	-	One test after all experiments to be conducted for **50 Marks** and obtained marks will be scaled down to **10 Marks**
	Total CIE Practical		**25**	**10**	
Total CIE Theory + Practical			**50**	**20**	
SEE		100	50	18	SEE exam is a theory exam, conducted for **100 Marks**, obtained marks will be scaled down to **50 Marks.**
CIE + SEE			**100**	**40**	
The practical component of the IPCC shall be for CIE only.					

Professional Core Courses (PCC) / Engineering Science Courses (ESC) / Professional Elective Courses (PEC) / Open Elective Courses (OEC): 03 or 02 Credits						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be **80 Marks** and the obtained marks will be scaled down to **30 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE - CCAs	CCA	20	20	-	Any **Two assessment methods** can be used from the list. If it is project-based, one CCA shall be given.
	Total CIE Theory			**50**	**20**	
SEE			100	50	18	SEE exam is a theory exam, conducted for **100 Marks**, obtained marks will be scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	

Computer Aided Engineering Drawing (1BCEDCS/CV/ME/EE/EC 103 / 203)								
Evaluation Type		**Topics/ Modules**	**Preparatory Sketch**	**Computer Printout**	**Max Marks**	**Total Marks**	**Marks to be scaled down to**	**Minimum Marks to Pass**
CIE	Sketch Book and CAD Modelling	Projection of Points	05	05	10	150	30	-
		Projection of Lines	05	10	15			
		Projection of Planes	10	15	25			
		Projection of Solids	15	25	40			
		Isometric Projection	10	15	25			
		Development of lateral surfaces	10	15	25			
		Module 5	05	05	10			
	Test 1	Module 1&2	12	18	30	70	20	-
		Module 3	16	24	40			
	Test 2	Module 3	16	24	40	70		
		Module 4	12	18	30			
CIE TOTAL MARKS							**50**	**20**
SEE		Module 1& 2	12	18	30	100	**50**	**18**
		Module 3	16	24	40			
		Module 4	12	18	30			
CIE + SEE							**100**	**40**

Professional Core Course Laboratory (PCCL) /Ability Enhancement Course Laboratory (AEC) - 01 Credit					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	CIE - Practical	30	30		Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE - Practical Test	50	20		One test after all experiments is to be conducted for **50 Marks** and to be scaled down to **20 Marks**.
	Total CIE	-	**50**	**20**	
SEE		100	50	18	SEE to be conducted for **100 Marks** using an appropriate Rubrics.
CIE+SEE		**100**		**40**	

Innovation and Design Thinking (1BIDTL108) 01 Credit					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	Problem Space Review	50	25	-	
	Solution Space Review	50	25	-	
	Total CIE	-	**50**	**20**	
SEE		100	50	18	SEE will be conducted in batches for **100 Marks** where the students will exhibit their projects along with the presentation and viva-voce. The obtained marks will be scaled down to **50 Marks**
CIE+SEE		**100**		**40**	

Samskruthika Kannada (1BSK109/209), Balake Kannada (1BBK109/209): 01 credit and Any other 01 Credit Courses – MCQ Type						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation (CIE)	CIE – IA Tests (MCQs)	CIE – Test 1 (1 hr)	40	40	-	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on a higher Bloom's level. The sum of the two internal assessment tests will be **80 Marks**, and the same will be scaled down to **40 Marks**.
		CIE – Test 2 (1 hr)	40			
	CIE - CCAs	CCA	10	10	-	Any One Assessment method can be used from the list provided below.
	Total CIE			**50**	**20**	

SEE- MCQ Type		50	18	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on higher Bloom's level. MCQ-type question papers of 50 questions with each question of a **01 Mark**, examination duration is 01 hour.
CIE + SEE		**100**	**40**	

Professional Communication Skills 1BPECL106/206 **01 Credit Course**						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	CIE-IA Tests (MCQs + Written)	CIE-Test 1 (1 hr- MCQ on Quiklrn platform)	50	-	-	CIE will be conducted in the end of the semester in the lab. The sum of the two internal assessment tests will be 100 marks and the same will be scaled down to 50 marks.
		CIE-Test 1 (1 hr- Written)	50			
Total CIE			**100**	**50**	**20**	
SEE **(MCQ Type on quiklrn + Viva)**				50	18	SEE wll be conducted in batches for 50 Marks. MCQ type on Quiklrn for 40 marks and Viva for 10 marks.
CIE + SEE				**100**	**40**	

Soft Skills (1BSS107/207) Non-credit Mandatory Course					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	Continuus assessment through activities	100	-	40	16 activities will be assessed during their regular classes.
Total CIE		**100**	**100**	**40**	
No SEE for this course					

Indian Constitution and Engineering ethics (1BIC107/207) Non-credit Mandatory Course					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	CIE-IA Tests (MCQs)	CIE-Test 1 (1 hr)	50	-	The question paper pattern for this course shall be an MCQ of 1 mark each. The sum of the two internal assessment tests will be 100
		CIE-Test 2 (1 hr)	50	-	
Total CIE		**100**	**100**	**40**	
No SEE for this course					

Learning Activities for CCAs:

A faculty member may choose the following CCAs based on the needs of the course:

1. Course project
2. Literature review
3. MOOC
4. Case studies
5. Tool exploration
6. GATE-based aptitude test

7. Open book tests
8. Industry integrated learning
9. Analysis of Industry / Technical / Business reports
10. Programming assignments with higher Bloom level
11. Group discussions
12. Industrial / Social / Rural projects

CoE 24/10/2025

Dean AA 24.10.2025

Principal 24/10/25.

Copy To:

1. The Vice-Principal, Deans, HoDs, and Associate HoDs
2. All faculty members and UG students of 2025 batch.
3. Examination Section

Applied Mathematics I & II Course (Program Specific)

1. **Calculus and Linear Algebra 1BMATCS101**
2. **Differential Calculus, Ordinary Differential Equations and Linear Algebra 1BMATEC101**
3. **Differential Calculus and Linear Algebra 1BMATME101**
4. **Linear Algebra, Differential Calculus and Ordinary Differential Equations 1BMATCV101**
5. **Ordinary Differential Equations and Numerical Methods 1BMATCS201**
6. **Calculus, Numerical Methods and Laplace Transforms1BMATEC201**
7. **Multivariate Calculus and Numerical Methods1BMATME201**
8. **Calculus and Numerical Methods 1BMATCV201**

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CALCULUS AND LINEAR ALGEBRA (Common to CSE, AIML & CSBS Branches)		Semester	I
Course Code	1BMATCS101	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorial	Total Marks	100
Credits	4	Exam Hours	3 Hours
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Determine the rate of change of multivariate functions using partial differentiation.

CO2: Apply the fundamental operations of vector calculus and curvilinear coordinates in engineering applications.

CO3: Compute the solution of system of linear equations, eigenvalues and eigenvectors using matrix methods.

CO4: Solve problems on vector spaces and linear transformations involving basis, orthogonality, decomposition and the Rank–Nullity theorem.

Module-1: Multivariate Calculus

Introduction, Partial differentiation, total derivative, differentiation of composite functions, Jacobians, Statement of Taylor's and Maclaurin's series expansion for two variables. Maxima and minima for the function of two variables.

Number of Hours: 8 Hours

Module-2: Vector Calculus

Introduction, Scalar and vector fields, Gradient, directional derivatives, divergence and curl - physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential.

Introduction to polar coordinates and polar curves. Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality.

Number of Hours: 8 Hours

Module-3: Solution of System of Linear Equations, Eigenvalues and Eigenvectors

Introduction, Elementary row transformation of a matrix, Echelon form, rank of a matrix. Solution of homogeneous system of linear equations, Consistency and solution of non-homogeneous system of linear equations- Gauss elimination method, LU decomposition method. Applications: Traffic flow. Eigenvalues and Eigenvectors, Diagonalization of 2x2 matrix.

Number of Hours: 8 Hours

Module-4: Vector Space

Introduction, Definition and examples, subspace: definition and examples. Linear Combinations, linear span, linearly independent and dependent sets, basis and dimension, row space and column space of a matrix, Coordinates vector, inner products and orthogonality. Singular value decomposition.

Number of Hours: 8 Hours

Module-5: Linear Transformations

Introduction, Definition and examples, algebra of linear transformations, matrix of a linear transformation. Singular, non-singular linear transformations and invertible linear transformations. Rank and nullity of linear transformations, Rank-Nullity theorem.

Number of Hours: 8 Hours

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **Gilbert Strang**: "Linear Algebra and its Applications", Cengage Publications, 4th Ed., 2022.

Reference books / Manuals:

1. **Srimanta Pal and Subodh C. Bhunia**: "Engineering Mathematics", Oxford University Press, 3rd Ed., 2016.
2. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
3. **C. Ray Wylie and Louis C. Barrett**: "Advanced Engineering Mathematics", McGraw Hill Book Co., New York, 6th Ed., 2017.
4. **James Stewart**: "Calculus", Cengage Publications, 7thEd., 2019.
5. **David C Lay**: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

Web links and Video Lectures (e-Resources):

1. **http://academicearth.org/**
2. **VTU e-Shikshana Program**
3. **VTU EDUSAT Program**
4. **https://nptel.ac.in/courses/111106135**
5. **https://nptel.ac.in/courses/111105160**
6. **https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/**
7. **https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/**

Teaching-Learning Process (Innovative Delivery Methods*):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching learning process and facilitate the achievement of course outcomes.

1. State the need for Mathematics with Engineering Studies and Provide real-life examples.
2. Support and guide the students for self–study.
3. Assigning homework, grading assignments and quizzes, and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.
5. Show short-related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Name of the CCA 1:	Tool Exploration - OnRamp Courses with MATLAB
Maximum marks:	10
Brief description about the CCA 1:	
Number of activities: 1 (2 onramp courses to be completed) • **MATLAB OnRamp** (Common to all branches) – 5 Marks • Stream-specific course – 5 Marks: ➢ IT Stream – **Introduction to Linear Algebra** ➢ Non-IT stream – **Introduction to Symbolic Math**	

Name of the CCA 2:	GATE based aptitude quiz
Maximum marks:	10
Brief description about the CCA 2:	
➢ Module covered: Module 4 – Vector Space ➢ GATE based 10 multiple choice questions each carrying 1 mark.	

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Rubrics for Learning Activity -1

Performance parameters	**Marks**
Submission of course completion certificates well within the timeline specified	5 Marks
Delay in submission of course completion certificates	1 – 4 Marks
Non-submission of course completion certificates	0 marks

Rubrics for Learning Activity -2

Performance parameters	**Marks**
Correct Answer	1 Mark
Incorrect Answer	0 Mark

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DIFFERENTIAL CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA (Common to ECE & EEE Branches)		Semester	I
Course Code	1BMATEC101	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorial	Total Marks	100
Credits	04	Exam Hours	3 Hours
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Apply calculus for problems related to polar curves.

CO2: Apply series expansions, L'Hospital's rule and multivariable calculus techniques for problems involving single and multivariable functions.

CO3: Solve first order ordinary differential equations and nonlinear forms arising in physical and engineering applications.

CO4: Determine solution of higher order ordinary differential equations with constant and variable coefficients using appropriate methods.

CO5: Compute the solution of system of linear equations, eigenvalues and eigenvectors using matrix methods.

Module-1: Polar Curves and Curvature

Introduction, Polar curves, angle between the radius vector and the tangent, angle between the polar curves, pedal equations. Curvature and radius of curvature in Cartesian, polar, parametric and pedal forms.

Number of Hours: 8 Hours

Module-2: Power Series Expansions, Indeterminate Forms and Multivariate Calculus

Introduction, Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms $(0^0, \infty^0, 1^\infty)$- L'Hospital's rule. Partial differentiation, total derivative, differentiation of composite functions. Jacobians, Maxima and minima for a function of two variables.

Number of Hours: 8 Hours

Module-3: Ordinary Differential Equations of First Order

Introduction, Bernoulli's equations, Exact and reducible to exact differential equations- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$ only. Orthogonal trajectories, L-R and C-R circuits.

Nonlinear differential equations: Introduction to general and singular solutions, equations solvable for p only, Clairaut's equations, equations reducible to Clairaut's form.

Number of Hours: 8 Hours

Module-4: Ordinary Differential Equations of Higher Order

Introduction, Solution of homogeneous linear ODE, solution of non-homogeneous linear ODE of higher order with constant coefficients $f(D)y = X$ using inverse differential operator where $X = e^{ax}, X = sin(ax+b)$ or $cos(ax+b)$ and X is a polynomial, Method of variation of parameters. Solution of linear ODE with variable coefficients- Cauchy's and Legendre's differential equations. L-C-R circuits.

Number of Hours: 8 Hours

Module-5: Linear Algebra

Introduction, Elementary transformations on a matrix, Echelon form, rank of a matrix. Consistency and Solution of system of linear equations- Gauss elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors of a square matrix, Rayleigh's Power method to determine the dominant eigenvalue of a square matrix.

Number of Hours: 8 Hours

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5. https://nptel.ac.in/courses/111105160
6. https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
7. https://www.youtube.com/watch?v=wsOoClvZmic&list=PL1C22D4DED943EF7B

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The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

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- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and**
- **SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Name of the CCA 1:	Tool Exploration - OnRamp Courses with MATLAB
Maximum marks:	10
Brief description about the CCA 1:	
Number of activities: 1 (2 onramp courses to be completed) • **MATLAB OnRamp** (Common to all branches) – 5 Marks • Stream-specific course – 5 Marks: ➢ IT Stream – **Introduction to Linear Algebra** ➢ Non-IT stream – **Introduction to Symbolic Math**	

Name of the CCA 2:	GATE based aptitude quiz
Maximum marks:	10
Brief description about the CCA 2:	
➢ Module covered: Module 3 - Ordinary Differential Equations of First Order ➢ GATE based 10 multiple choice questions each carrying 1 mark.	

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Rubrics for Learning Activity -1

Performance parameters	**Marks**
Submission of course completion certificates well within the timeline specified	5 Marks
Delay in submission of course completion certificates	1 – 4 Marks
Non-submission of course completion certificates	0 marks

Rubrics for Learning Activity -2

Performance parameters	**Marks**
Correct Answer	1 Mark
Incorrect Answer	0 Mark

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DIFFERENTIAL CALCULUS AND LINEAR ALGEBRA (For Mechanical Branch)		Semester	I
Course Code	1BMATME101	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorial	Total Marks	100
Credits	04	Exam Hours	3 Hours
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Apply calculus for problems related to polar curves.

CO2: Apply series expansions, L'Hospital's rule and multivariable calculus techniques for problems involving single and multivariable functions.

CO3: Solve first order ordinary differential equations and nonlinear forms arising in physical and engineering applications.

CO4: Compute the solution of system of linear equations, eigenvalues and eigenvectors using matrix methods.

Module-1: Polar curves and Curvature

Introduction, Polar curves, angle between the radius vector and the tangent, angle between the polar curves, pedal equations. Curvature and radius of curvature in Cartesian, polar, parametric, and pedal forms.

Number of Hours: 8 Hours

Module-2: Power Series Expansions, Indeterminate Forms and Multivariate Calculus

Introduction, Statement, and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms ($0^0, \infty^0, 1^\infty$)- L'Hospital's rule. Partial differentiation, total derivative, differentiation of composite functions, Jacobians, Maxima and minima for a function of two variables.

Number of Hours: 8 Hours

Module-3: Ordinary Differential Equations of First Order

Introduction, Bernoulli's equations, Exact and reducible to exact differential equations- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$ only. Orthogonal trajectories, Law of natural growth and decay.

Nonlinear differential equations: Introduction to general and singular solutions, equations solvable for p only, Clairaut's equations, equations reducible to Clairaut's form.

Number of Hours: 8 Hours

Module-4: Solution of System of Linear Equations

Introduction, Elementary row transformation of a matrix, Echelon form, rank of a matrix. Inverse of matrix by Jordan method. Consistency and Solution of system of linear equations- Gauss elimination method, LU decomposition method and approximate solution by Gauss-Seidel method.

Number of Hours: 8 Hours

Module-5: Linear Algebra

Introduction, Eigenvalues and Eigenvectors, Rayleigh's Power method to determine the dominant eigenvalue of a square matrix. Diagonalization of 2x2 matrix. Inverse of a matrix by Cayley-Hamilton theorem, Characteristic and minimal polynomials of block matrices, Moore-Penrose pseudoinverse.

Number of Hours: 8 Hours

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **Gilbert Strang**: "Linear Algebra and its Applications", Cengage Publications, 4th Ed., 2022.

Reference books / Manuals:

1. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
2. **James Stewart**: "Calculus", Cengage Publications, 7thEd., 2019.
3. **David C Lay**: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

Web links and Video Lectures (e-Resources):

1. **http://academicearth.org/**
2. VTU e-Shikshana Program
3. VTU EDUSAT Program
4. **https://nptel.ac.in/courses/111106135**
5. **https://nptel.ac.in/courses/111105160**
6. **https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/**
7. **https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/**

Teaching-Learning Process (Innovative Delivery Methods*):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching learning process and facilitate the achievement of course outcomes.

1. State the need for Mathematics with Engineering Studies and Provide real-life examples.
2. Support and guide the students for self–study.
3. Assigning homework, grading assignments and quizzes, and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.
5. Show short-related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Name of the CCA 1:	Tool Exploration - OnRamp Courses with MATLAB
Maximum marks:	10
Brief description about the CCA 1:	
Number of activities: 1 (2 onramp courses to be completed) • **MATLAB OnRamp** (Common to all branches) – 5 Marks • Stream-specific course – 5 Marks: ➢ IT Stream – **Introduction to Linear Algebra** ➢ Non-IT stream – **Introduction to Symbolic Math**	

Name of the CCA 2:	GATE based aptitude quiz
Maximum marks:	10
Brief description about the CCA 2:	
➢ Module covered: Module 3 - Ordinary Differential Equations of First Order ➢ GATE based 10 multiple choice questions each carrying 1 mark.	

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Rubrics for Learning Activity -1

Performance parameters	**Marks**
Submission of course completion certificates well within the timeline specified	5 Marks
Delay in submission of course completion certificates	1 – 4 Marks
Non-submission of course completion certificates	0 marks

Rubrics for Learning Activity -2

Performance parameters	**Marks**
Correct Answer	1 Mark
Incorrect Answer	0 Mark

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LINEAR ALGEBRA , DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS (For Civil Branch)		Semester	I
Course Code	1BMATCV101	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorial	Total Marks	100
Credits	04	Exam Hours	3 Hours
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Compute the solution of system of linear equations, eigenvalues and eigenvectors using matrix methods.
CO2: Apply calculus for problems related to polar curves.
CO3: Apply series expansions, L'Hospital's rule and multivariable calculus techniques for problems involving single and multivariable functions.
CO4: Solve first order ordinary differential equations and nonlinear forms arising in physical and engineering applications.
CO5: Determine solution of higher order ordinary differential equations with constant and variable coefficients using appropriate methods.

Module-1 : Linear Algebra

Introduction, Elementary transformations on a matrix, Echelon form, rank of a matrix, Consistency and Solution of system of linear equations- Gauss elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's Power method to determine the dominant eigenvalue of a square matrix.

Number of Hours: 8 Hours

Module-2 : Polar Curves and Curvature

Introduction, Polar curves, angle between the radius vector and the tangent, angle between the polar curves, pedal equations. Curvature and radius of curvature in Cartesian, polar, parametric and pedal forms.

Number of Hours: 8 Hours

Module-3 : Power Series Expansions, Indeterminate forms and Multivariate Calculus

Introduction, Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms $(0^0, \infty^0, 1^\infty)$- L'Hospital's rule. Partial differentiation, total derivative, differentiation of composite functions, Jacobians, Maxima and minima for a function of two variables.

Number of Hours: 8 Hours

Module-4 : Ordinary Differential Equations of First Order

Introduction, Bernoulli's equations, Exact and reducible to exact differential equations- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$ only. Orthogonal trajectories, Law of natural growth and decay.

Nonlinear differential equations: Introduction to general and singular solutions, equations solvable for p only, Clairaut's equations, equations reducible to Clairaut's form.

Number of Hours: 8 Hours

Module-5 : Ordinary Differential Equations of Higher Order

Introduction, Solution of homogeneous linear ODE, solution of non-homogeneous linear ODE of higher order with constant coefficients $f(D)y = X$ using inverse differential operator where $X = e^{ax}$, $X = \sin(ax + b)$ or $\cos(ax + b)$ and X is a polynomial, Method of variation of parameters. Solution of linear ODE with variable coefficients- Cauchy's and Legendre's differential equations.

Number of Hours: 8 Hours

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **Gilbert Strang**: "Linear Algebra and its Applications", Cengage Publications, 4th Ed., 2022.

Reference books / Manuals:

1. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
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4. https://nptel.ac.in/courses/111106135
5. https://nptel.ac.in/courses/111105160
6. https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
7. https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/

Teaching-Learning Process (Innovative Delivery Methods*):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching learning process and facilitate the achievement of course outcomes.

1. State the need for Mathematics with Engineering Studies and Provide real-life examples.
2. Support and guide the students for self–study.
3. Assigning homework, grading assignments and quizzes, and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.
5. Show short-related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Name of the CCA 1:	Tool Exploration - OnRamp Courses with MATLAB
Maximum marks:	10
Brief description about the CCA 1:	
Number of activities: 1 (2 onramp courses to be completed) • **MATLAB OnRamp** (Common to all branches) – 5 Marks • Stream-specific course – 5 Marks: ➢ IT Stream – **Introduction to Linear Algebra** ➢ Non-IT stream – **Introduction to Symbolic Math**	

Name of the CCA 2:	GATE based aptitude quiz
Maximum marks:	10
Brief description about the CCA 2:	
➢ Module covered: Module 5 – Ordinary Differential Equations of Higher Order ➢ GATE based 10 multiple choice questions each carrying 1 mark.	

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Rubrics for Learning Activity -1

Performance parameters	**Marks**
Submission of course completion certificates well within the timeline specified	5 Marks
Delay in submission of course completion certificates	1 – 4 Marks
Non-submission of course completion certificates	0 marks

Rubrics for Learning Activity -2

Performance parameters	**Marks**
Correct Answer	1 Mark
Incorrect Answer	0 Mark

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ORDINARY DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS (Common to CSE, AIML & CSBS Branches)		Semester	II
Course Code	1BMATCS201	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorial	Total Marks	100
Credits	04	Exam Hours	3 Hours
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Solve first and higher order ordinary differential equations analytically.

CO2: Compute the variables involved in the system of linear equations, eigen values and eigenvectors by matrix methods.

CO3: Determine the solution of ordinary differential equations numerically.

CO4: Solve transcendental equations and problems related to interpolation, integration by various numerical methods.

Module-1: Ordinary Differential Equations of First Order

Introduction, Bernoulli's equations, Exact differential equations and equations reducible to exact differential equations- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$ only. Orthogonal trajectories.

Nonlinear differential equations: Introduction to general and singular solutions, Equations solvable for p only, Clairaut's equations, equations reducible to Clairaut's form.

Number of Hours: 8 Hours

Module-2: Ordinary Differential Equations of Higher Order

Introduction, Solution of homogeneous linear ODE, solution of non-homogeneous linear ODE of higher order with constant coefficients f(D)y=X using inverse differential operator where $X = e^{ax}$, X=sin(ax+b) or cos(ax+b) and X is a polynomial, Method of variation of parameters. Solution of linear ODE with variable coefficients- Cauchy's and Legendre's differential equations.

Number of Hours: 8 Hours

Module-3: Numerical Solutions for System of Linear Equations

Introduction, Norms: Vector norms and Matrix norms-L1, L2 and L∞, ill conditioned linear system, condition number. Solution of system of linear equations: Gauss Seidel method. Eigenvalues and Eigenvectors: Rayleigh's Power method to determine the dominant eigenvalue of a square matrix.

Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson methods.

Number of Hours: 8 Hours

Module-4: Numerical Solution of Ordinary Differential Equations

Introduction, Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formulae (without proofs). Numerical solution of second order ODE by Runge-Kutta method of fourth order.

Number of Hours: 8 Hours

Module-5: Interpolation and Numerical Integration

Introduction, Finite differences, Interpolation, Newton's forward and backward interpolation formulae, Newton's divided difference formula, Lagrange's interpolation formula and (formulae without proofs), Piecewise interpolation- linear and quadratic.

Numerical integration: Simpson's (1/3)rd rule & Simpson's (3/8)th rule (without proofs).

Number of Hours: 8 Hours

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **B. S. Grewal:** "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig:** "Advanced Engineering Mathematics", John Wiley & Sons, 10thEd., 2018.
3. **M.K.Jain:** "Numerical Methods For Scientific And Engineering Computation", New Age Techno Press, 6th edition, 2012.

Reference books / Manuals:

1. **N.P Bali and Manish Goyal:** "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
2. **C. Ray Wylie, Louis C. Barrett**: "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.
3. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
4. **Srimanta Pal & Subodh C. Bhunia:** "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematics for Semester I and II", McGraw Hill Education (India) Pvt. Ltd, 2015.

Web links and Video Lectures (e-Resources):

1. http://elearn.psgcas.ac.in/nptel/courses/video/111106100/111106100.html
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. https://www.youtube.com/c/VTUeShikshanaProgramme/playlists

Teaching-Learning Process (Innovative Delivery Methods*):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching learning process and facilitate the achievement of course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short-related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

***Suggested Innovative Delivery Methods may include (but are not limited to):**

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1 (Marks- 10)
Learning Activity -2 (Marks- 10)

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploratio
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels
- Industry integrated learning
- Analysis of Industry / Technical / Business reports
- Group discussions
- Use of MOOCs and Online Platforms
- Any other relevant and innovative academic activity

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CALCULUS, NUMERICAL METHODS AND LAPLACE TRANSFORMS (Common to ECE & EEE Branches)		Semester	II
Course Code	1BMATEC201	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorial	Total Marks	100
Credits	04	Exam Hours	3 Hours
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Evaluate area and volume of a region with the help of double and triple integrals.

CO2: Apply vector differentiation and integration concepts to engineering problems involving scalar and vector fields.

CO3: Solve transcendental equations and problems related to interpolation, integration and ordinary differential equations by various numerical methods.

CO4: Apply Laplace transform techniques for time domain, wave forms, periodic functions and solving differential equations.

Module-1: Integral Calculus and its Applications

Introduction, Multiple Integrals: Evaluation of double and triple integrals, change of order of integration, changing to polar coordinates. Area and volume using double and triple integrals. Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions.

Number of Hours: 8 Hours

Module-2: Vector Calculus and its Applications

Introduction, Vector Differentiation: Scalar and vector fields, gradient of a scalar field, directional derivatives, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector, physical interpretation of gradient, divergence and curl and scalar potential.

Vector Integration**:** Line and surface integrals, Statement of Green's and Stokes' without verification problems.

Number of Hours: 8 Hours

Module-3: Interpolation and Numerical Integration

Introduction, Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton forward and backward interpolation formulae, Newton's divided difference interpolation formula and Lagrange's interpolation formula.

Numerical Integration: Trapezoidal rule, Simpson's $(1/3)^{rd}$ rule and Simpson's $(3/8)^{th}$ rule.

Solution of algebraic and transcendental equations: Regula-Falsi method and Newton-Raphson method.

Number of Hours: 8 Hours

Module-4: Numerical Solution of Ordinary Differential Equations

Introduction, Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method. Numerical solution of second order ODE by Runge-Kutta method of fourth order.

Number of Hours: 8 Hours

Module-5: Laplace Transforms

Introduction, Laplace transform (LT): Definition and Formulae of Laplace Transform, LT of elementary functions. Properties–linearity, scaling, shifting property, differentiation in the s domain, division by t. LT of periodic functions: square wave, saw-tooth wave, triangular wave, full and half wave rectifier. LT of Heaviside (Unit step) function.

Inverse Laplace Transforms: Definition, properties, evaluation using different methods and applications to solve ordinary differential equations.

Number of Hours: 8 Hours

Suggested Learning Resources: (Textbook/Reference Book):

Text books:

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2. **E. Kreyszig**, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **M.K. Jain**, **S.R.K. Iyengar and R.K. Jain**, "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 8thEd., 2022.

Reference books:

1. **B.V. Ramana**, "Higher Engineering Mathematics", McGraw-Hill Education, 11th Ed., 2017
2. **Srimanta Pal & Subodh C.Bhunia**, "Engineering Mathematics", Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and Manish Goyal**, "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
4. **H. K. Dass and Er. Rajnish Verma**, "Higher Engineering Mathematics", S. Chand Publication, 3rd Ed., 2014.
5. **Richard L. Burden, Douglas J. Faires and A. M. Burden**, "Numerical Analysis", 10th Ed.,2010, Cengage Publishers.
6. **S.S. Sastry**, "Introductory Methods of Numerical Analysis", PHI Learning Private Limited, 5th Ed., 2012.

Web links and Video Lectures (e-Resources):

1. http://academicearth.org/
2. https://nptel.ac.in/courses/111105160
3. https://nptel.ac.in/courses/127106019
4. https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019
5. https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring

Teaching-Learning Process (Innovative Delivery Methods*):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching learning process and facilitate the achievement of course outcomes.

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2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
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   - As additional examples (post-lecture activity).
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- As a model solution of some exercises (post-lecture activity).

***Suggested Innovative Delivery Methods may include (but are not limited to):**

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Assessment Structure:

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- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1 (Marks- 10)
Learning Activity -2 (Marks- 10)

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Industry integrated learning
- Analysis of Industry / Technical / Business reports
- Group discussions
- Use of MOOCs and Online Platforms
- Any other relevant and innovative academic activity

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MULTIVARIATE CALCULUS AND NUMERICAL METHODS (For Mechanical Branch)		Semester	II
Course Code	1BMATME201	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorial	Total Marks	100
Credits	04	Exam Hours	3 Hours
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Evaluate area and volume of a region with the help of double and triple integrals.

CO2: Determine solution of higher order ordinary differential equations with constant and variable coefficients using appropriate methods.

CO3: Apply vector differentiation and integration concepts to engineering problems involving scalar and vector fields.

CO4: Apply numerical methods to interpolate/extrapolate and integrate the given set of data points.

CO5: Determine the solution of ordinary differential equations numerically.

Module-1: Integral Calculus

Introduction, Multiple Integrals: Evaluation of double and triple integrals, change of order of integration, changing to polar coordinates. Area and volume using double and triple integrals.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions.

Number of Hours: 8 Hours

Module-2: Ordinary Differential Equations of Higher Order

Introduction, Solution of homogeneous linear ODE, solution of non-homogeneous linear ODE of higher order with constant coefficients $f(D)y = X$ using inverse differential operator where $X = e^{ax}$, $X = \sin(ax + b)$ or $\cos(ax + b)$ and X is a polynomial, Method of variation of parameters. Solution of linear ODE with variable coefficients- Cauchy's and Legendre's differential equations.

Number of Hours: 8 Hours

Module-3: Vector Calculus

Introduction, Vector Differentiation: Scalar and vector fields, gradient of a scalar field, directional derivatives, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector, physical interpretation of gradient, divergence and curl and scalar potential.

Vector Integration**:** Line and surface integrals, work done by a force and flux, Statement of Green's and Stokes' theorems without verification problems.

Number of Hours: 8 Hours

Module-4: Interpolation and Numerical Integration

Introduction, Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton forward and backward interpolation formulae, Newton's divided difference interpolation formula and Lagrange's interpolation formula.

Numerical Integration: Trapezoidal rule, Simpson's $(1/3)^{rd}$ rule and Simpson's $(3/8)^{th}$ rule.

Solution of algebraic and transcendental equations: Regula-Falsi method and Newton-Raphson method.

Number of Hours: 8 Hours

Module-5: Numerical Solution of Ordinary Differential Equations

Introduction, Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor corrector method. Numerical solution of 2^{nd} order ODE by Runge-Kutta method of fourth order.

Number of Hours: 8 Hours

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **B.S. Grewal**, "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **M.K. Jain, S.R.K. Iyengar and R.K. Jain**: "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 8thEd., 2022.

Reference books / Manuals:

1. **B.V. Ramana**, "Higher Engineering Mathematics", McGraw-Hill Education, 11th Ed., 2017
2. **Srimanta Pal & Subodh C.Bhunia**, "Engineering Mathematics", Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and Manish Goyal**, "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
4. **H. K. Dass and Er. Rajnish Verma**, "Higher Engineering Mathematics", S. Chand Publication, 3rd Ed., 2014.
5. **Ray Wylie**, **Louis C. Barrett**, "Advanced Engineering Mathematics", McGraw Hill Book Co., New York, 6th Ed., 2017.
6. **Steven V. Chapra and Raymond P. Canale**, "Applied Numerical Methods with Matlab for Engineers and Scientists", McGraw-Hill, 3rd Ed., 2011.
7. **Richard L. Burden, Douglas J. Faires and A. M. Burden**, "Numerical Analysis", 10th Ed.,2010, Cengage Publishers.
8. **S.S. Sastry**, "Introductory Methods of Numerical Analysis", PHI Learning Private Limited, 5th Ed., 2012.

Web links and Video Lectures (e-Resources):

1. http://academicearth.org/
2. VTU e-Shikshana Program
3. VTU EDUSAT Program
4. https://nptel.ac.in/courses/111105160
5. https://nptel.ac.in/courses/127106019
6. https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/
7. https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/pages/syllabus/

Teaching-Learning Process (Innovative Delivery Methods*):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching learning process and facilitate the achievement of course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short-related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

***Suggested Innovative Delivery Methods may include (but are not limited to):**

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1 (Marks- 10)
Learning Activity -2 (Marks- 10)

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Industry integrated learning
- Analysis of Industry / Technical / Business reports
- Group discussions
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CALCULUS AND NUMERICAL METHODS (For Civil Branch)		Semester	II
Course Code	1BMATCV201	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours Theory+20 Hours Tutorial	Total Marks	100
Credits	04	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Evaluate area and volume of a region with the help of double and triple integrals.
CO2: Solve first-order partial differential equations using appropriate methods.
CO3: Apply vector differentiation and integration concepts to engineering problems involving scalar and vector fields.
CO4: Solve transcendental equations and problems related to interpolation, integration and ordinary differential equations by various numerical methods.

Module-1: Multiple Integrals

Introduction, Multiple Integrals: Evaluation of double and triple integrals, change of order of integration, changing to polar coordinates. Area and volume using double and triple integrals.
Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions.

Number of Hours: 8 Hours

Module-2: Partial Differential Equations (PDE)

Introduction, Formation of PDEs by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Method of Separation of variables. Derivation of one-dimensional heat equation and wave equation.

Number of Hours: 8 Hours

Module-3: Vector Calculus

Introduction, Vector Differentiation: Scalar and vector fields, gradient of a scalar field, directional derivatives, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector, physical interpretation of gradient, divergence and curl and scalar potential.
Vector Integration: Line and surface integrals, work done by a force and flux, Statement of Green's and Stokes' theorems without verification problems.

Number of Hours: 8 Hours

Module-4: Interpolation and Numerical Integration

Introduction, Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton forward and backward interpolation formulae, Newton's divided difference interpolation formula and Lagrange's interpolation formula.
Numerical Integration: Trapezoidal rule, Simpson's (1/3)rd rule and Simpson's (3/8)th rule.
Solution of algebraic and transcendental equations: Regula-Falsi method and Newton-Raphson method.

Number of Hours: 8 Hours

Module-5: Numerical Solution of Ordinary Differential Equations

Introduction, Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor corrector method. Numerical solution of 2nd order ODE by Runge-Kutta method of fourth order.

Number of Hours: 8 Hours

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **B.S. Grewal**, "Higher Engineering Mathematics", Khanna Publishers, 44thEd., 2021
2. **E. Kreyszig**, "Advanced Engineering Mathematics", John Wiley & Sons, 10thEd., 2018
3. **M.K. Jain, S.R.K. Iyengar and R.K. Jain**, "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 8thEd., 2022.

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4. **S.S. Sastry,** "Introductory Methods of Numerical Analysis", PHI Learning Private Limited, 5th Ed., 2012

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2. **VTU EDUSAT Program**
3. **https://nptel.ac.in/courses/111105160**
4. **https://nptel.ac.in/courses/127106019**
5. **https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/**

Teaching-Learning Process (Innovative Delivery Methods*):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching learning process and facilitate the achievement of course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short-related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

***Suggested Innovative Delivery Methods may include (but are not limited to):**

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1 (Marks- 10)
Learning Activity -2 (Marks- 10)

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Industry integrated learning
- Analysis of Industry / Technical / Business reports
- Group discussions
- Use of MOOCs and Online Platforms
- Any other relevant and innovative academic activity

Applied Physics Course (Program Specific)

1. **Physics of Quantum Computing and Applications 1BPHYCS102/202**
2. **Quantum Physics and Optoelectronics 1BPHYEC102/202**
3. **Physics of Electrical Engineering Materials 1BPHYEE102/202**
4. **Physics of Materials 1BPHYME102/202**
5. **Physics of Structural Materials 1BPHYCV102/202**

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Physics of Quantum Computing and Applications		Semester	I/II
Course Code	1BPHYCS102/202	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 (Theory)+26(lab)	Total Marks	100
Credits	4	Exam Hours	3
Scheme	2025	AY	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

1. Apply the basic principles of quantum mechanics such as uncertainty principle, wave functions, and quantization of energy, with relevance to computational applications.
2. Apply the basic concepts of qubits, and mathematical formulations of qubits in quantum computations.
3. Illustrate the concepts of quantum computing such as quantum gates, and quantum logic using theoretical circuit models.
4. Use the principles and characteristics of superconductivity, including Meissner's effect, critical parameters, and Cooper pair formation, and their relevance in quantum systems.
5. Apply the principles of semiconductors and the interaction of radiation with matter in the operational principles of Hall sensor and photonic devices such as diode lasers.

Module-1

Elements of Quantum Mechanics

Introduction, Heisenberg's Uncertainty Principle and its significance, Application: Non-existence of electron inside the nucleus (Relativistic condition), Principle of Complementarity, Wave Function and its properties, Physical Significance of a wave function and Born's Interpretation, Expectation value. Time independent and time-dependent, Schrodinger wave equations, Eigen functions and Eigen Values, Applications of Schrodinger wave equation: Eigen Values and Eigen functions of a particle in a one-dimensional potential well of infinite depth, mapping of wave function and probability density, Simple Harmonic Oscillator, Numerical problems.

Number of Hours:8

Module-2

Quantum Computing

Evolution of computing: Introduction, classical to quantum, Moore's law & its end, single particle quantum interference, quantum superposition and entanglement, No-cloning theorem and quantum parallelism (qualitative).

Qubit: properties of a qubit, representation of qubit by Bloch sphere, Single and Two qubits, Extension to N qubits. Types of qubits-Super conducting, harmonic oscillator, charge qubits, Differences between classical & quantum computing.

Dirac representation: Matrix representation of 0 and 1 States, Identity Operator, Pauli Matrices and its operations on $|0\rangle$ and $|1\rangle$states, Conjugate of a matrix and Transpose of a matrix. Unitary matrix, Inner Product, Probability, normalization rule, Orthogonality, Orthonormality, Numerical problems.

Number of Hours:8

Module-3

Quantum Gates and Circuits

Introduction, Single Qubit Gates: Quantum Not Gate, Pauli-X,Y,Z Gates, Hadamard Gate, Phase Gate (or S Gate), T Gate.

Multiple Qubit Gates: CNOT Gate, Swap gate, Controlled-Z gate, Toffoli gate.

Quantum circuits: Predicting the outputs of various combinations of single and two qubit gates. Applications of quantum gates: Artificial Intelligence, Machine Learning and Quantum Cryptography, Numerical problems.

Number of Hours:8

Module-4

Superconductivity

Introduction, Zero resistance state, Persistent current, Critical temperature, Critical current (Silsbee Effect) – Derivation for a cylindrical wire using ampere's law, Critical field, Meissner effect.

Cooper pairs: Mediation of phonons, BCS Theory - Phase coherent state, Limitations of BCS theory, examples of systems with low and high electron-phonon coupling, Type-I and Type-II superconductors.

Quantum Tunnelling: DC and AC Josephson junctions, Superconducting materials for Quantum computing (Flux quantization), SQUID, Numerical problems.

Number of Hours:8

Module-5

Semiconductors and Photonics

Introduction, Fermi energy and Fermi level, Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band; holes concentration in valence band, Intrinsic carrier density, Law of mass action, Electrical conductivity in intrinsic semiconductor, Hall effect, Expression for Hall coefficient and its application: Hall sensor.

Interaction of radiation with matter, Expression for energy density equation, and its significance. Requisites of a Laser system. Conditions for Laser action. Principle, Construction , and working of Semiconductor diode laser. Applications: Quantum Dot Laser and its applications. Numerical problems.

Number of Hours:8

PRACTICAL COMPONENTS OF IPCC

CONVENTIONAL AND SIMULATION EXPERIMENTS

1. Photo Diode Characteristics
2. Determination of wavelength of laser using diffraction grating.
3. Magnetic field along the axis of the circular coil carrying current
4. Determination of energy band gap using four probe method
5. Numerical aperture of an optical fibers
6. Black Box
7. Quirk simulation of quantum gates.
8. Energy Band gap of semiconductor using simulation method
9. Simulating the Stern-Gerlach experiment
10. Simulating single-qubit gates using various quantum platforms
11. Designing multi-qubit circuits using various quantum platforms

12. Quantum teleportation simulation
13. QFT out put state calculation for given two qubit input
14. PHET Interactive Simulations-Stephan's law
15. Data analysis using spread sheet

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books: (added)

1. Solid State Physics, S O Pillai, New Age International Private Limited, 8th Edition, 2018.
2.. A textbook of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.
3. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition.

Reference books / Manuals:

1. Parag K Lala, "Quantum Computing – A Beginner's Introduction", Indian Edition, McGraw Hill, Reprint 2020.
2. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition.
3. Quantum Computing, Vishal Sahani, McGraw Hill Education, 2007 Edition. 14.11.2022
4. Ghatak, "Optics", Tata McGraw Hill Pub., 5th Edition, 2012.
1. A textbook of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.

Web links and Video Lectures (e-Resources):

1. Quantum Flytrap - Quantum Flytrap
2. Stern-Gerlach Experiment - Quantum Mechanics | Spin | Quantum Measurement - PhET Interactive Simulations
3. https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
4. https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1
5. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html
6. Optical Fiber : https://www.youtube.com/watch?v=N_kA8EpCUQo
7. Quantum Mechanics : https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s
8. Quantum Computing : https://www.youtube.com/watch?v=jHoEjvuPoB8
9. Quantum Computing :https://www.youtube.com/watch?v=ZuvCUU2jD30

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Flipped Classroom
2. Problem-Based Learning (PBL)
3. Simulation and Virtual Labs
4. Partial Delivery of course by Industry expert/ industrial visits
5. ICT-Enabled Teaching

Assessment Structure:
The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).
The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.

The **CIE Theory component** consists of two IA tests for 40 marks. The sum of the two tests will be 80 marks, and the marks obtained will be scale down to **25 marks**.
The **CIE Practical component**: Each laboratory experiment is evaluated for 30 marks using rubrics and scale down to **15 marks**, one lab test will be conducted after all experiments for 50 marks and obtained marks will be scaled down to **10 marks**.

- To pass the **CIE theory component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **CIE Practical component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for CIE Test / SEE:

Indicators	Superior	Good	Fair	Needs Improvement	Unacceptable
Basic principles of quantum mechanics (CO1-PO1, 2, 5, 8,9,11)	Clearly explains quantum principles (e.g., uncertainty, wave function) with computational relevance	Explains core principles accurately with minor conceptual gaps	Basic understanding with limited linkage to applications	Fragmented explanation with weak application context	Fails to explain quantum concepts or relevance to computation
Basic concepts of qubits, and mathematical formulations of qubits (CO1-PO1, 2, 5, 8,9,11)	Accurately summarizes quantum computing concepts	Good explanation of quantum computing concepts	Basic description of qubits	Inconsistent understanding of qubits	Fails to explain quantum computing principles
Fundamental concepts of quantum computing (CO1- PO1, 2, 5, 8,9,11)	Accurately summarizes quantum computing concepts and predicts circuit behavior	Good explanation of quantum gates with some errors in logic application	Basic description of quantum circuits without predictive insight	Inconsistent understanding of quantum computing logic	Fails to explain or apply quantum computing principles
Principles and characteristics of superconductivity (CO1- PO1, 2, 5, 8,9,11)	Effectively evaluates superconducting principles and applies them in quantum contexts	Good understanding of concepts but lacks depth in application	Identifies phenomena but struggles with significance or relevance	Limited and inaccurate explanation of superconductivity	Fails to explain or apply superconductivity principles
Principles of semiconductors and the interaction of radiation with matter (CO1-PO1, 2, 5, 8,9,11)	Demonstrates clear understanding of radiation-matter interaction and device principles	Explains device operations with minor misconceptions	Recognizes device function but lacks technical depth	Inadequate understanding of photonic principles	Unable to interpret or explain device behavior

Rubrics for CIE Practical and Test:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (10) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (9-10)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (7-8)	Student is capable of implementing the design with proper explanation. (4-6)	Student is capable of implementing the design. (1-3)
Result &Analysis (6) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (6)	Student will be able to run the program for all the cases. (5)	Student will be able to run the code for few cases and analyze the output (3-4)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (5) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (5)	The lab record is organized, with clear sections, but some sections are not well-defined. (4)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3)	The lab record is poorly organized, with missing or unclear sections. (1-2)

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Quantum Physics and Optoelectronics		Semester	I/II
Course Code	1BPHYEC102/202	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 (Theory)+26 (Lab)	Total Marks	100
Credits	04	Exam Hours	3
Scheme	2025	AY	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

1. Apply fundamental principles of quantum mechanics to analyse microscopic physical systems and predict quantized energy states and tunnelling phenomena.
2. Apply the electrical conduction mechanisms in semiconductors using quantum models, and interpret carrier concentration, Fermi energy calculations, diode laser and sensors.
3. Illustrate the principles, properties of the light-matter interaction, propagation mechanism, in laser and sensor devices.
4. Use the principles and characteristics of superconductivity, including Meissner's effect, critical parameters, and Cooper pair formation, and their relevance in technological applications.
5. Apply the laws of vector algebra, Maxwell's equations in electromagnetic waves and the field of communication.

Module-1

Fundamentals of Quantum theory and band theory of solids

Introduction, Wave functions and their properties, Schrodinger wave equations: time independent and time dependent, Eigen functions and Eigen Values, Particle inside a one-dimensional infinite potential well and free particle case, quantum tunnelling. Numerical problems.

Band theory of solids: QFET Free electron theory, Band structure of solids: metals, insulators and semiconductors, intrinsic and doped semiconductors, Applications: cyclotron resonance, galvanomagnetic phenomena, carrier lifetime.

Number of Hours:08

Module-2

Physics of Semiconductors

Introduction, Fermi energy and Fermi level in intrinsic semiconductors, effective mass, density of states, Expression for concentration of electrons in conduction band & holes in valence band, Electrical conductivity in intrinsic semiconductors and extrinsic semiconductors, relation between E_g and E_f, Hall effect, Expression for Hall coefficient and its application. Construction and working: Semiconductor diode Laser, Sensing mechanisms: Piezo electric sensors, Hall Sensor, Numerical problems.

Number of Hours:08

Module-3

Lasers and Optical fibres

Introduction, Interaction of radiation with matter, Expression for energy density equation and its significance. Requisites of a Laser system. Conditions for Laser action. Principle, Construction and working of Nd-YAG laser. Applications: Laser range finder and Laser Printing. Numerical problems.

Introduction, Propagation mechanism, angle of acceptance, Numerical aperture, Fractional index change, Modes of propagation, Number of modes and V-number, Types of optical fibres. Attenuation and causes, attenuation coefficient, mechanism, optical windows, wave guides and types. Applications: point-to-point communication, Intensity-based fibre optic displacement sensor. Numerical problems.

Number of Hours:08

Module-4

Superconductivity

Introduction, Zero resistance state, Persistent current, critical temperature, critical magnetic field and Critical current (Silsbee effect), Meissner's effect, Formation of Cooper pairs - Mediation of phonons, Two-fluid model, BCS Theory - Phase coherent state, Limitations of BCS theory, examples of systems with low and high electron-phonon coupling, Type-I and Type-II superconductors, Formation of Vortices, Explanation for upper critical field, DC and AC Josephson junctions, Flux quantization, SQUIDs, Numerical Problems.

Number of Hours:08

Module-5

Maxwell's equations and EM waves

Introduction, Divergence and curl of electric field and magnetic field (static), Gauss' divergence theorem and Stokes' theorem. Derivations of four Maxwell's equations and its significance. Current density & equation of Continuity; displacement current, Maxwell's equations in vacuum. Applications – RF IDs and Antennas.

EM - wave equation in differential form in free space, Plane electromagnetic waves in vacuum, and their transverse nature, Numerical problems.

Number of Hours:08

PRACTICAL COMPONENTS OF IPCC

CONVENTIONAL AND SIMULATION EXPERIMENTS

1. Determination of the wavelength of a laser using a diffraction grating.
2. Determination of acceptance angle and numerical aperture of the given optical Fiber.
3. Study the characteristics of a photodiode and to determine the power responsivity / Verification of the inverse square law of light.
4. Determination of the resistivity of a semiconductor by four probe method.
5. Determination of the dielectric constant of the material of capacitor by charging and discharging method.
6. Determination of the Fermi energy of copper.
7. Resonance in LCR circuit.
8. Black-Box experiment.
9. Modelling magnetic hysteresis and producing hysteresis loops.
10. Study of projectile motion of a body using spreadsheet.
11. Verification of Stefan's law by electrical method.
12. Inductance of a coil using Anderson's bridge.
13. Determination of charge carrier density and Hall coefficient of a given semiconductor using Hall effect.
14. Construction and analysing electronic circuits (Expeyes simulator/circuit lab).
15. Measurement of unknown inductance using a Maxwell's Bridge.

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Textbooks:

1. M N Avadhanulu and P G Kshirsagar, "Engineering Physics," S. Chand and company Pvt. Ltd., 11th edition, 2014.
2. R K Gaur & amp; S L Gupta, "Engineering Physics," Dhanpat Rai Publications, 8th edition, 2018.
3. S. K. Dwivedi, A Textbook of Engineering Physics, I K International Publishing House Pvt. Ltd., 1st edition 2010.

Reference books / Manuals:

1. S O Pillai, "Solid State Physics," New Age International publishers, 8th edition, 2017.
2. David Jeffery Griffiths, "Introduction to Electrodynamics", Pearson New International Edition, 4th edition, 2017.
3. B B Laud, "Lasers and Non-Linear Optics," New Age International publishers, 3rd edition, 2018.
4. Arthur Beiser, "Concepts of Modern Physics", Tata McGraw-Hill Education, 6th edition, 2010.
5. Ben G. Streetman, Sanjay Banerjee, "Solid State Electronic Devices" Pearson Prentice Hall, 6th edition, 2010.

Web links and Video Lectures (e-Resources):

1. **NPTEL – Quantum Mechanics I (IIT Madras): https://nptel.ac.in/courses/115106066.**
2. **Solid State Physics – NPTEL (IIT Madras) https://nptel.ac.in/courses/115106127.**
3. **Semiconductor Optoelectronics – NPTEL (IIT Delhi, Prof. M. R. Shenoy)Direct video link (start relevant lecture): https://nptel.ac.in/courses/108108174/05.**
4. **Concepts in Magnetism and Superconductivity – NOC (IIT Kharagpur)Series start (Lecture 1): https://digimat.in/nptel/courses/video/115105131/L01.html.**
5. **Maxwell's equations: a review. https://nptel.ac.in/courses/115101004.**

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Flipped Classroom
2. Problem-Based Learning (PBL)
3. Simulation and Virtual Labs
4. Partial Delivery of course by Industry expert/ industrial visits
5. ICT-Enabled Teaching

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.

The **CIE Theory component** consists of two IA tests for 40 marks. The sum of the two tests will be 80 marks, and the marks obtained will be scale down to **25 marks**.

The **CIE Practical component**: Each laboratory experiment is evaluated for 30 marks using rubrics and scale down to **15 marks**, one lab test will be conducted after all experiments for 50 marks and obtained marks will be scaled down to **10 marks**.

- To pass the **CIE theory component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **CIE Practical component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for Theory CIE Test / SEE:

Indicators	Superior	Good	Fair	Needs Improvement	Unacceptable
Fundamental principles of quantum mechanics - (CO1 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Explains quantum mechanical principles and quantized energy levels with clarity and depth	Explains most concepts accurately with minor gaps	Shows basic understanding but lacks connection to application	Misunderstands or inconsistently applies key quantum principles	Fails to explain or apply core quantum mechanics concepts
Electrical conduction mechanisms in semiconductors - (CO2 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Analyzes conduction models and calculates carrier concentration and Fermi levels accurately	Good interpretation with small conceptual errors	Partial understanding with simple calculations	Inaccurate analysis or incomplete application of models	Unable to perform conduction analysis or interpret results
Principles, properties of the light-matter interaction- (CO3 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Thoroughly investigates light-matter interaction and evaluates photonic devices effectively	Good device interpretation and physical explanation	Basic knowledge of devices with limited contextual clarity	Weak or inconsistent understanding of photonic systems	Lacks or misrepresents device functionality and interaction concepts
Principles and characteristics of superconductivity - (CO4 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Evaluates superconductivity and Josephson junction behaviour with clear reasoning and examples	Explains effects with fair understanding and application	Recognizes phenomena but lacks detailed reasoning	Minimal interpretation or misapplication of principles	Fails to identify superconducting phenomena or applications
Laws of vector algebra, Maxwell's equations- (CO5 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates strong understanding of Maxwell's equations and EM waves for electronics engineering applications	Applies concepts correctly with minor gaps in logic or selection	Recognizes device function but lacks depth in analysis	Incorrect application or unclear explanation of sensors	Fails to identify or describe devices or their functions

Rubrics for CIE Practical and Test:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (10) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (9-10)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (7-8)	Student is capable of implementing the design with proper explanation. (4-6)	Student is capable of implementing the design. (1-3)
Result &Analysis (6) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (6)	Student will be able to run the program for all the cases. (5)	Student will be able to run the code for few cases and analyze the output (3-4)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (5) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (5)	The lab record is organized, with clear sections, but some sections are not well-defined. (4)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3)	The lab record is poorly organized, with missing or unclear sections. (1-2)

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

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Physics of Electrical Engineering Materials		Semester	**I/II**
Course Code	1BPHYEE102/202	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3.0.2	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 (Theory)+26 (lab)	Total Marks	100
Credits	4	Exam Hours	3
Scheme	2025	AY	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

1. Illustrate the electrical transport mechanisms in metals and semiconductors using quantum models, and perform relevant calculations.
2. Apply the principles, properties, and applications of rare earth, ceramic, and smart materials in energy systems.
3. Use the principles and characteristics of superconductivity, including Meissner's effect, critical parameters, and Cooper pair formation, and their relevance in technological applications.
4. Implement the concepts of dielectric and magnetic properties of materials in electrical components like transformers, capacitors, and inductors.
5. Apply the laws of vector algebra, Maxwell's equations in electromagnetic waves and the field of communication.

Module-1

Electrical properties of metals and semiconductors

Electrical properties of metals: Introduction, Band theory of solids: Quantum free electron theory, Band structure of solids: classification of solids- metals, Insulators and semiconductors. Density of states, Fermi-Dirac statistics, Fermi energy, and variation of Fermi energy.

Electrical properties of semiconductors: Introduction**,** Fermi energy, and Fermi level in intrinsic semiconductors and extrinsic semiconductors. Effective mass, Expression for concentration of electrons in conduction band & holes in valence band, Electrical conductivity in intrinsic semiconductors and extrinsic semiconductors, Hall effect, Expression for Hall coefficient and its application, Numerical problems.

Number of Hours:8

Module-2

Electrical Engineering Materials

Introduction, Rare earth materials, Role in energy systems, Electrical & Magnetic phase diagram, Examples & high magnetic field applications, Ceramics: Types, Materials, Applications, Electrostriction, Strain proportional to square of the electric field, Comparison with piezoelectric effect, Materials, Applications, Electrorheological (ER) materials, Principle, Viscosity changes under applied electric field, ER Fluids, Applications, Magnetorheological (MR) materials, Principle, Magnetic field-induced change in viscosity, MR Fluids, Applications, Numerical problems.

Number of Hours:8

Module-3

Superconductivity

Introduction, Zero resistance state, Persistent current, Meissner effect, Critical temperature, Critical current (Silsbee Effect) – Derivation for a cylindrical wire using ampere's law, Critical field, Formation of Cooper pairs - Mediation of phonons, Two-fluid model, BCS Theory - Phase coherent state, Limitations of BCS theory, Type-I and Type-II superconductors, High Tc superconductors, Formation of Vortices, Explanation for upper critical field, Josephson junction, Flux quantization, DC squid, Superconducting magnet, MAGLEV, Numerical problems.

Number of Hours: 8

Module-4

Dielectrics and magnetic materials

Dielectric materials: Introduction, Electrical polarization mechanisms, Internal fields in solids, Clausius-Mossotti relation and its implications, Properties and frequency dependence of Dielectric constant, Dielectric loss, Solid, Liquid, and Gaseous dielectrics. Application of dielectrics in Capacitors, Transformers (Oils), SF6 in High Voltage applications.

Magnetic material: Introduction, Classification of magnetic materials, Weiss Molecular field theory of ferromagnetism, Importance of Curie Temperature, Ferromagnetic Hysteresis and Explanation using Domain theory, Energy loss, Hard and soft ferromagnetic materials and Applications, Transformer Cores, Armature, Inductors and chokes, Permanent Magnets, Numerical problems.

Number of Hours: 8

Module-5

Maxwell's equations and EM waves

Maxwell's equations: Introduction, Vector analysis, Divergence and curl of electric field and magnetic field (static), Gauss' divergence theorem, and Stokes' theorem. Derivations of the four Maxwell equations and their significance. Current density & equation of continuity, displacement current, Maxwell's equations in vacuum. Applications – Radio Frequency Identification (RFIDs) and Antennas, Numerical problems

EM waves: Introduction, wave equation in differential form in free space, Plane electromagnetic waves in vacuum, and their transverse nature.

Number of Hours:8

PRACTICAL COMPONENTS OF IPCC

CONVENTIONAL AND SIMULATION EXPERIMENTS

1. Study the Characteristics of a Photo-Diode and to determine the power responsivity
2. Determination of the resistivity of a semiconductor by four probe method
3. Determination of the dielectric constant of the material of capacitor by charging and discharging method
4. Determination of the Fermi energy of copper.
5. Determination of magnetic flux density at any point along the axis of a circular coil
6. Black box experiment- identification of circuit elements
7. Characteristics of Zener diode
8. Resonance in LCR circuit
9. Construction and analysing electronic circuits (Expeyes simulator/circuit lab).
10. Interactive simulations: energy-bandgap of a semiconductor
11. Interactive simulations: Variation of Fermi energy level and carrier concentration with temperature

12. PHET Interactive simulations: Verification of Stefan's law by electrical method
13. Interactive simulations: Determination of charge carrier density and Hall coefficient of a given semiconductor using Hall effect
14. Study of motion using spread sheets: Study of projectile motion using Excel sheet/PHET.
15. Interactive simulations: I -V characteristics of a diode

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.
2. A Text book of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar, S Chand, 2014, Revised
3. Engineering Physics, S.P. Basavaraju, CBCS edition, 2018.

Reference books / Manuals:

1. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBS Publishers and Distributers Pvt. Ltd., 2018
2. Tinkham, M. (2004). Introduction to Superconductivity (2nd ed.). Dover Publications
3. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017.
4. Electrical Engineering Materials, R. K. Shukla, Tata McGraw-Hill Education, India, 2017 reprint edition.
5. David Jeffery Griffiths, "Introduction to Electrodynamics", Pearson New International Edition, 4 th edition, 2017.

Web links and Video Lectures (e-Resources):

1. Module 1: https://www.youtube.com/playlist?list=PLvyl1YgaAepJwHETpzPyngFTFP8qcPAe1
2. Module2:https://www.slideshare.net/slideshow/mr-fluids-overview-definitions-working-applications-and-more/252110717
3. Module 3: https://nptel.ac.in/courses/115103108
4. Module 4: https://nptel.ac.in/courses/113104090
5. Module 5: https://www.youtube.com/watch?v=2WiMeh1Dxl8

Teaching-Learning Process (Innovative Delivery Methods):

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- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for Theory CIE Test / SEE:

Indicators	Superior	Good	Fair	Needs Improvement	Unacceptable
Electrical transport mechanisms in metals and semiconductors (CO1- PO1, 2, 5, 8,9,11)	Effectively evaluates classical and quantum transport models with accurate calculations	Good use of models with minor computational or conceptual errors	Basic understanding of models with limited calculation ability	Inconsistent explanation or poor calculation accuracy	No understanding of electrical transport models or calculations
Principles, properties, and applications of rare earth, ceramic, and smart materials (CO1- PO1, 2, 5, 8,9,11)	Thoroughly describes rare earth, ceramic, and smart materials with strong application insights	Explains material characteristics with reasonable applications	Basic understanding of materials with unclear application contexts	Weak explanation of properties or selection justification	Fails to describe or apply materials correctly
Principles and characteristics of superconductivity (CO1- PO1, 2, 5, 8,9,11)	Clearly explains superconducting principles, types, and their technological uses	Good grasp of concepts with minor classification or application errors	Some understanding of superconductors with few correct distinctions	Limited understanding of types or characteristics	Fails to explain superconductivity or its uses
Dielectric and magnetic properties of materials (CO1- PO1, 2, 5, 8,9,11)	Explains dielectric and magnetic properties and their role in real components like transformers and capacitors with clarity	Good explanation with minor application errors	Basic understanding of properties but unclear application	Limited or incorrect linkage of concepts to components	Fails to explain or apply dielectric and magnetic principles
Laws of vector algebra, Maxwell's equations (CO1- PO1, 2, 5, 8,9,11)	Accurately analyzes of Maxwell's equations, EM waves in the communication.	Sound explanation with partial linkage to applications	Basic description of the vector algebra, Maxwell's equations, EM waves	Weak or incorrect correlation of the vector algebra, Maxwell's equations, EM waves	Fails to explain the vector algebra, Maxwell's equations, EM waves

Rubrics for CIE Practical and Test:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (10) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (9-10)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (7-8)	Student is capable of implementing the design with proper explanation. (4-6)	Student is capable of implementing the design. (1-3)
Result &Analysis (6) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (6)	Student will be able to run the program for all the cases. (5)	Student will be able to run the code for few cases and analyze the output (3-4)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (5) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (5)	The lab record is organized, with clear sections, but some sections are not well-defined. (4)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3)	The lab record is poorly organized, with missing or unclear sections. (1-2)

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Physics of Materials		Semester	I/II
Course Code	1BPHYME102/202	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 (Theory)+26(lab)	Total Marks	100
Credits	4	Exam Hours	3
Scheme	2025	AY	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

1. Apply the principles of damped, and forced oscillations, and shock waves to solve problems involving mechanical oscillatory systems.
2. Apply the principles of crystals, defects, material characterization techniques and instrumentation to the engineering materials.
3. Apply the concepts of stress, strain, and elastic moduli to evaluate the elastic behavior of solids under various loading conditions.
4. Use the principles of thermoelectric effects and assess the performance of thermoelectric materials and devices for energy conversion and thermal management.
5. Demonstrate an understanding of low-temperature physics, including methods of cryogen production, and analyze the applications of cryogenics in scientific and engineering contexts.

Module-1

Oscillations and Shock waves

Oscillations: Free oscillations of springs, stiffness factor and its physical significance, Series and Parallel combination of springs. Theory of damped oscillations, Types of damping. Engineering applications of damped oscillations, Theory of forced oscillations, Resonance, Sharpness of resonance, Effect of Resonance in mechanical structures.

Shock waves: Mach number and Mach Angle, definition and characteristics of Shock waves, Construction and working of Reddy shock tube, Applications of Shock Waves. Numerical problems.

Number of Hours: 8

Module-2

Crystals- Defects and Characterization

Crystals: Crystal planes and Miller indices, Inter-planar spacing (derivation), Bragg's law, Powder X-ray diffraction, crystallite size determination by Scherer's equation.

Defects: Crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burger's vector and elastic strain energy- Slip systems.

Characterization Techniques: Principle, construction and working of Scanning electron microscopy (SEM) and Atomic force microscopy (AFM). Numerical Problems.

Number of Hours: 8

Module-3

Elasticity

Strain hardening and softening. Elastic Moduli, Poisson's ratio, Relation between Y, n and σ , mention relation between K, Y and σ, limiting values of Poisson's ratio. Static and dynamic loading, Types of beams, Bending moment, Single Cantilever, Torsion of a cylinder-couple per unit twist, I-section girder and their Engineering Applications. Numerical problems.

Number of Hours: 8

Module-4

Thermoelectric Materials and Devices

Thermoemf and thermo current, Seebeck effect, Peltier effect, Seebeck and Peltier coefficients, figure of merit, laws of thermoelectricity. Thermo emf in terms of T_1 and T_2 (Derivation), thermo couples, thermopile. Construction and working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high temperature thermoelectric materials.

Applications: Exhaust of Automobiles, Refrigerator, Space Program (Radioisotope Thermoelectric Generator- RTG). Numerical Problems.

Number of Hours: 8

Module-5

Cryogenics

Introduction to Thermodynamics, Carnot's principle, Efficiency, Production of low temperature - Joule Thomson effect (3 cases), Porous plug experiment with theory, Thermodynamical analysis of Joule Thomson effect, Liquefaction of Oxygen by cascade process, Lindey's air liquefier, Liquefaction of Helium and its properties (superfluidity), Platinum Resistance Thermometer, Applications of Cryogenics: Aerospace, Dewar Flask, Numerical Problems.

Number of Hours: 8

PRACTICAL COMPONENTS OF IPCC

CONVENTIONAL AND SIMULATION EXPERIMENTS

1. Study of Forced Mechanical Oscillations and Resonance.
2. Determination of Moment of Inertia of the given irregular body by setting Torsional Oscillations.
3. Study the frequency response of Series & Parallel LCR circuits.
4. Stiffness Constant of springs in different combinations.
5. Determination of Young's modulus by Single Cantilever.
6. Thermo Couple-Seebeck Effect
7. Thermo-emf or Peltier Module.
8. Determination of resistivity and energy band gap of a semiconductor by Four Probe Method.
9. STEP Interactive Physical Simulations. (Springs, Simple Pendulum).
10. Study of motion using spread Sheets (linear and Projectile motion).
11. Rigidity Modulus of The Suspension Wire of a Torsion Pendulum (Virtual)
12. Basics of Scanning Electron Microscopy: Secondary Electron and BSE imaging mode
13. Phase Identification by XRD
14. Young's Modulus-Uniform Bending (virtual)
15. Determination of Energy band gap of a semiconductor (virtual)

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. A Text book of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar, S Chand, 2014, Revised Edition.
2. Fundamentals of Cryogenic Engineering, Mamata Mukhopadhyay, PHI Learning (India).
3. Characterization of Materials- Mitra P.K. Prentice Hall India Learning Private Limited.

Reference books / Manuals:

1. Vibrations and Waves (MIT introductory Physics Series), A P French, CBS, 2003Edition.
2. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBSPublishers and Distributers Pvt. Ltd.
3. Cryogenics: A Text Book, S.S. Thipse, Alpha Science International, Limited, 2013.
4. Treatise on Heat, M N Saha and B N Srivastava, 2nd Edition, Indian Press, 1935;Original from, the University of California.
5. Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRCPress, First Edition, 2008.

Web links and Video Lectures (e-Resources):

1. Lecture Series on Physics - I: Oscillations and Waves by Prof.S.Bharadwaj,Department of Physics and Meteorology, IIT Kharagpurn:https://www.youtube.com/watch?v=gnD8Se92hfk
2. Stress- strain curves:https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
3. Cryogenic Engineering by Prof. M.D. Atrey , Department of MechanicalEngineering, IIT Bombay.: https://www.youtube.com/watch?v=4gGMBNEzeuc
4. Liquefaction of gases: https://www.youtube.com/watch?v=aMelwOsGpIs
5. Non-destructive testing: https://youtu.be/JGQnbwxPiFA
6. Materials Characterisation : https://youtu.be/SXIYzrFGmkU

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Flipped Classroom
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- To pass the **CIE Practical component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for CIE Test / SEE:

Indicators	Superior	Good	Fair	Needs Improvement	Unacceptable
Fundamental principles of damped, and forced oscillations, and shock waves (CO1/ PO1, PO2, PO5, PO8, PO9, PO11)	Accurately applies equations of SHM, damping, and forced oscillations	Mostly correct usage with minor formula or interpretation errors	Basic formulation without clear physical understanding	Incomplete calculations or irrelevant application	No use or wrong application of principles
Principles of crystals, defects, material characterization techniques (CO2/ PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates clear understanding of crystals, their defects and characterization techniques	Good understanding of concepts but lacks depth in application	Basic understanding with limited linkage to applications	Inadequate understanding of concepts	Fails to explain or apply principles of crystals, defects and characterization techniques
Elastic behavior of solids (CO3/ PO1, PO2, PO5, PO8, PO9, PO11)	Clearly understands the concepts of elasticity and its engineering applications	Minor gaps in conceptual application	Basic understanding with limited real-world linkage	Misinterprets or inconsistently applies concepts	Unable to analyze or apply principles of elasticity
Principles of thermoelectric effects (CO4/ PO1, PO2, PO5, PO8, PO9, PO11)	Accurately analyzes thermoelectric effects, construction, and material suitability	Sound explanation with partial linkage to applications	Basic description of thermoelectric concepts with some gaps	Weak or incorrect correlation of material to application	Fails to explain or misrepresents thermoelectric principles
Knowledge of low-temperature physics (CO5/ PO1, PO2, PO5, PO8, PO9, PO11)	Accurately analyses the principle of cryogenics and its applications	Minor gaps in conceptual application	Basic understanding with limited real-world linkage	Misinterprets or inconsistently applies concepts	Unable to analyze or apply cryogenic principles

Rubrics for CIE Practical and Test:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (10) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (9-10)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (7-8)	Student is capable of implementing the design with proper explanation. (4-6)	Student is capable of implementing the design. (1-3)
Result &Analysis (6) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (6)	Student will be able to run the program for all the cases. (5)	Student will be able to run the code for few cases and analyze the output (3-4)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (5) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (5)	The lab record is organized, with clear sections, but some sections are not well-defined. (4)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3)	The lab record is poorly organized, with missing or unclear sections. (1-2)

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Physics of Materials		Semester	I/II
Course Code	1BPHYME102/202	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 (Theory)+26(lab)	Total Marks	100
Credits	4	Exam Hours	3
Scheme	2025	AY	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

1. Apply the principles of damped, and forced oscillations, and shock waves to solve problems involving mechanical oscillatory systems.
2. Apply the principles of crystals, defects, material characterization techniques and instrumentation to the engineering materials.
3. Apply the concepts of stress, strain, and elastic moduli to evaluate the elastic behavior of solids under various loading conditions.
4. Use the principles of thermoelectric effects and assess the performance of thermoelectric materials and devices for energy conversion and thermal management.
5. Demonstrate an understanding of low-temperature physics, including methods of cryogen production, and analyze the applications of cryogenics in scientific and engineering contexts.

Module-1

Oscillations and Shock waves

Oscillations: Free oscillations of springs, stiffness factor and its physical significance, Series and Parallel combination of springs. Theory of damped oscillations, Types of damping. Engineering applications of damped oscillations, Theory of forced oscillations, Resonance, Sharpness of resonance, Effect of Resonance in mechanical structures.

Shock waves: Mach number and Mach Angle, definition and characteristics of Shock waves, Construction and working of Reddy shock tube, Applications of Shock Waves. Numerical problems.

Number of Hours: 8

Module-2

Crystals- Defects and Characterization

Crystals: Crystal planes and Miller indices, Inter-planar spacing (derivation), Bragg's law, Powder X-ray diffraction, crystallite size determination by Scherer's equation.

Defects: Crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burger's vector and elastic strain energy- Slip systems.

Characterization Techniques: Principle, construction and working of Scanning electron microscopy (SEM) and Atomic force microscopy (AFM). Numerical Problems.

Number of Hours: 8

Module-3

Elasticity

Strain hardening and softening. Elastic Moduli, Poisson's ratio, Relation between Y, n and σ , mention relation between K, Y and σ, limiting values of Poisson's ratio. Static and dynamic loading, Types of beams, Bending moment, Single Cantilever, Torsion of a cylinder-couple per unit twist, I-section girder and their Engineering Applications. Numerical problems.

Number of Hours: 8

Module-4

Thermoelectric Materials and Devices

Thermoemf and thermo current, Seebeck effect, Peltier effect, Seebeck and Peltier coefficients, figure of merit, laws of thermoelectricity. Thermo emf in terms of T_1 and T_2 (Derivation), thermo couples, thermopile. Construction and working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high temperature thermoelectric materials.

Applications: Exhaust of Automobiles, Refrigerator, Space Program (Radioisotope Thermoelectric Generator- RTG). Numerical Problems.

Number of Hours: 8

Module-5

Cryogenics

Introduction to Thermodynamics, Carnot's principle, Efficiency, Production of low temperature - Joule Thomson effect (3 cases), Porous plug experiment with theory, Thermodynamical analysis of Joule Thomson effect, Liquefaction of Oxygen by cascade process, Lindey's air liquefier, Liquefaction of Helium and its properties (superfluidity), Platinum Resistance Thermometer, Applications of Cryogenics: Aerospace, Dewar Flask, Numerical Problems.

Number of Hours: 8

PRACTICAL COMPONENTS OF IPCC

CONVENTIONAL AND SIMULATION EXPERIMENTS

1. Study of Forced Mechanical Oscillations and Resonance.
2. Determination of Moment of Inertia of the given irregular body by setting Torsional Oscillations.
3. Study the frequency response of Series & Parallel LCR circuits.
4. Stiffness Constant of springs in different combinations.
5. Determination of Young's modulus by Single Cantilever.
6. Thermo Couple-Seebeck Effect
7. Thermo-emf or Peltier Module.
8. Determination of resistivity and energy band gap of a semiconductor by Four Probe Method.
9. STEP Interactive Physical Simulations. (Springs, Simple Pendulum).
10. Study of motion using spread Sheets (linear and Projectile motion).
11. Rigidity Modulus of The Suspension Wire of a Torsion Pendulum (Virtual)
12. Basics of Scanning Electron Microscopy: Secondary Electron and BSE imaging mode
13. Phase Identification by XRD
14. Young's Modulus-Uniform Bending (virtual)
15. Determination of Energy band gap of a semiconductor (virtual)

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. A Text book of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar, S Chand, 2014, Revised Edition.
2. Fundamentals of Cryogenic Engineering, Mamata Mukhopadhyay, PHI Learning (India).
3. Characterization of Materials- Mitra P.K. Prentice Hall India Learning Private Limited.

Reference books / Manuals:

1. Vibrations and Waves (MIT introductory Physics Series), A P French, CBS, 2003Edition.
2. Engineering Physics, S L Kakani, Shubra Kakani, 3rd Edition, 2020, CBSPublishers and Distributers Pvt. Ltd.
3. Cryogenics: A Text Book, S.S. Thipse, Alpha Science International, Limited, 2013.
4. Treatise on Heat, M N Saha and B N Srivastava, 2nd Edition, Indian Press, 1935;Original from, the University of California.
5. Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRCPress, First Edition, 2008.

Web links and Video Lectures (e-Resources):

1. Lecture Series on Physics - I: Oscillations and Waves by Prof.S.Bharadwaj,Department of Physics and Meteorology, IIT Kharagpurn:https://www.youtube.com/watch?v=gnD8Se92hfk
2. Stress- strain curves:https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
3. Cryogenic Engineering by Prof. M.D. Atrey , Department of MechanicalEngineering, IIT Bombay.: https://www.youtube.com/watch?v=4gGMBNEzeuc
4. Liquefaction of gases: https://www.youtube.com/watch?v=aMelwOsGpIs
5. Non-destructive testing: https://youtu.be/JGQnbwxPiFA
6. Materials Characterisation : https://youtu.be/SXIYzrFGmkU

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Flipped Classroom
2. Problem-Based Learning (PBL)
3. Simulation and Virtual Labs
4. Partial Delivery of course by Industry expert/ industrial visits
5. ICT-Enabled Teaching

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).
The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.

The **CIE Theory component** consists of two IA tests for 40 marks. The sum of the two tests will be 80 marks, and the marks obtained will be scale down to **25 marks**.
The **CIE Practical component**: Each laboratory experiment is evaluated for 30 marks using rubrics and scale down to **15 marks**, one lab test will be conducted after all experiments for 50 marks and obtained marks will be scaled down to **10 marks**.

- To pass the **CIE theory component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **CIE Practical component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for CIE Test / SEE:

Indicators	Superior	Good	Fair	Needs Improvement	Unacceptable
Fundamental principles of damped, and forced oscillations, and shock waves (CO1/ PO1, PO2, PO5, PO8, PO9, PO11)	Accurately applies equations of SHM, damping, and forced oscillations	Mostly correct usage with minor formula or interpretation errors	Basic formulation without clear physical understanding	Incomplete calculations or irrelevant application	No use or wrong application of principles
Principles of crystals, defects, material characterization techniques (CO2/ PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates clear understanding of crystals, their defects and characterization techniques	Good understanding of concepts but lacks depth in application	Basic understanding with limited linkage to applications	Inadequate understanding of concepts	Fails to explain or apply principles of crystals, defects and characterization techniques
Elastic behavior of solids (CO3/ PO1, PO2, PO5, PO8, PO9, PO11)	Clearly understands the concepts of elasticity and its engineering applications	Minor gaps in conceptual application	Basic understanding with limited real-world linkage	Misinterprets or inconsistently applies concepts	Unable to analyze or apply principles of elasticity
Principles of thermoelectric effects (CO4/ PO1, PO2, PO5, PO8, PO9, PO11)	Accurately analyzes thermoelectric effects, construction, and material suitability	Sound explanation with partial linkage to applications	Basic description of thermoelectric concepts with some gaps	Weak or incorrect correlation of material to application	Fails to explain or misrepresents thermoelectric principles
Knowledge of low-temperature physics (CO5/ PO1, PO2, PO5, PO8, PO9, PO11)	Accurately analyses the principle of cryogenics and its applications	Minor gaps in conceptual application	Basic understanding with limited real-world linkage	Misinterprets or inconsistently applies concepts	Unable to analyze or apply cryogenic principles

Rubrics for CIE Practical and Test:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (10) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (9-10)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (7-8)	Student is capable of implementing the design with proper explanation. (4-6)	Student is capable of implementing the design. (1-3)
Result &Analysis (6) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (6)	Student will be able to run the program for all the cases. (5)	Student will be able to run the code for few cases and analyze the output (3-4)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (5) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (5)	The lab record is organized, with clear sections, but some sections are not well-defined. (4)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3)	The lab record is poorly organized, with missing or unclear sections. (1-2)

Applied Chemistry Course (Program Specific)

1. **Chemistry of Smart Material and Devices 1BCHECS102/202**
2. **Smart Materials for Energy Applications 1BCHEEC102/202**
3. **Advanced Metal Protection and Sustainable Energy Systems 1BCHEME102/202**
4. **Structural Materials and Sustainable Technologies1BCHECV102/202**

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Chemistry of Smart Materials and Devices		Semester	I/II
Course Code	**1BCHECS102 /202**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:2	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 (Theory) +20 (Lab)	Total Marks	100
Credits	04	Exam Hours	03
Scheme	2025	AY	2025-26
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

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

CO1. Develop the knowledge of electrochemical principles by contrasting scientific concepts with engineering applications, and apply this understanding to the development of sensor systems used in smart and connected technologies.

CO2. Apply concepts of battery technology in advanced batteries, fuel cells and supercapacitors for energy and IoT applications.

CO3. Analyze chemical materials, reactions, and processes in renewable energy systems including solar cells, biofuels, and hydrogen production.

CO4. Integrate knowledge of nanomaterials, quantum dots, and advanced display materials, and assess their role in developing sustainable smart devices.

CO5. Evaluate the applications of functional polymers and sustainable e-waste management with AI-enabled recycling and material recovery, while demonstrating teamwork, leadership, and practical problem-solving skills.

Module – 1 Electrochemical Advances in Sensing Devices

Electrochemical Advances in Sensing Devices

Introduction to Electrochemistry: Introduction, Basic Overview of Nernst Equation. Types of electrode systems with examples. Reference electrodes: primary and secondary reference electrodes with examples, advantages of secondary reference electrodes over SHE. Construction, working, and application of calomel electrode to determine electrode potential. Concentration cells: Definition, types, construction and working of electrolyte concentration cell, Numerical problems on concentration cell.

Smart Sensors and Devices: Introduction to sensor terminologies: Definitions of Transducer, Actuators and Sensors. Principle, components, and working mechanism of conductometric and pH sensors. Conductometric titration of acid mixture using strong base, and Construction and working of glass electrode to determine pH of unknown solution.

Number of Hours: 08

Module – 2 Energy storage and conversion Systems

Energy storage and conversion Systems

Batteries: Introduction, Classification of batteries: primary, secondary, and reserve batteries with examples.

Secondary batteries: Construction, working, and applications of lithium-ion batteries. Introduction to sodium-ion batteries as next-generation alternatives; comparison of sodium-ion and lithium-ion batteries in terms of performance and applications, Numerical problems on battery efficiency, and specific capacity.

Supercapacitors: Introduction, classification of supercapacitors. Constriction and working of pseudo capacitor. Construction and working of ultra-small asymmetric super capacitor and its applications in IoT/wearable devices.

Fuel cells: Introduction, fuel cell, difference between fuel cell and battery, construction, working principle, applications and limitations of solid-oxide fuel cell (SOFCs).

Number of Hours: 08

Module – 3 Sustainable Energy Systems

Sustainable Energy Systems

Material chemistry of solar cells: First, second and third generation solar cells, Construction and working of Photovoltaic cell for solar cell applications. Advanced solar cells: Introduction to perovskite, DSSCs and QDSSCs, Principle, Construction, working, and applications of perovskite cells and comparing the efficiency of Pervoskite, DSSCs and QDSSCs. Numerical problems on solar cell efficiency.

Chemistry of biofuels: Power alcohol: Introduction, Fermentation processes for bioethanol and advantages of power alcohol. Biodiesel: Transesterification reactions for biodiesel production, advantages and disadvantages.

Hydrogen as a green fuel: Introduction, H_2 generation: Production of green hydrogen by photocatalytic water splitting using TiO_2. Advantages and challenges of photocatalytic water splitting. Applications of green H_2: Use of H_2 in H_2-O_2 fuel cells.

Number of Hours: 08

Module – 4 Materials for Smart Devices

Materials for Smart Devices

Nanomaterials: Introduction, definition, Classification of nanomaterials, Size dependent properties of nanomaterials: Electronic, optical and catalytic properties. Numericals on Surface Area to Volume Ratio of Nanoparticles. Synthesis of ZnO nanoparticles by combustion method (Using urea as fuel) and NRAM Material- CNTs by CVD method.

Quantum Dots: Introduction, size dependent properties of QDs: quantum confinement effect, surface-to-volume ratio & band gap. Synthesis and applications of Cd-Se Quantum dots by hydrothermal method.

Advanced Display Materials: Introduction, Construction, and working of LEDs. Advantages and comparison of Organic Light Emitting Diodes (OLED s), Quantum Light Emitting Diodes (QLED), and Active-Matrix Organic Light Emitting Diodes (AMOLEDs). Biodegradable materials for display systems: Introduction, examples of biodegradable materials used in display systems and their applications in advanced display systems.

Number of Hours: 08

Module – 5 Functional Polymers and E-waste management

Functional Polymers and E-waste management

Polymers: Introduction and types of polymerizations: Addition and condensation polymerization reactions with examples. Molecular weight of polymers: Number and weight average molecular weight of polymers, and numerical. Synthesis and properties of nylon-12 and its applications in 3D printing. Introduction to biopolymers: Synthesis, properties and applications of polylactic acid (PLA).

Conducting polymers: Introduction, synthesis of polyaniline, conduction mechanism and its engineering applications.

E-waste: Introduction, sources, composition of e-waste, effects of e-waste on environment and human health, Artificial intelligence in e-waste management and its applications,

extraction of gold from e-waste by bioleaching method, direct recycling method of lithium from spent Li- ion batteries.

Number of Hours: 08

PRACTICAL COMPONENTS OF IPCC

CONVENTIONAL AND SIMULATION EXPERIMENTS

1. Redox estimation of Fe^{2+} vs $K_2Cr_2O_7$ using Potentiometric Sensor
2. Determination of pKa of acetic acid (vinegar) using pH Sensor.
3. Estimation of a binary acid mixture with a strong base using Conductometric Sensor
4. Colorimetric estimation using optical sensor for copper in E-waste with verification of Beer–Lambert's Law using Origin software.
5. Determination of total hardness of waste water by complexometric titration
6. Determination of the critical micelle concentration (CMC) of cationic surfactant (CTAB) using Conductometric Sensor.
7. Estimation of iron in TMT bar by external indicator method.
8. Colorimetric assay of caffeine in different soft drinks.
9. Smartphone-Based colorimetric estimation of total phenolic content in coffee products.
10. Synthesis of metal oxide by combustion method and its crystal structure identification and phase matching using crystal search-match software (e.g., Match! or VESTA).
11. Data plotting and non-linear curve fitting using FitYK / Origin software.
12. 3D Chemical structure drawing using software: Chem Draw/ Chem Sketch.
13. Data analysis of pka of a week acid and its interpretation using origin software.

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text Books:

1. Electrochemical methods: fundamentals and applications. Bard, Allen J., Larry R. Faulkner, and Henry S. White. John Wiley & Sons, 2022.
2. Electrochemical Energy Storage: Batteries, Fuel Cells, and Hydrogen Technologies. Petrovic, S., Kurzweil, P., & Garche, J. (2022). McGraw Hill.
3. Principles of sustainable energy systems. Kreith, F., Kutscher, C. F., & Milford, J. B. (2018). CRC Press.
4. Smart materials and smart systems for the future. Akhras, G. (2000). Materials and Devices for Smart Systems III. Materials Research Society
5. A Textbook of Engineering Chemistry, SS Dara & Dr. SSU mare, S Chand & Company Ltd., 12th Edition, 2011.

Reference books / Manuals:

1. Battery Technologies: Materials and Components *2021 by Jianmin Ma*
2. Battery Technology Crash Course: A Concise Introduction *2020 by Slobodan Petrovic*
3. Applied Chemistry, Sunita Rattan, Kataria5.Engineering Chemistry, Baskar, Wiley
4. Engineering Chemistry–I, D. Grour Krishana, Vikas Publishing
5. High Quality Liquid Crystal Displays and Smart Devices – Ishihara, Kobayashi & Ukai (2019, IET), ISBN: 9781785619397
6. Quantum Dots and Polymer Nanocomposites: Synthesis, Chemistry, and Applications-yotishkumar Parameswaranpillai, Poushali Das, Sayan Ganguly, Publisher: CRC Press, 2022, ISBN 13: 978 1032210148
7. Green Carbon Quantum Dots: Environmental Applications; Vijay Kumar, Pardeep

Singh, Devendra Kumar Singh (India), Springer Nature Singapore, Oct 2024, ISBN 13: 978 9819762026.

8. Conducting Polymers, Fundamentals and Applications: Including Carbon Nanotubes and Graphene: Prasanna Chandrasekhar (IIT Delhi alumnus), Springer, 2019 (2nd ed.), ISBN 13: 978 3030098858.

Web links and Video Lectures (e-Resources):

1.https://youtu.be/1TGTVQbMlIc
2. https://www.youtube.com/watch?v=IzWONUYlQ5E&t=56s
3. https://youtu.be/3j0jLuOs0v4
4. https://youtu.be/CeZxn8CyM6Q
5. https://youtu.be/om0gppRTKoU
6. https://youtu.be/_ubwkG7uCFA
7. https://youtu.be/0Eokkhdppg E?si=L6Znx5yXYjI9EVlw
8. https://youtu.be/hT2yCPnNEoI
9. https://www.youtube.com/watch?v=EE35ICGthR8
10. https://www.youtube.com/live/CMyIb58vd4Q
11. https://www.youtube.com/watch?v=YsZcSnqV9lg
12. https://youtu.be/xrsK9FUdvRE?si=prlzf7fRocxxygJr
13. https://youtu.be/OEDapr-9lNE?si=CYdVhq3d5ffzdXUC
14. https://youtu.be/QNKPaZkWC9Q?si=PyI4sQUL75340I9i
15. https://youtu.be/0Citdpy92EE
16. https://youtu.be/zaNdJ9I21YA
17. https://youtu.be/YAW7nMf8j0A
18. https://www.youtube.com/watch?v=FXGNQqdRBzc
19. https://www.youtube.com/watch?v=KvmqgAYO0MI
20. https://www.youtube.com/watch?v=SvlrAFDHOLc
21. https://youtu.be/kUCVBhSka2Q
22. https://www.youtube.com/watch?v=Ic5TEuKxj8M
23. https://www.youtube.com/watch?v=ATn92XwdgC4
24. https://www.youtube.com/watch?v=ldlniZfA2X4
25. https://www.youtube.com/watch?v=C0K1XRT1myg
26. https://www.youtube.com/watch?v=iVcSgej7-K8

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. **Project-Based Learning (PBL):** Students gain knowledge by working on complex, real-world projects over time. Example: Building prototypes, developing community solutions, research presentations.
2. **Case Study Presentation:** Students will have a better understanding by analyzing various concepts and will develop team work capabilities.

Flipped Classroom: Students learn theoretical content at home (videos, readings) and engage in problem-solving or discussions in class.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.

The **CIE Theory component** consists of two IA tests each for 40 marks. The sum of the two tests will be **80 marks**, and the marks scored will be scaled down to **25**.

The CIE Practical component: Each laboratory experiment is evaluated for **30 marks** using rubrics and scale down to **15 marks**, one lab test will be conducted after all experiments for 50 marks and obtained marks will be scaled down to **10 marks**.

- To pass the **CIE Theory component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **CIE Practical component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for Theory CIE Test/SEE:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental principles and concepts of Electrochemistry and sensors -	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)

(CO1-PO1, PO3, PO4 and PO5)				
Applications of various sustainable energy generation and storage devices- (CO2-PO1, PO3, PO5 and PO7)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best(4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Synthesis and fabrication of sustainable and green fuels and energy devices (CO3-PO1, PO2, PO3 and PO7) (PO3 &PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation.(3-4)	Student is capable of implementing the design. (1-2)
Development of smart materials for advanced display systems (CO4-PO1.PO2, PO3, PO5 and PO6)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases.(4)	Student will be able to run the code for few cases and analyze the output(3)	Student will be able to run the program but not able to analyze the output(1-2)
Principles of E-waste management and functional polymer materials for engineering applications (CO5-PO1, PO2, PO3, PO7)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

Suggested rubrics for CIE Practical and test:

Performance Indicators	Excellent	Very Good	Good	Satisfactory

Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation. (3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output (3)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

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Smart Materials for Energy Applications (3:0:1) 4		Semester	I/II
Course Code	**1BCHEEE102/202**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:2	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 + 20	Total Marks	100
Credits	4	Exam Hours	
Scheme	2025	AY	2025-26
Examination type (SEE)	**Theory/Practical**		

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:
CO1: Apply fundamental electrochemical and sensor principles to analyze and interpret measurements in energy and electronic systems.
CO2: Demonstrate knowledge of energy storage and conversion technologies, including batteries, fuel cells, and solar cells for sustainable energy solutions.
CO3: Analyze the properties and applications of smart materials such as nanomaterials, quantum dots, and conducting polymers in advanced energy and electronic devices.
CO4: Analyze the disadvantages of conventional energy systems and interpret the production and advantages of renewable energy sources and green fuels as sustainable energy sources.
CO5: Apply the knowledge of electroanalytical techniques and quantitative measurements in the laboratory to have hands-on experience for demonstrative skills and teamwork.

Module-1 Electrode System and Electrochemical Sensors

Electrode System: Introduction, types of electrodes. Ecell concept and Nernst Equation and numericals. Primary and secondary Reference electrodes. Construction and working of calomel electrode, Application of calomel electrode. Ion-selective electrode – definition, construction, and working of the glass electrode. Determination of pH using a glass electrode.

Concentration cell – Definition, types, construction, and working of electrolyte concentration cell, numericals on Ecell.

Electrochemical Sensors: Introduction, principle and instrumentation of colorimetric sensors; its application in the estimation of copper in PCBs, principle and instrumentation of potentiometric sensors; applications in the estimation of iron in steel, conductometric sensors; its application in the estimation of acid mixture in sample.

Number of Hours: 8

Bloom's Taxonomy levels: 3

Module-2 Energy Storage Systems

Batteries: Introduction, Components, Classification of batteries. Characteristics of battery. Construction, working, and applications of metal-air, Li-ion battery. Numerical on battery efficiency.

Advanced Battery: Solid state electrolyte battery (Li-polymer battery), Sodium ion battery. Materials used and advantages over conventional batteries.

Supercapacitors: Definition, classification and characteristics: Electrostatic Double Layer Capacitors, Pseudo Capacitors and Hybrid Capacitors with examples and applications. Construction and working of ultra-small asymmetric super capacitor and its applications in IoT/wearable devices.

Bloom's Taxonomy levels: 3

Module-3 Energy Conversion Devices

Photovoltaics: Introduction, Different generation solar cells, Construction and working of PV cell, advantages and disadvantages of Si-solar cells. Perovskite solar cells: materials, advantages and disadvantages. Introduction to MEMS-Based Energy Harvesters, working principle and applications. Numericals on solar cell efficiency.

Fuel Cells: Introduction, Classification, difference between conventional cell and fuel-cell, limitations & advantages, applications. Construction & working of H_2-O_2 fuel cell, and solid oxide fuel cell.

Number of Hours: 8

Bloom's Taxonomy levels: 3

Module-4 Smart Materials for Energy and Electronic Devices

Nanomaterials: Introduction to Nanomaterials, classification - 0D, 1D, 2D and 3D Nanomaterials, Size-dependent properties like electrical, catalytic, optical properties. Quantum Dots: Introduction, Synthesis, Properties and advantages of QD materials. Application of QDs in display devices and nanoelectronics.

Advanced Polymers: Introduction to polymers and conducting polymers, Synthesis, mechanism of conduction in poly-acetylene, applications, numericals.

Semiconducting materials: Introduction, principle, Silicon as a semiconducting material: manufacture of silicon by Czocharlski method, applications of GaAs, SiGe as semiconducting materials. Organic semiconducting materials and their conducting mechanism and applications.

Number of Hours: 8

Bloom's Taxonomy levels: 3

Module-5 Alternate energy sources and Waste Management

Green Fuel: Introduction to renewable energy, Power alcohol and biodiesel: preparation, properties, and advantages as a green energy source.

Hydrogen Fuel: Introduction to green hydrogen, Production of H2 from biomass. Use of H2 as fuel , advantages.

Nuclear energy: Introduction to radioactive materials, Nuclear reactions for Power Generation, Advantages of nuclear energy.

Waste Management: e-waste- Introduction, sources, ill effects, extraction of gold from e-waste. **Nuclear waste:** Environmental and Safety Aspects and management of nuclear waste.

Number of Hours: 8

Bloom's Taxonomy levels: 3

PRACTICAL COMPONENTS OF IPCC

CONVENTIONAL AND STIMULATION EXPERIMENTS

1. Estimation of acid mixture by conductometric sensor (Conductometry)
2. Estimation of iron in rust sample by Potentiometric sensor (Potentiometry)
3. Determination of pKa of vinegar using pH sensor (Glass electrode)
4. Estimation of copper present in e-waste by optical sensor (Colorimetry)
5. Estimation of total hardness of water by EDTA method.
6. Estimation of iron in TMT bar by external indicator method.
7. Determination of chemical oxygen demand (COD) of industrial effluent sample.
8. Determination of alkalinity of given boiler water sample.
9. Green synthesis of copper nanoparticles for conductive ink applications.
10. Smartphone-Based colorimetric estimation of total phenolic content in coffee products.
11. Data analysis of pka of a week acid and its interpretation using origin software.
12. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. **Engineering Chemistry, Suba Ramesh, Vairam, Ananda Murthy, 2011, Wiley India, ISBN: 9788126519880.**
2. **Engineering chemistry, Shubha Ramesh et.al., Wiley India, 1st Edition, 2011, ISBN: 9788126519880.**
3. **Chemistry for Engineering Students by Dr B S Jai Prakash, Prof R Venugopal, Dr Shivakumaraiah. .**

<u>Reference books / Manuals:</u>

1. **Electrochemical Energy System:Dr. K. K. Rajeshwar (IIT Madras), Publisher: IIT Madras Open Courseware (Free PDF & videos), ISBN: N/A (Open Educational Resource).**
2. **Engineering Chemistry: Jain & Jain, Publisher: Dhanpat Rai Publishing Company, ISBN: 978 9353161181.**
3. **Energy storage and conversion devices; Supercapacitors, batteries and hydroelectric Cells Editor: Anurag Gaur, 2021, CRC Press, ISBN: 9781000470512.**
4. **Smart materials, Harvey, James A. Handbook of materials selection, 2002, John Wiley & Sons Canada, Limited, ISBN: 9780471359241**

Web links and Video Lectures (e-Resources):

1. https://youtu.be/HT21wrGl6oM

2. https://youtu.be/aG2F-fd2drM

3. https://youtu.be/ivWXuOd5SrI

4. https://www.youtube.com/watch?v=BGdCj3-PEoE

5. https://www.youtube.com/watch?v=xvtOPHsukzE

6. https://www.youtube.com/watch?v=VxMM4g2Sk8U

7. https://www.youtube.com/watch?v=0bjRNq1PKak

8. https://youtu.be/XIjDw5Sw9c4

9. https://youtu.be/lB2zbQvnwXw

10. https://youtu.be/FNohb7ZKxMI

11. https://www.youtube.com/watch?v=Y-nZbZzBOPg

12. https://en.wikipedia.org/wiki/Graphene_quantum_dot

13. https://youtu.be/NCOwWEMEQN8

14. https://youtu.be/u_2YRTmOTWQ

15. https://youtu.be/ygtbo5KDXeI

16. https://youtu.be/whyIdJab1kM

17. https://youtu.be/3TYH-8pPDV4

18. https://youtu.be/xS60SGWSw4s

19. https://youtu.be/zJTQLce-WC8

20. https://www.youtube.com/watch?v=Kbta_BXZ4Vs&t=73s

21. https://nerdfighteria.info/v/v6uRuNboy4A?utm_source

22. https://www.youtube.com/watch?v=E7UIonbL4FU

23. https://www.youtube.com/watch?v=0KgFJqeALTU

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. **Project-Based Learning (PBL):** Students gain knowledge by working on complex, real-world projects over time. Example: Building prototypes, developing community solutions, research presentations.
2. **Case Study Presentation:** Students will have a better understanding by analyzing various concepts and will develop team work capabilities.
3. **Flipped Classroom:** Students learn theoretical content at home (videos, readings) and engage in problem-solving or discussions in class.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.

The **CIE Theory component** consists of two IA tests each for 40 marks. The sum of the two tests will be **80 marks**, and the marks scored will be scaled down to **25**.

The CIE Practical component: Each laboratory experiment is evaluated for **30 marks** using rubrics and scale down to **15 marks**, one lab test will be conducted after all experiments for 50 marks and obtained marks will be scaled down to **10 marks**.

- To pass the **CIE Theory component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **CIE Practical component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for Theory CIE Test/SEE:

Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental principles of electrochemical concepts and smart sensor device applications - (CO1 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates comprehensive understanding of electrochemical concepts; accurately explains principles, equations, and mechanisms with clear scientific reasoning.	Shows strong understanding of electrochemical principles with minor errors or omissions in explanation.	Demonstrates basic understanding; explanations are generally correct but lack depth or clarity.	Shows limited understanding; major concepts are incomplete or inaccurately described.
Applications of various energy storage and energy conversion devices (CO2 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates an in-depth and accurate understanding of the working principles, materials, and mechanisms of diverse energy storage and conversion devices.	Shows strong understanding with minor conceptual gaps; explanations are mostly accurate and logical.	Displays basic understanding; explanations are partially correct or lack sufficient detail.	Shows limited understanding; key concepts are missing or inaccurately described.
Principles, applications and advantages of sustainable energy systems (CO2 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates comprehensive understanding of fundamental principles of sustainable energy, including sources, technologies, and efficiency measures, with accurate scientific reasoning.	Shows strong understanding with minor conceptual or interpretational errors.	Demonstrates general understanding; explanations are correct but lack depth or clarity.	hows limited understanding; explanations are incomplete or contain significant inaccuracies.
Fundamentals of smart materials and their applications in smart devices (CO3 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates in-depth understanding of smart materials' properties, mechanisms, and classifications; explains underlying scientific principles with accuracy and clarity.	Shows strong understanding with minor conceptual or factual errors; explanations are mostly correct and logical.	Demonstrates basic understanding; can identify key types and properties but lacks depth or detail in explanation.	Shows limited understanding; explanations are incomplete, unclear, or contain major inaccuracies.
Characteristics and applications of functional polymers and significance of e-waste management	Effectively applies knowledge to analyze or design applications of functional polymers in smart, biomedical,	Applies principles to appropriate applications with sound reasoning	Applies concepts to standard or familiar examples; lacks innovation or	Shows minimal understanding of applications; provides weak or incorrect

(CO4 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	or energy-related devices with innovation and technical depth.	and minor conceptual gaps.	detailed justification.	connections between material and use.

Suggested rubrics for CIE Practical and test:

Performance Indicators	**Excellent**	**Very Good**	**Good**	**Satisfactory**
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation. (3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output (3)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

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Advanced Metal Protection and Sustainable Energy Systems		Semester	I/II
Course Code	**1BCHEME102/202**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:2	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40	Total Marks	100
Credits	04	Exam Hours	03
Scheme	2025	AY	2025-26
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

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

CO1: Impart knowledge on existing and future fuels for conservative approach.

CO2: Understand current and futuristic energy sources and devices for energy storage.

CO3: Understand the basis of electroanalytical processes that evaluate the performance and durability of materials.

CO4: Determine the various properties of materials and processing technologies for fabricating different materials.

CO5: To understand the concept of smart materials, nano technologies and polymers for engineering applications.

Module-1 Energy production and conversion.

Chemical Fuels: Introduction, Characteristics of a good fuel, Calorific value- gross and net calorific values, determination of calorific value of a fuel using Bomb calorimeter, numerical problems.

Petrol as chemical fuel – Refining of crude oil, process of preparation by cracking and reforming. Octane number. Petrol knocking: Mechanisms and adverse effects. Anti knocking agents - MTBE and ETBE – advantages and disadvantages. Introduction to novel antiknocks to improve quality – nanomaterials.

Bio-Fuels: Introduction. Power alcohol, Biogas, Biodiesel (by trans esterification): Synthesis, advantages and disadvantages. Applications.

Number of Hours: 08

Module-2 Sustainable Energy generation and Storage devices

Photovoltaics: Introduction, construction and working of solar cell. Advantages and disadvantages.

Green hydrogen: Hydrogen as future fuel. Green hydrogen production from photocatalytic method. Advantages and disadvantages of hydrogen as a fuel.

Fuel cell: Introduction, construction, working of H_2-O_2 fuel cell, solid oxide fuel cell. Advantages and limitations.

Battery: Introduction, classification of batteries. Construction, working and applications of Lithium ion battery. Advantage and limitations of sodium-ion batteries over lithium ion batteries. A brief overview of Multivalent metal-ion batteries - Redox flow batteries.

Number of Hours: 08

Module-3 Corrosion mitigation an engineering application

Introduction to Electrode Systems: Introduction, types of electrochemical cells. Nernst equation for single electrode potential and numerical.

Corrosion and Control: Introduction. Types – Dry and wet corrosion, Electrochemical theory of corrosion taking rusting of iron as an example. Differential metal corrosion and differential aeration corrosion.

Corrosion mitigation – Protective Coatings – Anodic and cathodic coatings – galvanization and tinning. Cathodic protection- Sacrificial anode method and impressed current method.

Corrosion mitigation analysis techniques – Introduction to Corrosion penetration rate. Chemical Method – Weight loss method. Numerical problems**.**

Number of Hours: 08

Module-4 Surface Coating Methods and Analysis

Coating Methods: Introduction, coating materials, coating technologies, types of coating: Chemical Vapor Deposition (CVD), Physical Vapor Deposition (PVD), High Velocity Oxy-Fuel Coating, advantages and disadvantages of surface coating.
Electroplating: Principle. Electroplating of Chromium- Hard and Decorative Cr plating. **Electroless plating**: Principle. Electroless plating of Copper in PCBs. Differences between electroplating and electroless platting.
Spectro analytical techniques: Introduction, basics of - Scanning electron microscopy (SEM) coupled with an energy-dispersive X-ray spectroscopy (EDX) unit, X-ray diffraction (XRD), atomic force microscopy (AFM).

Number of Hours: 08

Module-5 Engineering Smart Materials

Smart Materials: Introduction – Types of smart materials, self-healing materials, shape memory alloys and uses of smart materials in space applications taking NITINOL as case study.
Nanomaterials: Introduction to Nanomaterials, classification and properties - catalytic and electrical properties. Synthesis of nanomaterials: top-down brief overview of – Mechanical milling, lithography, Electric ach discharge; bottom-up approach by Sol-gel, sonochemistry, spray pyrolysis.
Polymers in engineering application: Introduction to polymers, polymerization methods – addition (TEFLON) and condensation (PLA). High performance polymers and applications - synthesis, applications of PEEK. Nylon-2-nylon-6 - synthesis, application in soft robotics, medical robotics, environmental robotics. Biodegradable polymers - PLA robotic applications.

Number of Hours: 08

PRACTICAL COMPONENTS OF IPCC

CONVENTIONAL AND SIMULATION EXPERIMENTS

1. Estimation of acid mixture using conductometric sensor
2. Estimation of iron in rust sample using potentiometric sensor
3. Determination of pKa value of vinegar solution using pH sensor
4. Estimation of copper using optical sensor
5. Determination of viscosity coefficient of organic solvent using Ostwald's Viscometer
6. Estimation of iron in TMT bar by external indicator method
7. Drawing of Chemical structure using ChemDraw.
8. Energy stabilization of the organic structures using Chem 3d.
9. Molecular docking analysis using AutodockVina and Pymol tool.
10. Determination of rusting of iron by CPR method.
11. Determination of CaO in cement by EDTA method.
12. Use of Avagadro software for material design.
13. Smartphone-Based colorimetric estimation of total phenolic content in coffee products.
14. Synthesis of metal oxide by combustion method and its crystal structure identification and phase matching using crystal search-match software (e.g., Match! or VESTA).
15. Data plotting and non-linear curve fitting using FitYK / Origin software.
16. Data analysis of pka of a week acid and its interpretation using origin software.
16.

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):
Textbooks:

1. Textbook of Engineering Chemistry: S. S. Dara & S. S. Umare, S. Chand Publishing, ISBN:9788121903593
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi, 1st edition, 2012.

3. Engineering Chemistry: Jain & Jain, Publisher: Dhanpat Rai Publishing Company, ISBN: 978-935316118.

Reference books / Manuals:

1. Materials Science: S. K. Malik, Publisher: New Age International Publishers, ISBN: 978 8122418713.
2. Electrochemical Energy System: Dr. K. K. Rajeshwar (IIT Madras), Publisher: IIT Madras Open Courseware (Free PDF & videos), ISBN: N/A (Open Educational Resource).
3. Materials Science: S. K. Malik, Publisher: New Age International Publishers, ISBN: 978 8122418713.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/113/104/113104021/
2. https://nptel.ac.in/courses/103/102/103102103/ 3.https://www.youtube.com/watch?v=JvzH4QQOfSw
4. https://www.youtube.com/watch?v=1F9Vjae7k60 5.https://www.youtube.com/watch?v=xrsK9FUdvRE
6.https://www.youtube.com/watch?v=QNKPaZkWC9Q
7.https://www.youtube.com/watch?app=desktop&v=dwUVMVNSO2k
8.https://www.youtube.com/watch?v=MzTiZp01_qs 9.https://nptel.ac.in/courses/103/102/103102014/
10.https://www.youtube.com/watch?app=desktop&v=4Ur3eqGiLzc
11.https://www.youtube.com/watch?v=nU3a8dA0Oc4 12.https://www.youtube.com/watch?v=570mPvlxqPg
13.https://www.youtube.com/watch?v=1SOtM_Vq8es 14.https://www.youtube.com/watch?v=_Y2ePj3wr8M
15.https://www.youtube.com/watch?v=eT34ypRodB0

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Project-Based Learning (PBL): Students gain knowledge by working on complex, real-world projects over time.
Example: Building prototypes, developing community solutions, research presentations.

2. Flipped Classroom: Students learn theoretical content at home (videos, readings) and engage in problem-solving or discussions in class.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).
The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.

The **CIE Theory component** consists of two IA tests for 40 marks. The sum of the two tests will be 80 marks, and the marks obtained will be scale down to **25 marks**.
The **CIE Practical component**: Each laboratory experiment is evaluated for 30 marks using rubrics and scale down to **15 marks**, one lab test will be conducted after all experiments for 50 marks and obtained marks will be scaled down to **10 marks**.

- To pass the **CIE theory component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **CIE Practical component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics for Theory CIE Test/SEE:

Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental principles of Energy production and conversion - (CO1 mapped to PO1, PO5, PO6, PO9, PO10, PO11)	Demonstrates comprehensive understanding of energy; accurately explains principles, equations, and mechanisms with clear scientific reasoning.	Shows strong understanding of energy principles with minor errors or omissions in explanation.	Demonstrates basic understanding; explanations are generally correct but lack depth or clarity.	Shows limited understanding; major concepts are incomplete or inaccurately described.
Applications of various sustainable energy generation and storage devices (CO2 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates an in-depth and accurate understanding of the working principles, materials, and mechanisms of diverse energy storage and conversion devices.	Shows strong understanding with minor conceptual gaps; explanations are mostly accurate and logical.	Displays basic understanding; explanations are partially correct or lack sufficient detail.	Shows limited understanding; key concepts are missing or inaccurately described.
Principles, applications and advantages of corrosion mitigation and engineering application (CO3 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates comprehensive understanding of fundamental principles of corrosion and efficiency measures, with accurate scientific reasoning.	Shows strong understanding with minor conceptual or interpretational errors.	Demonstrates general understanding; explanations are correct but lack depth or clarity.	hows limited understanding; explanations are incomplete or contain significant inaccuracies.
Characteristics and applications of surface coating methods (CO4 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Effectively applies knowledge to analyze or design applications of surface coating methods with innovation and technical depth.	Shows strong understanding with minor conceptual or factual errors; explanations are mostly correct and logical.	Demonstrates basic understanding; can identify key types and properties but lacks depth or detail in explanation.	Shows limited understanding; explanations are incomplete, unclear, or contain major inaccuracies.
Fundamentals of smart materials and their applications in smart devices (CO5 mapped to PO1, PO2, PO5, PO8, PO9, PO11)	Demonstrates in-depth understanding of smart materials' properties, mechanisms, and classifications; explains underlying scientific principles with accuracy and clarity.	Applies principles to appropriate applications with sound reasoning and minor conceptual gaps.	Applies concepts to standard or familiar examples; lacks innovation or detailed justification.	Shows minimal understanding of applications; provides weak or incorrect connections between material and use.

Suggested rubrics for CIE Practical and test:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation. (3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output (3)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

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STRUCTURAL MATERIALS AND SUSTAINABLE TECHNOLOGIES		Semester	I/II
Course Code		CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:2	SEE Marks	50
Total Hours of Pedagogy (Theory and Lab hours)	40 (Theory) +20 (Lab)	Total Marks	100
Credits	04	Exam Hours	03
Scheme	2025	AY	2025-26
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

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

CO1: Understand electrochemical principles, energy storage systems and green hydrogen production for sustainable energy applications.

CO2: Analyse polymers, nanomaterials and composite materials for structural integrity and sensor applications.

CO3: Evaluate sustainable construction materials like geopolymer concrete, biopolymers and smart coatings including photochromic and piezoelectric composites.

CO4: Explain corrosion mechanism in metals and alloys, types of corrosion in civil structures and apply metal finishing techniques for surface protection.

CO5: Apply water chemistry principles and analytical techniques like potentiometry, conductometry and colorimetry for environmental and industrial water quality assessment.

Module-1 Energy Systems and Green Fuels

Electrochemistry: Introduction, electrode potential, cell potential, derivation of Nernst equation, concentration cell, numerical problems.

Energy systems: Introduction, classification of batteries, construction and working of Lithium-ion battery, redox flow battery and its applications.

Fuel cells: Definition, differences between battery and fuel cell, construction and working of solid oxide fuel cell.

Green Fuels: Introduction, green hydrogen production by TiO_2-Photocatalytic method and applications, construction and working of solar cells.

Number of Hours: 08

Module-2 Materials for Structural Integrity

Polymer: Introduction, types of polymerization (addition and condensation), synthesis properties and engineering applications of PVC, PLA, Kevlar fiber and epoxy resins, molecular weight determination of polymers - number average and weight average molecular weights, properties and industrial applications of carbon based reinforced composites - graphene/carbon nano-tubes as fillers.

Nanomaterials: Introduction, size dependent properties - surface area, water absorption, permeability, thermal and mechanical properties, composition of nano-concrete and its advantages, synthesis of TiO_2 nanoparticles by sol-gel method for sensor applications.

Number of Hours: 08

Module-3 Conventional and Sustainable Construction Materials

Cement: Introduction, composition, manufacturing process of cement - wet process, process of setting and hardening of cement, special cements (Sulphate Resistant Cement) - composition, properties and applications.

Geopolymer Concrete: Introduction, manufacturing process and applications.

Photochromic Coatings: Introduction, spiropyran as photochromic coating, working principle with chemical reactions and applications in construction activities.

Piezoelectric Cement Composites: Introduction, piezoelectric materials in cement composites and its applications in civil engineering.

Number of Hours: 08

Module-4 Corrosion Science and Surface Protection

Metals and Alloys: Introduction, classification of metals: ferrous and non-ferrous, composition, properties, applications of iron and its alloys-wrought iron, cast iron, pig iron and steel, aluminium and its alloys-Duralumin and Magnalium.

Corrosion: Introduction, electrochemical corrosion of steel in concrete, types- differential metal corrosion and differential aeration corrosion, stress corrosion in civil structures. Corrosion control by galvanization and anodization, corrosion penetration rate (CPR) - definition, importance and numerical problems.

Metal Finishing: Introduction, technological importance of metal finishing, electroplating of Chromium-decorative and hard coating.

Number of Hours: 08

Module-5 Water Chemistry and Analytical Techniques

Water Chemistry: Introduction, significance of water quality parameters - pH, turbidity, chlorides, dissolved oxygen and alkalinity for environmental and construction applications. Hard water: types, determination of total hardness by EDTA method, determination of dissolved oxygen in sewage water by Winkler's method, COD and numericals.

Analytical Techniques: Introduction, potentiometric sensors: principle, instrumentation and application in estimation of iron in industrial effluents, conductometric sensors: principle, instrumentation and application in determination of acid mixture in water and industrial effluents: colorimetric sensor: principle, instrumentation and estimation of copper in brass alloy

Number of Hours: 08

PRACTICAL COMPONENTS OF IPCC

PART – A: FIXED SET OF EXPERIMENTS

1. Estimation of acid mixture using conductometric sensor
2. Estimation of iron in rust sample using potentiometric sensor
3. Determination of pKa value of vinegar solution using pH sensor
4. Estimation of iron in TMT bar using optical sensor
5. Determination of chemical oxygen demand (COD) of industrial effluents
6. Estimation of iron in TMT bar by diphenyl amine indicator method
7. Determination of CaO in cement by EDTA method
8. Estimation of total hardness of hard water sample by EDTA method.
9. Determination of Chloride content in Cement.
10. Determination of alkali and alkaline earth metals present in soil samples – Flame photometry (V).
11. Soil Analysis-Determination of Available Nitrogen content in the Soil by Kjeldahl method (V)

12. Estimation of Phosphate Content in Soft Drinks (V).

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Textbooks:

1. Textbook of Engineering Chemistry: S. S. Dara & S. S. Umare, S. Chand Publishing, ISBN:9788121903593
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi, 1st edition, 2012.
3. Engineering Chemistry: Jain & Jain, Publisher: Dhanpat Rai Publishing Company, ISBN: 978-935316118.

Reference books / Manuals:

1. Materials Science: S. K. Malik, Publisher: New Age International Publishers, ISBN: 978 8122418713.
2. Electrochemical Energy System: Dr. K. K. Rajeshwar (IIT Madras), Publisher: IIT Madras Open Courseware (Free PDF & videos), ISBN: N/A (Open Educational Resource).
3. Materials Science: S. K. Malik, Publisher: New Age International Publishers, ISBN: 978 8122418713.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/113/104/113104021/
2. https://nptel.ac.in/courses/103/102/103102103/
3.https://www.youtube.com/watch?v=JvzH4QQOfSw
4. https://www.youtube.com/watch?v=1F9Vjae7k60
5.https://www.youtube.com/watch?v=xrsK9FUdvRE
6.https://www.youtube.com/watch?v=QNKPaZkWC9Q
7.https://www.youtube.com/watch?app=desktop&v=dwUVMVNSO2k
8.https://www.youtube.com/watch?v=MzTiZp01_qs
9.https://nptel.ac.in/courses/103/102/103102014/
10.https://www.youtube.com/watch?app=desktop&v=4Ur3eqGiLzc
11.https://www.youtube.com/watch?v=nU3a8dA0Oc4
12.https://www.youtube.com/watch?v=570mPvlxqPg
13.https://www.youtube.com/watch?v=1SOtM_Vq8es
14.https://www.youtube.com/watch?v=_Y2ePj3wr8M
15.https://www.youtube.com/watch?v=eT34ypRodB0

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Project-Based Learning (PBL): Students gain knowledge by working on complex, real-world projects over time.

Example: Building prototypes, developing community solutions, research presentations.

2. Flipped Classroom: Students learn theoretical content at home (videos, readings) and engage in problem-solving or discussions in class.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.

The **CIE Theory component** consists of two IA tests for 40 marks. The sum of the two tests will be 80 marks, and the marks obtained will be scale down to **25 marks**.

The **CIE practical component**: Each laboratory experiment is evaluated for 30 marks using rubrics and scale down to **15 marks**, one lab test will be conducted after all experiments for 50 marks and obtained marks will be scaled down to **10 marks**.

- To pass the **CIE Theory component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **CIE Practical component**, a student must secure **a minimum of 40% of 25 marks**, i.e., **10 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

CIE Practical component:

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The summation of all the experiments marks to be scaled down to 15 marks.

The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 5 marks. For laboratory test and SEE, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for SEE / CIE Test:

Performance Indicator (CO/PO Mapping)	Superior	Good	Fair	Needs Improvement	Unacceptable
Performance Indicator- 1 (CO1 - PO1, PO2, PO3, PO6, PO11)	Provides insightful analysis and explains both conventional and alternative energy systems for sustainable energy generation.	Provides relevant analysis with accurate explanation of conventional and alternative energy systems.	Provides a general explanation of energy systems with limited insight or depth.	Provides a partially accurate explanation with minimal analysis.	Fails to provide a meaningful explanation, lacks understanding of both energy systems and sustainability concepts.
Performance Indicator 2 (CO2 - PO1, PO2, PO3, PO4, PO11)	Provides an accurate evaluation of composite materials, with deep understanding of structural applications.	Gives an evaluation of composite materials with appropriate focus on structural use.	Provides a basic evaluation with some understanding of structural applications and optimization for durability and performance.	Provides minimal evaluation, lacks adequate understanding of structural applications.	Fails to evaluate composite materials or shows no understanding of structural applications.
Performance Indicator 3 (CO3 - PO1, PO2, PO3, PO6, PO11)	Effectively applies advanced chemical principles to innovatively develop and critically assess sustainable construction materials.	Clearly applies relevant chemical principles in the development and assessment of sustainable construction materials	Applies basic chemical concepts with partial accuracy; demonstrates limited ability to develop sustainable materials.	Demonstrates minimal application of chemical principles; weak or unclear understanding of sustainable construction materials.	Fails to apply chemical principles or shows no understanding of sustainable construction materials.
Performance Indicator 4 (CO4 - PO1, PO2, PO3, PO4, PO11)	Demonstrates a deep understanding of corrosion mechanisms and effectively selects and applies appropriate alloy based surface protection techniques with clear justification.	Shows a clear understanding of corrosion processes and applies suitable alloy-based protection methods with reasonable accuracy.	Provides a basic understanding of corrosion mechanisms and mentions general surface protection techniques, but lacks detail or accuracy.	Shows minimal understanding of corrosion or protection methods; application of alloys is weak.	Fails to demonstrate understanding of corrosion mechanism and no application of alloys is evident.
Performance Indicator 5 (CO5 - PO1, PO2, PO3, PO6, PO11)	Accurately assesses key water chemistry parameters and effectively applies appropriate wastewater treatment methods.	Clearly assesses major water chemistry parameters and applies suitable treatment methods with adequate focus on sustainability.	Provides a basic assessment of water chemistry with partial application of treatment methods and limited understanding of environmental management principles.	Shows minimal understanding of water chemistry and weak connection to sustainability.	Fails to assess water chemistry and lacks of understanding in environmental management.

Rubrics for CIE Practical and Test:

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation. (3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output (3)	Student will be able to run the program but not able to analyze the output (1-2)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

Computer Aided Engineering Drawing (Program Specific)

1. **Computer Aided Engineering Drawing for CSE Stream 1BCEDCS103/203**

2. **Computer Aided Engineering Drawing for ECE Stream 1BCEDEC103/203**

3. **Computer Aided Engineering Drawing for EEE Stream1BCEDEE103/203**

4. **Computer Aided Engineering Drawing for ME Stream1BCEDME103/203**

5. **Computer Aided Engineering Drawing for CV Stream1BCEDCV103/203**

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COMPUTER AIDED ENGINEERING DRAWING FOR CSE STREAM		Semester	I/II
Course Code	1BCEDCS103/203	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Illustrate competence in orthographic projections of points and lines.

CO2: Apply the concepts of orthographic projections of planes and solids pertaining to industrial drawings.

CO3: Construct isometric drawings of objects and development of lateral surfaces.

Module-1

Preamble: Importance of Engineering Drawing, Industrial /defence application, research in the field of ME, Impact of the course on societal and sustainable solutions.

Introduction to Engineering drawing

Drawing Instruments and their uses, relevant BIS conventions and standards. Lettering, line conventions, dimensioning, material conventions, and free hand practicing. Co- ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.
Orthographic Projections: Planes of projection.

Projections of points in all the four quadrants.

Projections of straight lines

True length and True inclinations of a line, Apparent length and apparent inclinations of a line. Projection of straight line inclined to both the planes

Number of Hours:**06**

Module-2

Projections of plane surfaces

Introduction to projection of plane surfaces, Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to horizontal and vertical planes.

Number of Hours:**08**

Module-3

Projections of solids

Introduction to projections of Solids, Projections of right regular Prisms, Pyramids, Cones, Tetrahedron and Hexahedron (cube) inclined to both the planes.

Number of Hours:**10**

Module-4

Isometric Projection

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones, Hemisphere and spheres. Isometric projection of combination of two solids.

Development of lateral surfaces

Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only. Number of Hours:**10**

Module-5(For CIE only)

Creation of basic and complex 2D sketches using lines, arcs, and geometric constraints. Apply parametric dimensions and design intent to control shape and behavior of sketches. . Number of Hours:**04**

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Textbooks:

1. K.R. Gopalakrishna, *Engineering Graphics*, 32nd ed. Bangalore: Subhas Publications,2013.
2. N.D. Bhatt, *Engineering Drawing*, 48th ed. Gujarat: V. M. Panchal Charutha Publishing House, 2005.

References:

1. A Primer on Computer Aided Engineering Drawing, 2nd edition, Published by VTU, Belagavi.
2. Luzadder Warren J., Duff John M Eastern, 2009, Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, 7th edition, Best Publications.
3. Parthasarathy N. S., Vela Murali, Engineering Drawing, Oxford University Press, 2015.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**. A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Internal Evaluation (CIE)

- CIE shall be evaluated for max. marks of 100 and later the same shall be scaled down to 50 marks as detailed below:
- CIE component should comprise of Continuous evaluation of Drawing work of students based on below detailed weightage

Module	Max. Marks Weightage	Evaluation weightage in marks	
		Computer display and printout (a)	Sketching (b)
Module 1	35		
Module 2	35		
Module 3	60		
Module 4	70		

- Two tests covering all the modules is to be conducted and evaluation to be basedon SEE pattern, and average marks is to be scaled down to **20 Mark**s.
- The final CIE (50) = Class work marks (30) + Test marks (20)

Question paper pattern:

- Module 1 and Module 2 will have ONE question each. Student required to answer any ONE question.
- Module 3 will have TWO questions. Student required to answer any ONE question.
- Module 4 will have TWO questions. Student required to answer any ONE question.
- Module 5 is for understanding the application concepts and for practice using the necessary software. This module is not considered for SEE.

Scheme of Evaluation:

- Each of the question will be distributed in to TWO segments. The first being **SKETCHING** to its actual scale in the sketch book followed by the second segment being **DRAFTING** using a relevant Graphics Software.

Q.No.	Question paper pattern	Marks for SKETCHING	Marks for DRAFTING	TOTAL MARKS
1	Module 1 and Module 2	10	20	30
2	Module 3	20	20	40
3	Module 4	10	20	30
Total		**40**	**60**	**100**

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COMPUTER AIDED ENGINEERING DRAWING FOR ECE PROGRAM		Semester	I/II
Course Code	**1BCEDEC103/203**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Illustrate competence in orthographic projections of points and lines.

CO2: Apply the concepts of orthographic projections of planes and solids pertaining to industrial drawings.

CO3: Construct isometric drawings of objects and development of lateral surfaces.

Module-1

Preamble: Importance of Engineering Drawing, Industrial /defence application, research in the field of ME, Impact of the course on societal and sustainable solutions.

Introduction to Engineering drawing

Drawing Instruments and their uses, relevant BIS conventions and standards. Lettering, line conventions, dimensioning, material conventions, and free hand practicing. Co- ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.
Orthographic Projections: Planes of projection.

Projections of points in all the four quadrants.

Projections of straight lines

True length and True inclinations of a line, Apparent length and apparent inclinations of a line. Projection of straight line inclined to both the planes

Number of Hours:**06**

Module-2

Projections of plane surfaces

Introduction to projection of plane surfaces, Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to horizontal and vertical planes.

Number of Hours:**08**

Module-3

Projections of solids

Introduction to projections of Solids, Projections of right regular Prisms, Pyramids, Cones, Tetrahedron and Hexahedron (cube) inclined to both the planes.

Number of Hours:**10**

Module-4

Isometric Projection

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones, Hemisphere and spheres. Isometric projection of combination of two solids.

Development of lateral surfaces

Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only. Number of Hours:**10**

Module-5(For CIE only)

Simple circuits and PCB circuits. Number of Hours:**04**

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Textbooks:

1. K.R. Gopalakrishna, *Engineering Graphics*, 32nd ed. Bangalore: Subhas Publications,2013.
2. N.D. Bhatt, *Engineering Drawing*, 48th ed. Gujarat: V. M. Panchal Charutha Publishing House, 2005.

References:

1. A Primer on Computer Aided Engineering Drawing, 2nd edition, Published by VTU, Belagavi.
2. Luzadder Warren J., Duff John M Eastern, 2009, Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, 7th edition, Best Publications.
3. Parthasarathy N. S., Vela Murali, Engineering Drawing, Oxford University Press, 2015.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**. A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Internal Evaluation (CIE)

- CIE shall be evaluated for max. marks of 100 and later the same shall be scaled down to 50 marks as detailed below:
- CIE component should comprise of Continuous evaluation of Drawing work of students based on below detailed weightage

Module		Evaluation weightage in marks

	Max. Marks Weightage	Computer display and printout (a)	Sketching (b)
Module 1	35		
Module 2	35		
Module 3	60		
Module 4	70		

- Two tests covering all the modules is to be conducted and evaluation to be basedon SEE pattern, and average marks is to be scaled down to **20 Mark**s.
- The final CIE (50) = Class work marks (30) + Test marks (20)

Question paper pattern:

- Module 1 and Module 2 will have ONE question each. Student required to answer any ONE question.
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- Module 4 will have TWO questions. Student required to answer any ONE question.
- Module 5 is for understanding the application concepts and for practice using the necessary software. This module is not considered for SEE.

Scheme of Evaluation:

- Each of the question will be distributed in to TWO segments. The first being **SKETCHING** to its actual scale in the sketch book followed by the second segment being **DRAFTING** using a relevant Graphics Software.

Q.No.	Question paper pattern	Marks for SKETCHING	Marks for DRAFTING	TOTAL MARKS
1	Module 1 and Module 2	10	20	30
2	Module 3	20	20	40
3	Module 4	10	20	30
Total		**40**	**60**	**100**

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COMPUTER AIDED ENGINEERING DRAWING FOR EE PROGRAM		Semester	I/II
Course Code	1BCEDEE103/203	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Illustrate competence in orthographic projections of points and lines.

CO2: Apply the concepts of orthographic projections of planes and solids pertaining to industrial drawings.

CO3: Construct isometric drawings of objects and development of lateral surfaces.

Module-1

Preamble: Importance of Engineering Drawing, Industrial /defence application, research in the field of ME, Impact of the course on societal and sustainable solutions.

Introduction to Engineering drawing

Drawing Instruments and their uses, relevant BIS conventions and standards. Lettering, line conventions, dimensioning, material conventions, and free hand practicing. Co- ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.
Orthographic Projections: Planes of projection.

Projections of points in all the four quadrants.

Projections of straight lines

True length and True inclinations of a line, Apparent length and apparent inclinations of a line. Projection of straight line inclined to both the planes

Number of Hours:**06**

Module-2

Projections of plane surfaces

Introduction to projection of plane surfaces, Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to horizontal and vertical planes.

Number of Hours:**08**

Module-3

Projections of solids

Introduction to projections of Solids, Projections of right regular Prisms, Pyramids, Cones, Tetrahedron and Hexahedron (cube) inclined to both the planes.

Number of Hours:**10**

Module-4

Isometric Projection

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones, Hemisphere and spheres. Isometric projection of combination of two solids.

Development of lateral surfaces

Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only. Number of Hours:**10**

Module-5(For CIE only)

Circuit diagram of half wave rectifier, full wave rectifier, Wheatstone bridge, positive clamper circuit, 2 way control switches, 3 way control switches, Operation amplifier, Inverting amplifier. Number of Hours:**04**

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Textbooks:

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2. N.D. Bhatt, *Engineering Drawing*, 48th ed. Gujarat: V. M. Panchal Charutha Publishing House, 2005.

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Module 2	35		
Module 3	60		
Module 4	70		

- Two tests covering all the modules is to be conducted and evaluation to be basedon SEE pattern, and average marks is to be scaled down to **20 Mark**s.
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Question paper pattern:

- Module 1 and Module 2 will have ONE question each. Student required to answer any ONE question.
- Module 3 will have TWO questions. Student required to answer any ONE question.
- Module 4 will have TWO questions. Student required to answer any ONE question.
- Module 5 is for understanding the application concepts and for practice using the necessary software. This module is not considered for SEE.

Scheme of Evaluation:

- Each of the question will be distributed in to TWO segments. The first being **SKETCHING** to its actual scale in the sketch book followed by the second segment being **DRAFTING** using a relevant Graphics Software.

Q.No.	Question paper pattern	Marks for SKETCHING	Marks for DRAFTING	TOTAL MARKS
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3	Module 4	10	20	30
Total		**40**	**60**	**100**

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COMPUTER AIDED ENGINEERING DRAWING FOR ME STREAM		Semester	I/II
Course Code	1BCEDME103/203	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Illustrate competence in orthographic projections of points and lines.

CO2: Apply the concepts of orthographic projections of planes and solids pertaining to industrial drawings.

CO3: Construct isometric drawings of objects and development of lateral surfaces.

Module-1

Preamble: Importance of Engineering Drawing, Industrial /defence application, research in the field of ME, Impact of the course on societal and sustainable solutions.

Introduction to Engineering drawing

Drawing Instruments and their uses, relevant BIS conventions and standards. Lettering, line conventions, dimensioning, material conventions, and free hand practicing. Co- ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.
Orthographic Projections: Planes of projection.

Projections of points in all the four quadrants.

Projections of straight lines

True length and True inclinations of a line, Apparent length and apparent inclinations of a line. Projection of straight line inclined to both the planes

Number of Hours:**06**

Module-2

Projections of plane surfaces

Introduction to projection of plane surfaces, Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to horizontal and vertical planes.

Number of Hours:**08**

Module-3

Projections of solids

Introduction to projections of Solids, Projections of right regular Prisms, Pyramids, Cones, Tetrahedron and Hexahedron (cube) inclined to both the planes.

Number of Hours:**10**

Module-4

Isometric Projection

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones, Hemisphere and spheres. Isometric projection of combination of two solids.

Development of lateral surfaces

Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only.

Number of Hours:**10**

Module-5(For CIE only)

Introduction to 3D drawing: Conversion of pictorial views of components into orthographic projections.

Number of Hours:**04**

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Textbooks:

1. K.R. Gopalakrishna, *Engineering Graphics*, 32nd ed. Bangalore: Subhas Publications,2013.
2. N.D. Bhatt, *Engineering Drawing*, 48th ed. Gujarat: V. M. Panchal Charutha Publishing House, 2005.

References:

1. A Primer on Computer Aided Engineering Drawing, 2nd edition, Published by VTU, Belagavi.
2. Luzadder Warren J., Duff John M Eastern, 2009, Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, 7th edition, Best Publications.
3. Parthasarathy N. S., Vela Murali, Engineering Drawing, Oxford University Press, 2015.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**. A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Internal Evaluation (CIE)

- CIE shall be evaluated for max. marks of 100 and later the same shall be scaled down to 50 marks as detailed below:
- CIE component should comprise of Continuous evaluation of Drawing work of students based on below detailed weightage

Module		Evaluation weightage in marks

	Max. Marks Weightage	Computer display and printout (a)	Sketching (b)
Module 1	35		
Module 2	35		
Module 3	60		
Module 4	70		

- Two tests covering all the modules is to be conducted and evaluation to be basedon SEE pattern, and average marks is to be scaled down to **20 Mark**s.
- The final CIE (50) = Class work marks (30) + Test marks (20)

Question paper pattern:

- Module 1 and Module 2 will have ONE question each. Student required to answer any ONE question.
- Module 3 will have TWO questions. Student required to answer any ONE question.
- Module 4 will have TWO questions. Student required to answer any ONE question.
- Module 5 is for understanding the application concepts and for practice using the necessary software. This module is not considered for SEE.

Scheme of Evaluation:

- Each of the question will be distributed in to TWO segments. The first being **SKETCHING** to its actual scale in the sketch book followed by the second segment being **DRAFTING** using a relevant Graphics Software.

Q.No.	Question paper pattern	Marks for SKETCHING	Marks for DRAFTING	TOTAL MARKS
1	Module 1 and Module 2	10	20	30
2	Module 3	20	20	40
3	Module 4	10	20	30
Total		**40**	**60**	**100**

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COMPUTER AIDED ENGINEERING DRAWING FOR CV STREAM		Semester	I/II
Course Code	1BCEDCV103/203	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Illustrate competence in orthographic projections of points and lines.

CO2: Apply the concepts of orthographic projections of planes and solids pertaining to industrial drawings.

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Number of Hours:**06**

Module-2

Projections of plane surfaces

Introduction to projection of plane surfaces, Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to horizontal and vertical planes.

Number of Hours:**08**

Module-3

Projections of solids

Introduction to projections of Solids, Projections of right regular Prisms, Pyramids, Cones, Tetrahedron and Hexahedron (cube) inclined to both the planes.

Number of Hours:**10**

Module-4

Isometric Projection

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones, Hemisphere and spheres. Isometric projection of combination of two solids.

Development of lateral surfaces

Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only. Number of Hours:**10**

Module-5(For CIE only)

Conventional representation of Building Materials. Basic Building Drawing: Simple Architectural floor plan and elevation. Basic foundation drawing, House Water supply & drainage drawing using Auto CAD or suitable software. Number of Hours:**04**

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Textbooks:

1. K.R. Gopalakrishna, *Engineering Graphics*, 32nd ed. Bangalore: Subhas Publications,2013.
2. N.D. Bhatt, *Engineering Drawing*, 48th ed. Gujarat: V. M. Panchal Charutha Publishing House, 2005.

References:

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Module		Evaluation weightage in marks

	Max. Marks Weightage	Computer display and printout (a)	Sketching (b)
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Module 2	35		
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Module 4	70		

- Two tests covering all the modules is to be conducted and evaluation to be basedon SEE pattern, and average marks is to be scaled down to **20 Mark**s.
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Scheme of Evaluation:

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Q.No.	Question paper pattern	Marks for SKETCHING	Marks for DRAFTING	TOTAL MARKS
1	Module 1 and Module 2	10	20	30
2	Module 3	20	20	40
3	Module 4	10	20	30
Total		**40**	**60**	**100**

Emerging Technology Course

1. Introduction to AI and Applications 1BAI103/203

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Introduction to AI and Applications		Semester	I
Course Code	1BAI103	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcomes (Course Skill Sets)

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

1. Explain the concept of Artificial Intelligence and its foundational principles.
2. Describe different learning paradigms and strategies such as supervised, unsupervised, and semi-supervised learning.
3. Make use of prompt engineering techniques to interact with generative AI models.
4. Identify the ethical and social issues related to AI.
5. Analyze the applications of AI across different domains.

Module-1

Foundations of AI: What is Artificial Intelligence? The Foundations of AI, The History of AI, The State of the Art.

Intelligent Agents: Agents & Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Textbook 1: Chapters 1 & 2 **Number of Hours: 8**

Module-2

Machine Learning (ML) Basics: What is Machine Learning, How do machines learn, Well-posed learning problem. **Types of ML**: Supervised, Unsupervised, Reinforcement. State-of-the-art Languages / Tools in ML, Issues in ML, **Key ML Concepts**: Training and Testing, Overfitting and Underfitting, **Evaluation Metrics**: Accuracy, Precision, Recall, F-measure.

Reference Books (Faculty curated references) **Number of Hours: 8**

Module-3

Prompt Engineering and Generative AI: Basics of Prompting, Prompt Elements, General tips for designing prompts, Examples of prompts.

Prompting Techniques: Zero-shot Prompting, Few-shot Prompting, Chain-of-Thought Prompting, Meta Prompting.

Overview of Generative AI Models: ChatGPT, Claude 3, Gemini, Grok-1, LLaMA, Mistral 7B, Sora.

Reference: The Prompt Engineering Guide by DAIR.AI (https://www.promptingguide.ai/)

Text Book 2: Chapters 1 & 3 **Number of Hours: 8**

Module-4

Philosophical Foundations: Weak AI, Strong AI, The ethics & risks of developing AI.

Current Trends in AI: AI and Ethical Concerns, AI as a Service (AIaaS).

Text Book 1: Chapter 26; Reference Book 1: Chapter 8 – 8.1 & 8.2 **Number of Hours: 8**

Module-5

Applications of AI, Robotics, Drones using AI, The Future of AI, No Code AI, Low Code AI.

Industrial Applications of AI: Healthcare, Finance, Retail, Agriculture, Education, Transportation, AI in Experimentation and Multi-disciplinary Research.

Reference Book 1: Chapter 1 – 1.6 to 1.11

Reference Book 2: Chapter 3 & 5 (5.1) **Number of Hours: 8**

Suggested Learning Resources: (Text Books / Reference Books):

Text Books:

1. Stuart Russell and Peter Norvig, **"Artificial Intelligence: A Modern Approach"**, 3rd Edition, Pearson Education.
2. Ajantha Devi Vairamani and Anand Nayyar, "**Prompt Engineering: Empowering Communication"**, 1st Edition, CRC Press, Taylor & Francis Group, 2024.

Reference Books:

1. Reema Thareja, "**Artificial Intelligence: Beyond Classical AI"**, Pearson Education, 2023.
2. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, **"AI for Everyone – A Beginner's Handbook for Artificial Intelligence"**, Pearson, 2024.
3. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, **"Machine Learning"**, Pearson, 2022**.**
4. Saroj Kaushik, **"*Artificial Intelligence"*,** 2nd Edition, Cengage Learning, 2023.

Web links and Video Lectures (e-Resources):

1. Elements of AI – *https://www.elementsofai.com*
2. CS50's Introduction to Artificial Intelligence with Python – Harvard *https://cs50.harvard.edu/ai/*
3. Google Machine Learning Crash Course – *https://developers.google.com/machine-learning/crash-course*
4. Learn Prompting (Open-Source Guide) – *https://learnprompting.org*
5. Google AI – Learn with Google AI *https://ai.google/education/*
6. Coursera – Machine Learning by Andrew Ng (Stanford University) *https://www.coursera.org/learn/machine-learning*
7. OpenAI Prompt Engineering Guide (for ChatGPT) *https://platform.openai.com/docs/guides/gpt-best-practices*
8. Prompt Engineering for Developers – DeepLearning.AI + OpenAI *https://www.deeplearning.ai/short-courses/chatgpt-prompt-engineering-for-developers/*
9. Ethics in AI – Google Responsible AI Practices *https://ai.google/responsibilities/responsible-ai-practices/*
10. Google Teachable Machine (Train AI models visually without code) https://teachablemachine.withgoogle.com

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- ICT-Enabled Teaching
- Tool Demonstration

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

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Continuous Comprehensive Assessments (CCA):

Learning Activity

Sl. No	Activity on Creating Effective Prompts
Note: To conduct the activity students can use any of the AI tools such as ChatGPT.	
1	**Basic Prompt writing:** Create two different prompts to ask an AI about the topic "Electricity." The first prompt should be vague, and the second prompt should be clear and specific. Compare the responses you get and describe which prompt gave a better answer and why.
2	**Zero-Shot Prompting**: Create a prompt that asks an AI to explain Ohm's Law without giving any example or background. Evaluate how well the AI explains the concept based on your prompt alone.
3	**One-Shot and Few-Shot Prompting:** Provide the AI with a single example of how to calculate the resistance in a simple circuit. Then write your own prompt asking the AI to solve a similar resistance calculation. After that, add two more examples to your prompt and observe any changes in the AI's response quality.
4	**Chain-of-Thought Prompting:** Develop a prompt that guides the AI step-by-step through calculating current flow in a circuit using Ohm's Law with resistors in series. Then, ask a final question for the AI to solve. Analyze how breaking down the reasoning steps impacts the accuracy of the answer.
5	**Prompt Refinement:** Start with an ambiguous prompt related to the "Water Cycle." Test the AI's response, note the confusion or errors, and then refine your prompt to make it clearer and more specific. Repeat this process twice and record how the AI's responses improve with each refinement. **Role-Based Prompting:** Create three prompts asking the AI to explain "Newton's Laws of Motion," each with a different role instruction: (a) as an expert engineer, (b) as a high school teacher, (c) as a beginner. Compare the tone, detail, and style of the responses.
6	**Creative Engineering Problem Prompts:** Craft a prompt that asks the AI to brainstorm ideas for designing a low-cost water purification system suitable for rural areas. Encourage creativity by adding phrases like **"limited resources"** and **"sustainability"**.
7	**Ethical Prompt Design Discussion:** Identify a biased prompt related to job descriptions (e.g. language with respect to a gender). Rewrite the prompt to remove bias and create a neutral, inclusive version. Explain why this revision is more ethical.
8	**Simulated Customer Support Chatbot:** Develop a prompt that instructs the AI to play the role of a technical support agent helping a customer troubleshoot a failure in an electronic circuit. Include instructions to keep the tone friendly and professional and to ask diagnostic questions.
9	**Multi-Language Prompting:** Develop a prompt that asks the AI to translate a simple engineering glossary (5 technical terms) from English to your native language. Then modify the prompt to request additional explanations of these terms in the translated language.
10	Review a curated set of different prompt types (e.g., for summarization, information extraction, paraphrasing, question answering) from a "Prompt Gallery." For each prompt type, match it with a real- world task (e.g., summarizing a lecture note, extracting names from a project report). Test at least three prompt templates on an AI tool or by role-play (students simulate being the AI), with varied wording. Record the outcomes and discuss which prompt (or template) was most effective for each task, and explain why you think it worked best. Reflect on how changing small parts of a prompt can alter model response quality, completeness, or accuracy.
11	Choose a real engineering challenge or societal problem relevant to your field (e.g., "Reducing plastic waste in campus cafeterias" or "Optimizing solar panel placement on campus rooftops"). Draft an initial prompt that asks an AI to propose practical solutions. Share the AI's (or peer's) answer in small groups and identify aspects that are missing, vague, or not actionable. Refine your prompt based on feedback (e.g., specify constraints, ask for step-by-step solutions, or require a list of pros and cons). Repeat the process one more time, refining again for further clarity or

	specificity. Document the entire prompt-refinement process and share the best solution generated, along with a brief analysis of how prompt improvements led to better responses.

Component & CO-PO Mapping	Outstanding (9 - 10)	Exceeds Expectations (7 - 8)	Meets Expectations (5 - 6)	Needs Improvement (3 - 4)	Unsatisfactory (1 - 2)
Appropriate Use of Prompting Technique [PO1, PO5]	Demonstrates precise and creative application of the intended prompting technique (e.g., zero-shot, few-shot, role-based) with full alignment to objectives.	Correctly applies the prompting technique with minor gaps or missed opportunities.	Uses the prompting technique, but with partial understanding or inconsistent application.	Limited understanding of the technique; incorrect or weak application.	No evidence of correct prompting technique use.
Analysis & Comparison of Responses [PO2, PO4]	Provides thorough, insightful, and well-supported analysis of AI responses, comparisons highlight key strengths and weaknesses.	Provides clear analysis with relevant comparisons, though slightly less detailed.	Provides basic analysis with limited insight, comparisons are present but shallow.	Minimal analysis, comparisons are weak or incomplete.	No meaningful analysis or comparison.
Creativity & Problem-Solving [PO3, PO11]	Demonstrates outstanding creativity and innovation in crafting prompts, especially for problem-solving or design tasks.	Demonstrates creativity and some innovation; solutions are practical.	Shows moderate creativity; prompts are functional but not innovative.	Minimal creativity; prompts are repetitive or unimaginative.	No creativity or problem-solving is evident.
Ethical Awareness & Inclusivity [PO7]	Identifies biases clearly and revises prompts to be fully ethical, inclusive, and culturally sensitive.	Identifies some biases and revises prompts to improve inclusivity.	Attempts bias identification, but revisions are incomplete or partly effective.	Minimal effort is made to address bias; inclusivity not fully considered.	No consideration of bias or ethics is used in prompts.

Clarity & Specificity of Prompts, Documentat i on & Reflection [PO8, PO9, PO11]	Prompts are self-explanatory, specific, and well-structured for the intended activity; no ambiguity is present. Documentation is complete, well-organized, and includes deep reflection on improvements across iterations.	Prompts are clear and mostly specific; minor ambiguity is present. Documentation is complete with some reflection on prompt refinement.	Prompts are somewhat clear but could be more specific; moderate ambiguity. Documentation is present but lacks detail or depth in reflection.	Prompts are vague and lack clarity; high ambiguity. Incomplete documentation, reflection is minimal.	Prompts are unclear, incomplete, or irrelevant to the activity. No documentation or reflection provided as per schedule

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Industry integrated learning
- Analysis of Industry / Technical / Business reports
- Group discussions
- Use of MOOCs and Online Platforms
- Any other relevant and innovative academic activity

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Engineering Science Course - I (ESC I)

1. **Essentials of Information Technology 1BESC104A/204A**
2. **Introduction to Electronics Engineering 1BESC104B/204B**
3. **Introduction to Electrical Engineering 1BESC104C/204C**
4. **Introduction to Mechanical Engineering 1BESC104D/204D**
5. **Building Science and Mechanics 1BESC104E/204E**

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	Essentials of Information Technology	Semester	I/II
Course Code	1BESC104A/204A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0/3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:
CO1: Make use of Information Technology (IT) infrastructure for information exchange.
CO2: Apply basic software engineering concepts for project management.
CO3: Develop queries for quick insert, access and updating of structured information.
CO4: Identify role of cybersecurity and ethics issues in Information Technology (IT).
CO5: Illustrate the different types of data structures and Algorithms efficiency in real world problems.

Module-1

Data Storage: Bits and Their Storage, Main Memory, Mass Storage, Representing Information as Bit Patterns, The Binary System, Storing Integers, Storing Fractions. Data Manipulation: Computer Architecture, Machine Language, Program Execution, Arithmetic/Logic Instructions, Communicating with Other Devices.

Textbook 1: Chapter-1 (1.1-1.7), Chapter-2 (2.1-2.5) Number of Hours:8

Bloom's Taxonomy levels: L1, L2

Module-2

Operating Systems: The History of Operating Systems, Operating System Architecture, Coordinating the Machine's Activities, Handling Competition Among Processes, Security. Networking and the Internet: Network Fundamentals, The Internet, The World Wide Web, Internet Protocols, Security.

Textbook 1: Chapter-3,Chapter-4 Number of Hours: 8

Bloom's Taxonomy levels: L1, L2

Module-3

Cybersecurity: Overview—What is Cybersecurity?, Brief History of Cybersecurity Events, The Basic Information Security Model, Cyber Hygiene, Teams in Cybersecurity. Ethical Issues in Information Technology: Overview, Ownership Rules, Ethics and Online Content.

Textbook 2: Chapter-16, Chapter-17 Number of Hours: 8

Bloom's Taxonomy levels: L1, L2

Module-4

Software Engineering: The Software Engineering Discipline, The Software Life Cycle, Software Engineering Methodologies, Modularity, Tools of the Trade. Database Systems: Database Fundamentals, The Relational Model.

Textbook 1: Chapter-7 (7.1-7.5), Chapter-9 (9.1-9.2) Number of Hours: 8

Bloom's Taxonomy levels: L1, L2

Module-5

Introduction to Data Structures and Algorithms: Basic Terminology Classification of Data Structures, Operations on Data Structures, Abstract Data Type, Algorithms, Different Approaches to Designing an Algorithm, Control Structures Used in Algorithms, searching and sorting examples.

Textbook 3: Chapter-2. Chapter-14(14.2,14.3,14.7,14.9) Number of Hours: 8

Bloom's Taxonomy levels:

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Textbooks:

1. J. Glenn Brookshear and Dennis Brylow, Computer Science: An Overview, 12th Edition, Pearson Education Limited, 2017.
2. Roy, Shambhavi; Daniel, Clinton; and Agrawal, Manish, "Fundamentals of Information Technology", Digital Commons at The University of South Florida (2023).
https://digitalcommons.usf.edu/dit_tb_eng/19
3. Data Structures using C, Reema Thareja 3rd edition Oxford press, 2012.

Reference books / Manuals:

1. V. Rajaraman, "Introduction to Information Technology", Third Edition, PHI Learning, 2018.
2. Pelin Aksoy, Information Technology in Theory, First Edition, Cengage.

Web links and Video Lectures (e-Resources):

Information Technology: https://onlinecourses.swayam2.ac.in/cec20_cs05/preview
Computer Organization and Architecture: https://nptel.ac.in/courses/106103068
Introduction To Internet: https://nptel.ac.in/courses/106105084

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Flipped Classroom
2. Problem-Based Learning (PBL)
3. Case-Based Teaching
4. Simulation and Virtual Labs
5. ICT-Enabled Teaching

Assessment Structure:

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- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: (Marks- 10) Conceptual Assessment on IT essentials

- Practical exercise programming activity aligned with Modules 1 and 2

Learning Activity -2 (optional): (Marks- 10) Case Study and Project Demonstration

- A collaborative team-based activity aligned with Modules 3, 4, and 5, wherein students analyse a real-world problem and design a prototype.

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Component & CO-PO Mapping	Outstanding (5)	Exceeds Expectations (4)	Meets Expectations (3)	Needs Improvement (2)	Unsatisfactory (1)
Clarity & Simplicity of procedure/ method [CO1-5] [PO9]	procedure/ method is, specific, and well- structured for the intended activity; no ambiguity is present.	procedure/ methods are clear and mostly specific; minor ambiguity is present.	procedure/ methods are somewhat clear but could be more specific; moderate ambiguity.	procedure/ methods are vague and lack clarity; high ambiguity.	procedure/ methods are unclear, incomplete, or irrelevant to the activity.
Appropriate Use of elements/ techniques and design of solution [CO2-5] [PO1, PO3]	Demonstrates precise and creative usage of the features, elements and techniques	Correctly applies the features and elements with minor gaps or missed opportunities.	Uses the features and elements, but with partial understanding or inconsistent usage.	Limited understanding of the features and elements; incorrect or weak usage.	No evidence of correct/relevant features and elements use.
Complete Solution & Comparison of Results/output for various cases. [CO2-4] [PO2, PO4, PO5]	Provides clear and correct solution/results with analysis for multiple cases; comparisons among cases highlight key strengths and weaknesses.	Provides correct solution/results with analysis for multiple cases, though slightly less detailed.	Provides correct solution/results with limited analysis; comparisons are present but shallow.	Provides correct solution/results. Minimal analysis: comparisons are weak or incomplete.	Solution/results are partially correct. No meaningful analysis or comparison.
Creativity, efficiency of Problem-Solving [CO2-4]	Demonstrates outstanding creativity and innovation in developing solution, especially	Demonstrates creativity and some innovation; developed solution is practical.	Shows moderate creativity; developed solution is functional but not innovative.	Minimal creativity; developed solution is repetitive or unimaginative.	No creativity or problem-solving/adequat e solution is evident.

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

Introduction to Electronics Engineering		Semester	I/II
Course Code	BESC104C/204C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

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

1. Analyse basic electronic circuits using the principles of rectifiers, voltage regulators, and amplifiers.
2. Analyse the behaviour of analog circuits including oscillators and operational amplifiers in signal generation and conditioning applications.
3. Illustrate the fundamental concepts of analog and digital modulation techniques based on their characteristics and suitability for communication systems.
4. Interpret the structure and functionality of embedded systems and digital logic components such as microcontrollers, sensors, and logic gates.
5. Apply number system conversions and Boolean algebra to design and implement basic combinational logic circuits.

Module-1

Semiconductor devices: PN-junction diode, Characteristics and parameters.

Power Supplies: Half wave rectifier, Full wave rectifier: Center tapped rectifier, Bridge rectifier, Power Supply system, RC Power supply filter, Zener diode voltage regulator.

Bipolar Junction Transistor: BJT Operations, BJT voltage and Current, BJT amplifier, Common-Emitter Characteristics.

Text 1: 2.1, 2.2, 3.1, 3.2, 3.4, 3.5,3.7, 4.1, 4.2,4.3,4.6 Number of Hours:8

Module-2

Oscillators: Positive Feedback, Condition for Oscillations, Ladder Network Oscillator, Wein Bridge Oscillator, Crystal Controlled Oscillators (Only Concepts, Working, and Waveforms. No Mathematical Derivations).

Operational Amplifiers: Operational Amplifier Parameters, Characteristics, applications, Configurations, Operational Amplifier Circuits: Inverting amplifier, non-inverting amplifier, Adder, Voltage follower, Integrator and differentiator.

Text 2: Page No:179-182, 165-169, 171-175. Number of Hours:8

Module-3

Analog Communication Schemes: Introduction, Modern Communication System Scheme: Information Source and Input Transducer, Transmitter, Channel or Medium, Noise, Receiver, Concept of Modulation, Concept of Radio Wave Propagation (Ground, Space, Sky), Types of Communication Systems.

Modulation Schemes: Amplitude Modulation, Angle Modulation, Advantages of Digital Communication Over Analog Communication, Multiplexing, Digital Modulation Schemes: ASK, FSK, PSK, (Explanation with Waveform)

Text 3: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 1.12, 1.15, 2.2.1, 3.2.1, 6.1, 6.11, 6.12, 6.13, 6.15, 6.16. Number of Hours:8

Module-4

Embedded Systems: Definition, Embedded Systems Vs General Computing Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of an Embedded System, Core of The Embedded System: Microprocessors, GPP Vs ASIP, Microcontrollers, Microprocessor Vs Microcontroller, DSP, RISC V/S CISC, Memory: ROM, Sensors, Actuators, LED, 7-Segment LED Display.

Text 4: 1.1, 1.2, 1.4, 1.5, 1.6, 2.1.1.1-2.1.1.6, 2.2.1, 2.3.1, 2.3.2, 2.3.3.1, 2.3.3.2. Number of Hours:8

Module-5

Boolean Algebra and Logic Circuits: Binary Numbers, Number Base Conversion- Binary, Decimal And Octal and Hexa Decimal Numbers and Vice-Versa, Complements-1's and 2's, Basic Definitions, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

Combinational Logic: Introduction, Design Procedure, Adders- Half Adder, Full Adder.

Text 5: 1.2, 1.3, 1.4, 1.5, 2.1, 2.3, 2.4, 2.5, 2.7, 4.1, 4.2, 4.3. Number of Hours:8

Suggested Learning Resources: (Text Book)

1. Electronic Devices and Circuits, David A Bell, 5th Edition, Oxford, 2016
2. Mike Tooley "Electronic Circuits Fundamentals & Applications,"5th Edition, Elsevier, 2020.
3. S L Kakani and Priyanka Punglia, 'Communication Systems', Ist Edition, New Age International Publisher, 2017.
4. K V Shibu, 'Introduction to Embedded Systems', 2nd Edition, McGraw Hill Education (India), Private Limited, 2019.
5. Digital Logic and Computer Design, M. Morris Mano, Pearson Education, 2017, ISBN-978-93-325- 4252-5.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/122106025
- https://nptel.ac.in/courses/108105132

Teaching-Learning Process (Innovative Delivery Methods)

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various analog and digital circuits.
3. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
4. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks.**

Continuous Comprehensive Assessments (CCA):

Learning Activity 1: (Marks 10): IIT-Kharagpur Virtual Laboratory. Link: http://vlabs.iitkgp.ac.in/be/ .Simulate the given set of experiments and submit a report.

Learning Activity 2: (Marks 10**)**: Demonstration of simple circuits using any simulation tool such as LTSpice, KICad etc. Also give a report that includes circuit design, schematic, and simulation results.

Rubrics for Virtual Lab Report Evaluation

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Demonstrates an Understanding of Simulation Environment – 5 marks	Explains simulation concepts clearly, accurately, and with insightful connections **(5)**	Explains simulation concepts accurately with minor gaps in detail **(4)**	Shows basic understanding of simulation concepts but lacks depth or has some inaccuracies **(3)**	Understanding is limited, with frequent errors or confusion **(2)**	Shows little or no grasp of the simulation concepts **(2)**
Able to Apply Laws/Equations and Correct Methodology – 10 marks	Applies laws/equations flawlessly with correct and efficient methodology **(10)**	Applies laws/equations correctly with minor methodological lapses **(9)**	Applies laws/equations partially correctly; some steps or logic missing **(7)**	Frequent errors in applying laws/equations or methodology **(5)**	Unable to apply laws/equations or follow correct methodology **(3)**
Performs Accurate Calculations and Provides precise Answers – 10 marks	All calculations and simulations are accurate; answers precise and in correct format/units **(10)**	Minor calculation and simulation errors; answers mostly precise and correctly formatted **(9)**	Some correct calculation/simulations but noticeable errors; precision inconsistent **(7)**	Frequent calculations/simulation errors; answers often imprecise or incomplete **(6)**	Calculations/Simulations mostly incorrect; answers missing or irrelevant **(3)**

Rubrics for Circuit Simulation

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Student has a well defined problem statement and a good technical report– 5 marks	Problem statement and report are clear, specific, and well-justified with context **(5)**	Problem statement and report are clear and specific but lacks strong justification **(4)**	Problem statement and report are understandable but somewhat vague or incomplete **(3)**	Problem statement and report are unclear or too broad **(2)**	No clear problem statement provided and poor report **(1)**
The design provided by the student meets requirement– 10 marks	Design fully meets all requirements with optimal functionality **(10)**	Design meets most requirements; minor gaps in functionality **(8)**	Design meets basic requirements but with noticeable limitations **(6)**	Design meets few requirements; significant shortcomings **(4)**	Design does not meet requirements or is non-functional **(2)**
Circuit layout and demonstration is as per requirements– 10 marks	Circuit layout is correct, neat, and demonstration fully meets requirements **(10)**	Circuit layout is correct with minor issues; demonstration meets most requirements **(8)**	Circuit layout partially correct; demonstration meets basic requirements only **(6)**	Circuit layout has major errors; demonstration incomplete or unclear **(4)**	Circuit layout incorrect or missing; no meaningful demonstration **(2)**

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Introduction to Electrical Engineering		Semester	I/II
Course Code	**1BESC104C/204C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:
CO1: Explain conventional and non-conventional energy resources, power system structure, and domestic wiring with safety measures.
CO2: Analyse DC and AC circuits using fundamental laws, waveforms, phasor relationships, and power calculations.
CO3: Describe the construction, working, and characteristics of AC & DC machines.
CO4: Evaluate the performance of AC and DC machines through operating principles and simple calculations.

Module-1

Introduction: Conventional and non-conventional energy resources; General structure of electrical power systems using single line diagram approach.
Power Generation: Hydel, Nuclear, Solar & wind power generation (Block Diagram approach).
DC Circuits: Ohm's Law and its limitations. KCL & KVL, series, parallel, series-parallel circuits. Simple Numerical. Number of Hours: 08

Module-2

A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. (definitions & derivations)
Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, R-C, R-L-C Series circuits. Active power, reactive power and apparent power. Concept of power factor. (Simple Numerical). Number of Hours: 08

Module-3

DC Machines: DC Generator: Principle of operation, constructional details, induced emf expression, types of generators. Relation between induced emf and terminal voltage. Simple numerical.
DC Motor: Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and applications. Simple numerical. Number of Hours: 08

Module-4

Transformers: Necessity of transformer, principle of operation, Types and construction of single-phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency and simple numerical.
Three-phase induction Motors: Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor. Slip and its significance. simple numerical.
Number of Hours: 08

Module-5

Domestic Wiring: Requirements, Types of wiring: casing, capping. Two-way and three-way control of load.
Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits.
Personal Safety Measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.
Number of Hours: 08

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, First Edition 2019.
2. A text book of Electrical Technology by B.L. Theraja, S Chand and Company, reprint edition 2014

Reference books / Manuals:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill 4th edition, 2019.
2. Principles of Electrical Engineering & Electronics by V. K. Mehta, Rohit Mehta, S. Chand and Company Publications, 2nd edition, 2015.
3. Electrical Technology by E. Hughes, Pearson, 12th Edition, 2016.
4. Electrical and electronic measurements and instrumentation by A K Sawhney, Dhanapat Rai and Co. edition, January 2015

Web links and Video Lectures (e-Resources): www.nptel.ac.in

1. Principle of Electrical Sciences, Prof Sanjay Agrawal, Indira Gandhi National Open University.
2. Electricity and Electrical Wiring, Dr. Antara Mahanta Barua, Krishna Kanta Handi Qui State Open University, Guwahati.

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Usage of real-life based examples in Teaching -Learning Process.
2. Demonstration of cut-section models for electrical machines related modules.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1(Assignment (at RBL4): Tabulating the power ratings of various domestic appliances and calculating the total energy bill of one's residence (Marks- 10)

Learning Activity -2 (Tool/Software Exploration): Analysis of a given circuit using conventional method and with a suitable software tool. Compare and validate the results.(Marks- 10)

Rubrics for Learning Activity 1 & 2 **Maximum Marks: 10**
(Based on the nature of learning activity, design the rubrics for each activity):

Activity type	Performance Indicator	Superior	Good	Fair	Needs Improvement	Unacceptable
Case Study/ Problem based learning	PO2.2: Analyse problems using first principles. (4)	PO2.2: Analyse problems using first principles. (4)	Applies first principles thoroughly to produce logical, and innovative solutions. (3)	Applies first principles effectively with minor mistakes. (2)	Applies first principles adequately for regular problems (1)	Applies first principles to only simple problems. (0)
	PO3.1: Produce appropriate solutions (4)	Produces creative, technically sound, and sustainable solutions to almost all problems. (4)	Produces acceptable solutions to many problems. (3)	Produces satisfactory solutions only to standard problems (2)	Produces incomplete Solutions. (1)	Produces no relevant solutions. (0)
	PO11.1: Understand impact of engineering solutions in societal context (2)	Provides comprehensive solutions covering societal, health, safety, environmental and cost effective issues. (2)	Provides appreciable solutions covering only a few societal issues. (2)	Recognizes basic societal impacts. Provides satisfactory solutions covering only some of the societal issues. (1)	Limited understanding of societal impacts. Provides an abridged solution. (1)	Very limited consideration of societal impacts. Provides solutions that do not have much relevance to the context. (0)

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BUILDING SCIENCE AND MECHANICS		Semester	I/II
Course Code	**1BCIV105/205**	50	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	50	50
Total Hours of Pedagogy	40	100	100
Credits	03	03 Hrs	03 Hrs
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory/Practical/MCQ		

Course outcome (Course Skill Set)

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

1. Comprehend the fundamental concepts of building science and materials
2. Describe the sustainable materials and rating systems
3. Understand the principles of force systems
4. Compute the unknowns in coplanar system of forces using equilibrium condition
5. Locate the centroid of the cross sections

Module-1

Introduction to Building Science: Definition, scope, and importance in engineering. Building as an integrated system: structure, envelope, mechanical systems, occupants. Influence of climate zones on building design. Building performance metrics: comfort, safety, durability, energy efficiency, and environmental impact. Overview of sustainable and green building concepts. Importance, Scope and discipline of Civil Engineering.

Basic Materials of Construction: Types and Uses of Bricks, Stones, Cement, Structural Steel, Wood and Concrete.

Number of Hours: 8

Module-2

Sustainable Built Environment:

Emerging materials: Types and Uses of Autoclaved Aerated Concrete (AAC) blocks, Bamboo, Recycled plastics, Material selection criteria, Durability, Sustainability, Smart City concept.

Green Building: Green building materials and rating systems IGBC, LEED, GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weightage.

Number of Hours: 8

Module-3

Force Systems: Concept of idealization, System of forces, Principles of transmissibility of a force, Resolution and composition of forces, Law of Parallelogram of forces, Concurrent and non-concurrent coplanar force systems, Moment of forces, Couple, Varignon's theorem: Numerical examples.

Number of Hours: 8

Module-4

Equilibrium and Support Reactions

Free body diagram, equations of equilibrium, Lami's Theorem, Equilibrium of Coplanar Concurrent and Non -concurrent force systems: Numerical examples.

Types of loadings, beams and supports, Concept of Statically determinate and indeterminate structures (Definitions with examples only), Support reactions: Numerical examples on Statically determinate beams.

Number of Hours: 8

Module-5

Centroid of Plane areas: Introduction, Locating the centroid of rectangle, triangle, circle, semicircle and quadrant of a circle using method of integration, centroid of composite areas and simple built up sections:

Numerical examples.

Number of Hours:8

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals) Text books:

1 Rangwala, Building Construction,33rd Edition, 2016, Charotar Publishing House Pvt. Ltd., **ISBN-10 :** 9385039040, **ISBN-13 :** 978-9385039041

2 Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, 3rd Edition, 2015, Laxmi Publications, ISBN: 9789380856674.

3 Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, 11th Edition, 2018, Eastern Book Promoters Belgaum [EBPB], ISBN: 5551234003896

Reference Books:

1 Beer F.P. and Johnston E. R., Mechanics for Engineers: Statics and Dynamics, 4th Edition, 1987, McGraw Hill, ISBN: **9780070045842**

2 Meriam J. L. and Kraige L. G, Engineering Mechanics-Statics, Vol I–6th Edition,2008, Wiley publication.

3 Irving H. Shames, Engineering Mechanics-Statics and Dynamics, 4th Edition, 2002, Prentice-Hall of India(PHI).

4 Hibbler R. C., Engineering Mechanics: Principles of Statics and Dynamics, 2017, Pearson Press, New Delhi.

5 Timoshenko S, Young D. H., Rao J. V., Sukumar Patil, Engineering Mechanics, 5th Edition, 2017,McGraw Hill Publisher, ISBN: **9781259062667**

6 Bhavikatti S S, Engineering Mechanics, 4th Edition, 2018, New Age International Publications.

7 Reddy Vijaykumar K and Suresh Kumar K, Engineering Mechanics, 3rd Edition 2013, BS Publications.

Web links and Video Lectures (e-Resources):

- Web links and Video Lectures (e-Resources):
- https://www.youtube.com/watch?v=nGfVTNfNwnk&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT
- https://www.youtube.com/watch?v=nkg7VNW9UCc&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=2
- https://www.youtube.com/watch?v=ljDIIMvxeg&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=5
- https://www.youtube.com/watch?v=3YBXteL-qY4
- https://www.youtube.com/watch?v=z95UW4wwzSc&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=10
- https://www.youtube.com/watch?v=ksmsp9OzAsI
- https://www.youtube.com/watch?v=x1ef048b3CE
- https://www.youtube.com/watch?v=l_Nck-X49qc
- https://www.youtube.com/watch?v=R8wKV0UQtlo
- https://www.youtube.com/watch?v=0RZHHgL8m_A
- https://www.youtube.com/watch?v=Bls5KnQOWkY
- Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
- https://www.youtube.com/watch?v=Zrc_gB1YYS0
- https://www.youtube.com/watch?v=Hn_iozUo9m4

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Chalk and talk
2. Activity based learning.
3. NPTEL and other videos
4. ICT-Enabled Teaching.
5. Tutorials

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: (Marks- 10) – Mooc

Learning Activity -2 (optional): (Marks- 10) – Assignment

Rubrics for Learning Activity: Assignment

Performance Indicator	Excellent ≥ 90%	Very Good (70-89)%	Good (60-69)%	Satisfactory 50-59%	Unsatisfactory <50%
Conceptual Understanding (3 Marks) PO1	Demonstrates complete and accurate understanding of mechanics principles; applies laws/theorems correctly. (3)	Good understanding with minor errors. (2.5)	Partial understanding; some correct, some misapplied. (2)	Weak understanding; relies on copying. (1.5)	No conceptual clarity; irrelevant/incorrect. (<1.5)
Application & Problem Solving (5Marks) PO1,& PO2	Applies concepts to solve problems systematically; correct results with proper logic. (5)	Correctly solves most problems; minor calculation/procedure errors. (4)	Attempts problem-solving; incomplete steps or major errors. (3)	Solves only simple/partial problems; poor logic. (2.5)	Unable to solve/irrelevant solutions. (<2.5)
Presentation & Clarity (2 Marks) PO9	Well-organized answers with neat diagrams, steps, and units. (2)	Mostly clear with minor lapses in diagrams/steps (1.5)	Average presentation; some diagrams/steps missing. (1)	Poorly organized, difficult to follow. (0.5)	Incoherent, incomplete, illegible. (<0.5)

Rubrics for Learning Activity: Mooc

Performance Indicator	Excellent ≥ 90%	Very Good (70-89)%	Good (60-69)%	Satisfactory 50-59%	Unsatisfactory <50%
Course Completion and submission of certificate (5 Marks) PO1	Successfully completed MOOC course with certificate of completion. (5)	Completed ≥75% of course, submitted the of certificate within a grade period (4)	Completed ≥60% of course, partial certificate/evidence. (3)	Enrolled but completed only 50–59% of course. (2.5)	Not completed MOOC course (<50%). (0–2)
Quiz (5Marks) PO1,& PO2	10 Questions based on the Mooc Course				

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment

- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Industry integrated learning
- Analysis of Industry / Technical / Business reports
- Group discussions
- Use of MOOCs and Online Platforms
- Any other relevant and innovative academic activity

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Programming Language Course (PLC)

1. Introduction to C Programming 1BPLC105A/205A

2. Python Programming 1BPLC105B/205B

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Introduction to C Programming		Semester	I/II
Course Code	1BPLC105A/205A	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

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

CO1: Describe the basic structure of a C program, variable concepts, data types, and input and output operations in C.

CO2: Demonstrate the use of appropriate conditional statements and iterative loops to manage control flow.

CO3: Apply concepts of arrays and strings, to implement solution for the given problems.

CO4: Develop modular programs using functions, recursion, and different storage classes in C.

CO5: Use the concept of pointers and structures, in manipulation of the complex data of real-world objects.

Module-1

BASICS OF C: Introduction: Why Learn C? The Future of C, Structure of a C Program, Concept of a Variable. Data Types in C. Program Statement: Declaration, How Does The Computer Store Data in Memory? How are Integers Stored? How Floats and Doubles are Stored? Tokens, Operators, and Expressions. Expressions Revisited, Lvalues and Rvalues, Type Conversion in C.

INPUT AND OUTPUT: Basic Screen and Keyboard I/O in C, Non-Formatted Input and Output, Formatted Input and Output Functions Number of Hours: 08

Bloom's Taxonomy levels: 1,2,3

Module-2

CONTROL STATEMENTS: Specifying Test Condition for Selection and Iteration, Writing Test Expression, Conditional Execution and Selection. Selection Statements, The Conditional Operator, The Switch Statement

Iteration and Repetitive Execution: while, for, do-while, Goto Statement/Unconditional statements and Nested Loops

Module-3

ARRAYS: One-Dimensional Array: Declaration of a One-dimensional Array, Initializing Integer Arrays, Accessing Array Elements, Other Allowed Operations, Internal Representation of Arrays in C ,Working with One-dimensional Arrays.

Two-Dimensional Arrays: Declaration of a Two-dimensional Array, Accessing 2D Arrays. Working with Two-dimensional Arrays. Number of Hours: 08

Module-4

Strings: One-dimensional Character Arrays, Declaration of a String, String Initialization, Printing Strings, String Input, Character Manipulation in the String, String Manipulation String operations: using built-in functions.

FUNCTIONS: Introduction: Concept of Function, why are Functions Needed? Using Functions, Function Prototype Declaration, Function Definition, Function Calling. **Call by Value Mechanism:** Working with Functions , Passing Arrays to Functions **Scope and Extent:** Concept of Global and Local Variables, Scope Rules. -Call by Reference. Number of Hours:08

Module-5

Introduction to POINTERS AND STRUCTURES

Introduction: Understanding Memory Addresses, Address Operator (&), Pointer: Declaring a Pointer, Initializing Pointers.

Pointers and Strings, Structures: Declaring Structures and Structure Variables, Accessing the Members of a Structure, Initialization of Structures, Typedef and its Use in Structure Declarations, Nesting of Structures. Arrays of Structures, Initializing Arrays of Structures, Arrays within the Structures. Structures and Pointers, Structures and Functions.

Number of Hours:08

PRACTICAL COMPONENTS OF IPCC

PART – A: CONVENTIONAL EXPERIMENTS

1. A. Implement a C program to compute area of circle by using the concept of constant.
   B. Implement a c program to compute area of triangle, given length of all three sides
2. A. Design and develop C program to find the bigger number among three numbers using ternary operator.
   B. Develop a C program to find the swap to numbers without using temporary variable.
3. A. Develop C program to build simple calculator using switch.
   B. Develop C program to check whether given number is Armstrong number or not.
4. A. Write a C program to evaluate quadratic equation of the form ax2+bx+c=0. Given a,b and c values
   B. Develop a C program to convert decimal to binary number.
5. A. Develop a C program to find the sum of even numbers and odd numbers in the array of elements and also compute average of all the elements of array.
   B. Develop C program to find the maximum marks scored in the among the marks of N students.
6. Develop C program to compute sum of elements of each row in the given matrix.
7. Develop C program to perform matrix multiplication and check for the compatibility rules.
8. Develop C program to search for a key element in an array of 'n' elements using binary seach.
9. Define structure to store student details like USN, name, percentage, semester. Write C program to display names of students who scored above 75%.
10. Implement C program to compute sum, variance , standard deviation of N real numbers using pointers

PART – B
OPEN ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

1. Control structures
2. Arrays, Strings, Functions
3. Structures, Pointers

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

- Computer Science : A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F .Gilberg, Third Edition, Cengage India Private Limited, ISBN 9788131503638, January 2007.

Reference books / Manuals:

1. Brian W. Kernighan and Dennis M. Ritchie, **"The 'C' Programming Language"**, Prentice Hall of India.
2. Computer fundamentals and programming in c, **"Reema Thareja",** Oxford University, Second edition, 2017.
3. Jeff Szuhay , "Learn C Programming" Pact Publishing,June 2020.

Web links and Video Lectures (e-Resources):

- E-learning.vtu.ac.in/econtent/courses/video/BS/15PCD23.html
- https://nptel.ac.in/courses/106/105/106105171

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Python Tutor
2. Online Coding Platforms (hacker earth, Hacker rank, Leetcode etc.)

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of 30% weightage for theory and 20% for lab. Theory components have two IA tests and one Continuous Comprehensive Assessments (CCA). Each IA is for 40Marks. 80Marks of IA to be scaled to down to 25 Marks. CCA to be conducted for 10Marks to be scaled down to 05 marks. Lab components consist of continuous weekly evaluation and one practical lab exam. Continuous weekly evaluation to be done for 30marks. Average of all continuous evaluation to be scaled down to 15Marks. Practical lab internal for 20 Marks to be conducted after completing all lab programs. 20 Marks to be scaled down to 05 Marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for 10 marks. It is recommended to include learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: MOOC Course (Marks- 10)

CIE Practical component:

The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The summation of all the experiments marks to be scaled down to 15 marks. The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 20 marks and scaled down to 05 marks. For laboratory test and SEE, the student is required to conduct one experiment each from both Part A and Part B. Part A is assessed with a weightage of 70%, while Part B carries a weightage of 30%

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Learning Activity -1: MOOC Course

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Course Completion and Participation (CO5/PO2)	Completed 100% of course modules and assignments	Completed 80-99% of course content	Completed 60-79% of course content	Completed less than 60% of course content	Not completed the course and submitted certificate.
Knowledge Acquisition and Understanding (CO5/PO2)	Demonstrates comprehensive understanding of key concepts	Shows good understanding of most concepts	Basic understanding of core concepts	Limited understanding of concepts	Not demonstrated the knowledge acquisition and understanding.

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Python Programming		Semester	I/II
Course Code	1BPLC105B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	04	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:
CO1: Understand syntax and semantics of python programming
CO2: Apply knowledge of python programming for different applications.
CO3: Develop python programs to realize various computational applications
CO4: Demonstrate the conduction of experiments for the given requirement using python
CO5: Take part in self-study individually, through an online course related to python programming and complete the course successfully.

Module-1

Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program

Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys. exit ()

Textbook 1: Chapters 1 – 3 Number of Hours: 08

Module-2

Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments, and print (), Local and Global Scope, the global Statement, Exception Handling, A Short Program: Guess the Number

Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying

Classes and functions: Time, Pure functions, Modifiers

Textbook 1: Chapter 4

Textbook 2: Chapters 16, 14 Number of Hours:08

Module-3

Classes and methods: Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The str method, Operator overloading, Type-based dispatch, Polymorphism,

Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References

Textbook 2: Chapters 15

Textbook 1: Chapter 6 Number of Hours: 08

Module-4

Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things

Manipulating Strings: Working with Strings, Putting Strings Inside Other Strings, Useful String Methods, Numeric Values of Characters with the ord() and chr () Functions, Coping and Pasting Strings with the pyperclip Module, Project: Multi-Clipboard Automatic Messages

Textbook 1: Chapters 7-8 Number of Hours:08

Module-5

Reading and Writing Files: Files and File Paths, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint. pformat () Function

Organizing Files: The shutil Module, walking a Directory Tree, Compressing Files with the zip file Module

Working with Excel Spreadsheets: Excel Documents, Installing the openpyxl Module, Reading Excel Documents

Textbook 1: Chapters 10-11,14 Number of Hours:08

PRACTICAL COMPONENTS OF IPCC

PART – A: CONVENTIONAL EXPERIMENTS

1. You are working as a software developer for "CoffeeKutira Restaurant". The restaurant manager has asked you to create a calculator program to help staff quickly calculate various bill-related operations for a single item during busy hours. The program should allow staff to choose from 4 operations:
    a) Add - Calculate total bill (food cost + tax)
    b) Subtract - Calculate discount amount (original bill - discounted bill)
    c) Multiply - Calculate total for multiple identical orders
    d) Divide - Split bill among customers
2. You're working as a cashier at a shopping mall. Write a program that asks customers how many items they want to buy. For each item, input the price, Calculate total bill and apply 10% discount if total > Rs. 100. Display itemized receipt
3. You're managing an ice cream parlour. Write a program that shows the menu, takes customer orders, Asks "Do you want to order more?" after each order and calculates total bill with 8% tax.
4. Develop a program that uses class Student which prompts the user to enter marks in three subjects and calculates total marks, percentage and displays the score card details. [Hint: Use list to store the marks in three subjects and total marks. Use __init__() method to initialize name, USN and the lists to store marks and total, Use getMarks() method to read marks into the list, and display () method to display the score card details.]
5. Amazon.com monitors their website response times during festival sales. They collect response times (in milliseconds) for 10 random page loads during peak traffic hours.
   Response Times (ms): [245, 312, 189, 276, 298, 234, 389, 267, 301, 223]
   Compute the Average response time (Mean) and inconsistent performance (Standard Deviation) of the website.
6. A digital library wants to analyze book content to help readers find similar books and improve their recommendation system. Develop a program that can find the 10 most frequent words in each book and generate a report showing Top 10 words in a book. [Hint: Use dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display dictionary slice of first 10 items]
7. Develop a function named DivExp which takes TWO parameters a, b and returns a value c (c=a/b). Write a suitable assertion for a>0 in function DivExp and raise an exception for when b=0. Develop a suitable program which reads two values from the console and calls a function DivExp.
8. Develop Student Grade Tracker: Accept multiple students' names and marks. Store them in a list of tuples or dictionaries. Display summary reports (average, topper, etc.).
9. You are developing multiplicationTable.py for a primary school teacher who wants to generate a multiplication table for numbers up to N. Develop a program that creates an NxN Multiplication table taking the value N through command line arguments and it should write multiplication table to the Excel spreadsheet.
10. Consider a studData.xlsx file. The file has the USN, Name and CGPA of the students in the class. Develop a program to find the first topper of the class.

PART – B: OPEN ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

1. Decision Making, Looping
2. Functions
3. Classes and Objects
4. Files

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Text books:

l. Sweigart, "Automate the Boring Stuff with Python Practical Programming for total beginners", 3rd Edition, No Starch Press, 2025.

2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 3rd Edition, Oreilly, Green Tea Press, 2024.

Reference books / Manuals:

- Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, by Charles Dierbach, Wiley India Edition, 2018, ISBN: 978-81-265-5601-4
- PYTHON PROGRAMMING AN INTRODUCTION TO COMPUTER SCIENCE, John Zelle, Franklin, Beedle & Associates Inc,2016,ISBN 9781590282755
- Practical Programming, Third Edition An Introduction to Computer Science Using Python 3.6 by Paul Gries, Jennifer Campbell, Jason Montojo,O'Reilly; 3rd edition (9 January 2018)

Web links and Video Lectures (e-Resources):

- **https://www.learnbyexample.org/python/**
- **https://www.learnpython.org/**
- **https://pythontutor.com/visualize.html#mode=edit**

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Python Tutor
2. Online Coding Platforms (hacker earth, Hacker rank, Leetcode etc.)

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of 30% weightage for theory and 20% for lab. Theory components have two IA tests and one Continuous Comprehensive Assessments (CCA). Each IA is for 40Marks. 80Marks of IA to be scaled to down to 25 Marks. CCA to be conducted for 10Marks to be scaled down to 05 marks. Lab components consist of continuous weekly evaluation and one practical lab exam. Continuous weekly evaluation to be done for 30marks. Average of all continuous evaluation to be scaled down to 15Marks. Practical lab internal for 20 Marks to be conducted after completing all lab programs. 20 Marks to be scaled down to 05 Marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
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Continuous Comprehensive Assessments (CCA):

CCA will be conducted for 10 marks. It is recommended to include learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: MOOC Course (Marks- 10)

CIE Practical component:

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Learning Activity -1 : MOOC Course.

	Superior	Good	Fair	Needs Improvement	Unacceptable
Course Completion and Participation (CO5/PO2)	Completed 100% of course modules and assignments	Completed 80-99% of course content	Completed 60-79% of course content	Completed less than 60% of course content	Not completed the course and submitted certificate.
Knowledge Acquisition and Understanding (CO5/PO2)	Demonstrates comprehensive understanding of key concepts	Shows good understanding of most concepts	Basic understanding of core concepts	Limited understanding of concepts	Not demonstrated the knowledge acquisition and understanding.

Program Specific Course (PSC)

1. **Programming in C 1BPIC105/205**
2. **Basic Electronics 1BBEE105/205**
3. **Elements of Electrical Engineering 1BEEE105/205**
4. **Elements of Mechanical Engineering 1BEME105/205**
5. **Engineering Mechanics1BEMM105/205**

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Programming in C		Semester	I/II
Course Code	1BPIC105 /205	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0/3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours	Total Marks	100
Credits	03	Exam Hours	3 hours
Examination type (SEE)	Descriptive		

Course outcome (Course Skill Set)

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

CO1: Apply the concepts of Algorithm, flowchart and basic C constructs to solve the problems

CO2: Make use of arrays & strings with modular programming concepts to solve problems.

CO3: Apply the concepts of Pointers and Structures for real world scenarios.

CO4: Develop C programs to solve practical problems, employing core programming principles and debugging techniques.

CO5: Analyse the code snippets to identify the errors and predict the output.

Module-1

Basic Definitions of programing: Algorithm, Flowchart, Programs.
Introduction To The C Language: Structure of a C Program, Your First C Program, Comments, The Greeting Program, Identifiers, Types, Void Type, Integral Type, Floating-Point Types. **Variables:** Variable Declaration, Variable Initialization
Constants: Constant Representation, Coding Constants
Input/Output: Streams, Formatting Input/Output
Textbook 1: Chapter 1(1.1 to 1.4), Chapter 2(2.1-2.7) Number of Hours:08

Module-2

Type Conversion: Implicit Type Conversion, Explicit Type Conversion **Logical Data and Operators**: Logical Data in C, Logical Operators, Evaluating Logical Expressions, Comparative Operators **Two-Way Selection**: if… else, Null else Statement, Nested if Statements, Dangling else Problem, Simplifying if Statements, Conditional Expressions. **Multiway Selection**: The switch Statement, The else-if **Concept of a loop**: Pretest and Post-test Loops, Initialization and Updating, Loop Initialization, Loop Update **Loops in C**: The while Loop, The for Loop, The do…while Loop, The Comma Expression, Other Statements Related to Looping
Textbook 1: Chapter 3 (3.5 to 3.6), Chapter 5 (5.1 to 5.3), Chapter 6 (6.1 to 6.7)
Number of Hours: 08

Module-3

FUNCTIONS: Designing Structured Programs, Functions in C **User-Defined Functions**: Basic Function Designs, Function Definition, Function Declaration, The Function Call, Function Examples Inter-Function Communication: Basic Concept, C Implementation**. Scope**: Global Scope, Local Scope. **Recursion**: Iterative Definition, Recursive Definition, Iterative Solution, Recursive Solution. Designing Recursive Functions, Fibonacci Numbers

Textbook 1: Chapter 4 (4.1 to 4.6), Chapter 6(6.9) Number of Hours: 08

Module-4 :

ARRAYS: Concepts, Using Arrays in C, Declaration and Definition, Accessing Elements in Arrays, Storing Values in Arrays, Precedence of Array References, Index Range Checking Inter- Function Communication: Passing Individual Elements, Passing the Whole Array
Two- Dimensional Arrays: Declaration, Passing A Two-Dimensional Array
STRINGS: C Strings: Storing Strings, The String Delimiter, String Literals, Strings and Characters. Declaring Strings Initializing Strings, Strings and the Assignment Operator, Reading and Writing Strings String Manipulation Functions: String Length, String Copy, String Concatenate.
Textbook 1: Chapter 8 (8.1-8.3, 8.7), Chapter 9 (9.2), Chapter 11 (11.1 to 11.5)
Number of Hours:08

Module-5 :

POINTERS: Pointer Constants, Pointer Values, Pointer Variables, Accessing Variables Through Pointers , Pointer Declaration and Definition, Declaration versus Redirection, Initialization of Pointer Variables **The Type Definition (typedef) Structure**: Structure Type Declaration, Initialization, Accessing Structures Operations on Structures, Complex Structures **Unions**: Referencing Unions, Initializers
Textbook 1: Chapter 8(8.5 to 8.6), Chapter 9(9.1), Chapter 12(12.1 to 12.4)
Number of Hours:08

Suggested Learning Resources:
Text books:

1. Computer Science : A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F .Gilberg, Third Edition, Cengage India Private Limited, ISBN 9788131503638, January 2007.

Reference books:

1. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice Hall of India.
2. Computer fundamentals and programming in c, "Reema Thareja", Oxford University,
Second edition, 2017

Web links and Video Lectures(e-Resources):

- elearning.vtu.ac.in/econtent/courses/video/BS/15PCD23.html
- **Introduction to Programming in C** [https://onlinecourses.nptel.ac.in/noc23_cs02/preview]
- **C for Everyone: Programming Fundamentals** [https://www.coursera.org/learn/c-for-everyone]
- **Computer Programming Virtual Lab** [https://cse02-iiith.vlabs.ac.in/exp/pointers/]
- **C Programming: The ultimate way to learn the fundamentals of the C language**

[https://www.pdfdrive.com/c-programming-the-ultimate-way-to-learn-the-fundamentals-of-the-c-language-e187584209.html]

- **C Programming: The Complete Reference [https://viden.io/knowledge/programming-in-c-language/attachment/28313/c-the-complete-reference-herbert-schildt-4th-edition-pdf/preview]**

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

- Flipped Classroom
- **Interactive Coding Platforms**

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1: MOOC Course (Marks- 10)

Learning Activity -2: Programming Assignment (Marks- 10): Hacker Rank Platform to use to test the basic skill set. https://www.hackerrank.com/domains/c

Rubrics for Learning Activity (Based on the nature of learning activity, design the rubrics for each activity):

Learning Activity -1: MOOC Course

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Course Completion and Participation (CO5/PO1)	Completed 100% of course modules and assignments	Completed 80-99% of course content	Completed 60-79% of course content	Completed less than 60% of course content	Not completed the course and submitted certificate.
Knowledge Acquisition and Understanding	Demonstrates comprehensive understanding of key concepts	Shows good understanding of most concepts	Basic understanding of core concepts	Limited understanding of concepts	Not demonstrated the knowledge

(CO5/PO1)					acquisition and understanding.

Learning Activity -2: Programming Assignment

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Functionality (CO3/PO3)	Program runs flawlessly, meets all requirements, handles edge cases appropriately	Program runs well, meets most requirements with minor issues	Program runs but has some functional problems or missing features	Program runs partially, several requirements not met	Program doesn't run or fails to meet basic requirements
Code Quality & Style (CO3/PO5)	Consistent formatting, meaningful variable names, appropriate comments, follows style guidelines	Generally well-formatted with minor style inconsistencies	Adequate formatting, some unclear naming or missing comments	Poor formatting, unclear naming, minimal comments	Very poor style, difficult to read
Algorithm & Logic (CO4/PO3)	Efficient algorithms, clear logical flow, optimal solutions	Sound logic with room for minor improvements	Logic works but may be inefficient or overly complex	Flawed logic in some areas	Poor or incorrect logic throughout
Documentation (CO4/PO10)	Clear comments, comprehensive README, well-documented functions	Adequate documentation with minor gaps	Basic documentation present	Minimal or unclear documentation	Little to no documentation
Testing & Error Handling (CO4/PO4)	Comprehensive testing, graceful error handling	Good test coverage with minor gaps	Basic testing implemented	Limited testing	No testing or error handling

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B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

Basic Electronics		Semester	I
Course Code	BBEE103/203	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

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

1. Apply the working principles, fundamental characteristics of various semiconductor devices including diodes, transistors and operational amplifiers in basic electronic circuits.
2. Analyze basic rectifier and amplifier circuits using the principles of diodes, BJTs, and operational amplifiers.
3. Illustrate the fundamental concepts of communication systems and their applications.
4. Design basic combinational circuits using the fundamental principles of digital systems.
5. Analyze the fundamental concepts of electronic circuits, communication systems, and digital systems for their role in building basic electronic applications.

Module-1

Diodes and Their Application: Diode Operation: The Diode, Forward Bias, Reverse Bias, Voltage-Current (V-I) Characteristic of a Diode: V-I Characteristic for Forward Bias, V-I Characteristic for Reverse Bias, Half-Wave Rectifiers: The Basic DC Power Supply, Half-Wave Rectifier Operation, Full-Wave Rectifiers: Center-Tapped Full-Wave Rectifier Operation, Bridge Full-Wave Rectifier Operation, Power Supply, Filters and Regulators: Capacitor-Input Filter, Voltage Regulators, Percent Regulation. The Zener Diode: Zener Breakdown, Zener Diode Applications: Zener Regulation with a Variable Input Voltage, Zener Regulation with a Variable Load.

Text 1: 2.1, 2.2, 2.4, 2.5, 2.6, 3.1, 3.2 Number of Hours:8

Module-2

Bipolar Junction Transistors: Bipolar Junction Transistor (BJT) Structure, Basic BJT Operation: Biasing, Operation, Transistor Currents, BJT Characteristics and Parameters: DC Beta and DC Alpha, BJT Circuit Analysis (CE Mode), Collector Characteristic Curves, Cutoff, Saturation, DC Load Line, The BJT as an Amplifier: Voltage Amplification.

Field Effect Transistor: The JFET: Basic Structure, Operation, Drain Characteristics, The MOSFET: MOSFET Operation, Enhancement MOSFET, Depletion MOSFET.

Text 1: 4.1, 4.2, 4.3, 4.4, 8.1, 8.2, 8.5, 8.6 Number of Hours:8

Module-3

Operational Amplifiers: Introduction to Operational Amplifiers: The Ideal Op-Amp, The Practical Op-Amp.

Op-Amp Input Modes and Parameters: Differential and Common Mode, Common-Mode Rejection Ratio, Maximum Output Voltage Swing, Input Offset Voltage, Input Bias Current, Input Impedance, Input Offset Current, Output Impedance, Slew Rate.

Op-Amps with Negative Feedback: Noninverting Amplifier, Voltage-Follower, Inverting Amplifier, Summing Amplifier, The Op-Amp Integrator, The Op-Amp Differentiator.

Text 1: 12.1, 12.2, 12.4, 13.2, 13.3 Number of Hours:8

Module-4

Fundamentals Of Communication: Elements of a Communication System, Communication Channels and Their Characteristics: Wireline, Fiber Optic, Wireless Electromagnetic Channels **Introduction to Analog Modulation Types**: Amplitude Modulation, Frequency and Phase Modulation, Waveforms. (Excluding Derivation and Spectral Diagrams).

Applications: AM Radio Broadcasting, Superheterodyne FM Receiver, Mobile Wireless Telephone Systems**.**

Case Study of Converting Analog Signal to Digital Signal Using PCM

Text 2: 1.2, 1.3, 3.1.

Text 3: 3.5, 4.4.1, 4.5, 18.3.1, 18.3.2. Number of Hours:8

Module-5

Digital Systems and Binary Numbers: Digital Systems, Numbering System (Binary, Octal, Decimal and Hexadecimal), Number Base Conversion – (Binary to Decimal, Hexadecimal And Vice Versa), 1's and 2's Complement Operation, Signed Binary Numbers-Arithmetic Addition and Subtraction, Binary Logic.

Boolean Algebra: Basic Definitions, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates (Excluding Extension to Multiple Inputs, Positive and Negative Edge) NAND And NOR As Universal Gates (Excluding Multilevel Presentation), Binary Adders. (Half Adder and Full Adder)

Case Study with 4-Bit Adder Simulation

Text 4: 1.1,1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 2.2,2.4, 2.5, 2.6, 2.8, 3.6, 4.5. Number of Hours:8

Suggested Learning Resources: (Text Books)

1. Thomas L. Floyd, Electronic Devices, 10th Edition, Pearson Education, 2018.
2. John G. Proakis, Masoud Saleh, Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014.
3. D.P Kothari and I J Nagrath, Basic electronics, Second Edition, McGraw Hill Education Pvt ltd, 2018.
4. M. Morris Mano and Michael D. Ciletti, Digital Design - With an Introduction to the Verilog HDL, VHDL and System Verilog 6th Edition, Pearson Education Inc, 2024.

Reference Book

1. Mike Tooley, Electronic Circuits, Fundamentals & Applications, 5th Edition, Elsevier, 2020.
2. Ramakanth A Gayakwad, Op-amps and Linear Integrated Circuits, 4th Edition, Pearson Education, 2015.

Web links and Video Lectures (e-Resources):

- Introduction to Basic Electronics: https://nptel.ac.in/courses/122106025
- Digital Electronic Circuits https://nptel.ac.in/courses/108105132

Teaching-Learning Process (Innovative Delivery Methods)

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.

2. Show Video/animation films to explain the functioning of various analog and digital circuits.

3. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.

4. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.

5. Arrange visits to nearby industries to give brief information about the electronics manufacturing industry.

5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks.**

Note: The Case Studies provided in Modules 4 and 5 are only meant to motivate the application of concepts to students and will not appear in the SEE

Continuous Comprehensive Assessments (CCA):

Learning Activity 1: (Marks 10): IIT-Kharagpur Virtual Laboratory. Link: http://vlabs.iitkgp.ac.in/be/ .Simulate the given set of 10 experiments and submit a report.

Learning Activity 2: (Marks 10): Circuit simulation using any simulation tool (e.g. LTSpice, KICad etc.) similar to those mentioned in case studies of Module 4 and 5 relevant to that module.

Rubrics for Virtual Lab Report Evaluation

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Demonstrates an Understanding of Simulation Concepts – 10 marks	Explains concepts clearly, accurately, and with insightful connections **(10)**	Explains concepts accurately with minor gaps in detail **(8)**	Shows basic understanding of concepts but lacks depth or has some inaccuracies **(6)**	Understanding is limited, with errors or confusion **(4)**	Shows little or no grasp of the simulation concepts **(2)**
Able to Apply Laws/Equations and Correct Methodology – 10 marks	Applies laws/equations flawlessly with correct and efficient methodology **(10)**	Applies laws/equations correctly with minor methodological lapses **(8)**	Applies laws/equations partially correctly; some steps or logic missing **(6)**	Frequent errors in applying laws/equations or methodology **(4)**	Unable to apply laws/equations or follow correct methodology **(2)**
Performs Accurate Calculations, Simulations and Provides precise Answers – 10 marks	All calculations are accurate; answers precise and in correct format/units **(10)**	Minor calculation errors; answers mostly precise and correctly formatted **(8)**	Some correct calculation but noticeable errors; precision inconsistent **(6)**	Frequent calculations errors; answers often imprecise or incomplete **(4)**	Calculations mostly incorrect; answers missing or irrelevant **(2)**

Rubrics for Circuit Simulation

	Superior	**Good**	**Fair**	**Needs Improvement**	**Unacceptable**
Student has a well defined problem statement and a good technical report– 5 marks	Problem statement and report are clear, specific, and well-justified with context **(5)**	Problem statement and report are clear and specific but lacks strong justification **(4)**	Problem statement and report are understandable but somewhat vague or incomplete **(3)**	Problem statement and report are unclear or too broad **(2)**	No clear problem statement provided and poor report **(1)**
The design provided by the student meets requirement– 10 marks	Design fully meets all requirements with optimal functionality **(10)**	Design meets most requirements; minor gaps in functionality **(8)**	Design meets basic requirements but with noticeable limitations **(6)**	Design meets few requirements; significant shortcomings **(4)**	Design does not meet requirements or is non-functional **(2)**
Circuit layout and demonstration is as per requirements– 10 marks	Circuit layout is correct, neat, and demonstration fully meets requirements **(10)**	Circuit layout is correct with minor issues; demonstration meets most requirements **(8)**	Circuit layout partially correct; demonstration meets basic requirements only **(6)**	Circuit layout has major errors; demonstration incomplete or unclear **(4)**	Circuit layout incorrect or missing; no meaningful demonstration **(2)**

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

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ELEMENTS OF ELECTRICAL ENGINEERING		Semester	I/II
Course Code	1BEEE105/205	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory		

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:
CO1: Analyse DC circuits using Ohm's law, Kirchhoff's laws, and power relations.
CO2: Apply concepts of single-phase and three-phase AC circuits to determine electrical quantities in R–L–C circuits.
CO3: Explain the construction, operating principles, and performance characteristics of electrical machines.
CO4: Explain safe practices in domestic wiring, protective devices and earthing methods.

Module-1

D. C. Circuits: Introduction, Ohm's Law and Kirchhoff's Laws, analysis of series, parallel and series- parallel circuits excited by independent voltage sources. Power and Energy. Illustrative examples.

Single-phase A.C. Circuits: Introduction, generation of sinusoidal voltage, definition and derivation of average value, root mean square value, form factor and peak factor of sinusoidally varying voltage and current, phasor representation of alternating quantities. Number of Hours:08

Module-2

Analysis of Single-phase A.C. Circuits: Analysis with phasor diagrams, of R, L, C, R-L, R-C and R-L-C circuits, real power, reactive power, apparent power and power factor. Resonance of Series RLC circuit. Illustrative examples involving series, parallel and series - parallel circuits.

Domestic Wiring: Service mains, meter board and distribution board. Two-way and three-way control of a lamp. Elementary discussion on fuse and Miniature Circuit Breaker (MCB's). Electric shock, precautions against shock –Earthing: Pipe and Plate. Number of Hours: 08

Module-3

Three Phase Circuits: Introduction to three phase systems, 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. Illustrative examples.

Synchronous Generators: Introduction, principle of operation. Types and constructional features. EMF equation. Concept of winding factor (excluding derivation of distribution and pitch factors). Illustrative examples on EMF equation. Number of Hours: 08

Module-4

Transformers: Introduction, Principle of operation and construction of single-phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation (Open Circuit and Short circuit tests, equivalent circuit and phasor diagrams are excluded). Illustrative problems on EMF equation and efficiency only.

Three Phase Induction Motors: Introduction, 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. Illustrative examples on slip calculations. Number of Hours: 08

Module-5

DC Machines: Introduction, working principle of DC generator. Types and constructional features. EMF equation of generator. Illustrative examples.

DC motor working principle, Back EMF and its significance, torque equation. Types of D.C. motors, characteristics (shunt and series only) and applications. Necessity of a starter for DC motor and three-point starter. Illustrative examples on back EMF and torque. Number of Hours: 08

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. D.C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2nd edition, June 2019.
2. V.K. Mehta, Rohit Mehta, "Principles of Electrical Engineering & Electronics", S. Chand Publications, 2nd edition, 2019.

References:

1. E. Hughes, "Electrical and Electronics Technology", Pearson Education, 12th edition, 2016.
2. S.S. Parker Smith and N.N Parker Smith, "Problems in Electrical Engineering "CBS publishers & Distributors Pvt Ltd, 9th edition, 2018.
3. D.P. Kothari and I.J. Nagrath, "Theory and Problems of Basic Electrical Engineering", PHI learning Private Limited, 2nd edition, 2017.

Web links and Video Lectures (e-Resources): www.nptel.ac.in
1.Principle of Electrical Sciences, Prof Sanjay Agrawal, Indira Gandhi National Open University.
2.Electricity and Electrical Wiring, Dr. Antara Mahanta Barua, Krishna Kanta Handiqui State Open University, Guwahati.

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Usage of real-life based examples in Teaching -Learning Process
2. Demonstration of cut-section models for electrical machines related modules.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity -1 (Assignment (at RBL4): Tabulating the power ratings of various domestic appliances and calculating the total energy bill of one's residence. (Marks- 10)

Learning Activity -2 (Simulation Tool Exploration): Analysis of a given electrical (AC/DC) circuit using conventional methods and with a suitable software tool. Compare and validate the results. (Marks- 10)

Rubrics for Learning Activity 1 & 2 Maximum Marks: 10
(Based on the nature of learning activity, design the rubrics for each activity):

Activity type	Performance Indicator	Superior	Good	Fair	Needs Improvement	Unacceptable
Case Study/ Problem based learning	PO2.2: Analyse problems using first principles. (4)	Applies first principles thoroughly to produce logical, and innovative solution. (4)	Applies first principles effectively with minor mistakes. (3)	Applies first principles adequately for regular problems (2)	Applies first principles to only simple problems. (1)	Applies first principles in an inappropriate way. (0)
	PO3.1: Produce appropriate solutions (4)	Produces creative, technically sound, and sustainable solutions to almost all problems. (4)	Produces acceptable solutions to many problems. (3)	Produces satisfactory solutions only to standard problems (2)	Produces incomplete Solutions. (1)	Produces no relevant solutions. (0)
	PO11.1: Understand impact of engineering solutions in societal context (2)	Provides comprehensive solutions covering societal, health, safety, environmental and cost effective issues. (2)	Provides appreciable solutions covering only few societal issues.(2)	Recognizes basic societal impacts. Provides satisfactory solutions covering only some of the societal issues.(1)	Limited understanding of societal impacts. Provides an abridged solutions. (1)	Very limited consideration of societal impacts. Provides solutions that do not have much relevance to the context. (0)

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ENGINEERING MECHANICS		Semester	I/II
Course Code	**1BCIV105/205**	50	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	50	50
Total Hours of Pedagogy	40	100	100
Credits	03	03 Hrs	03 Hrs
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	Theory/Practical/MCQ		

Course outcome (Course Skill Set)

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

1. Understand the principles of force systems
2. Compute the unknowns in coplanar system of forces using equilibrium condition
3. Determine the frictional force using laws of friction
4. Locate the centroid of the cross sections
5. Calculate the second moment of area for the cross sections

Module-1

Coplanar force system: Basic dimensions and units, Idealisation, Force, Classification of force system, principle of transmissibility of a force, Composition and resolution of forces, Free body diagrams, Resultant of coplanar concurrent and non-concurrent force system, Moment, Couple and Characteristics of couple, Varignon's theorem: Numerical Examples.

Number of Hours: 8

Module-2

Equilibrium: Conditions of static equilibrium, Equilibrium of coplanar concurrent force systems, Lami's theorem, Equilibrium of coplanar non-concurrent force system, Numerical examples. Types of supports, loadings and beams, Concept of statically determinate and indeterminate beams. Support reactions for statically determinate beams subjected to various loadings: Numerical examples.

Number of Hours: 8

Module-3

Friction: Introduction, Types of friction, Concept of static friction, Kinetic (Dynamic) friction, Laws of friction, Angle of repose, Cone of friction, Equilibrium of blocks on horizontal and inclined plane, Ladder friction: Numerical examples.

Number of Hours: 8

Module-4

Centroid: Introduction, definitions of centroid and centre of gravity.

Axes of symmetry, Locating the centroid of square, rectangle, triangle, circle, semicircle, quadrant and sector of a circle using method of integration, Centroid of composite areas and simple built- up sections: Numerical examples.

Number of Hours: 8

Module-5

Moment of Inertia of plane Areas: Introduction, Moment of inertia about an axis, Parallel axes theorem, Perpendicular axes theorem, Polar moment of inertia, Radius of gyration. Moment of inertia of square, rectangular, triangular and circular areas from the method of Integration, Moment of inertia of composite areas and simple built-up sections: Numerical Examples.

Number of Hours:8

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, third edition, 2015, Laxmi Publications, ISBN: 9789380856674.
2. Bhavikatti S S, Engineering Mechanics, fourth edition, 2018, New Age International Publications

Reference books / Manuals:

1. Beer F.P. and Johnston E. R., Mechanics for Engineers: Statics and Dynamics, Fourth edition, 1987, McGraw Hill, ISBN: 9780070045842.
2. Irving H. Shames, Engineering Mechanics-Statics and Dynamics, fourth edition, 2002, Prentice-Hall of India(PHI).
3. Hibbler R. C., Engineering Mechanics: Principles of Statics and Dynamics, fourteenth edition, 2017, Pearson Press, New Delhi.ISBN:9789332584747.
4. Timoshenko S, Young D. H., Rao J. V., Sukumar Patil, Engineering Mechanics, fifth Edition, 2017,McGraw Hill Publisher, ISBN: 9781259062667
5. Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, Eleventh edition, 2018, Eastern Book Promoters Belgaum [EBPB], ISBN: 5551234003896

Web links and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc21_me70/preview?utm_source=chatgpt.com
2. https://nptel.ac.in/courses/112103108?utm_source=chatgpt.com
3. https://ocw.mit.edu/courses/2-001-mechanics-materials-i-fall-2006/pages/lecture-notes/

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Chalk and talk
2. Activity based learning.
3. NPTEL and other videos
4. ICT-Enabled Teaching.
5. Tutorials

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each). The CIE component consists of IA tests for 30 marks and Continuous Comprehensive Assessments (CCA) for 20 marks.

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 20 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.
Learning Activity -1: (Marks- 10) – Open Book Test
Learning Activity -2 (optional): (Marks- 10) – Assignment

Rubrics for Learning Activity: Open Book Test & Assignment

Performance Indicator	**Excellent ≥ 90%**	**Very Good (70-89)%**	**Good (60-69)%**	**Satisfactory 50-59%**	**Unsatisfactory <50%**
Conceptual Understanding (3 Marks) PO1	Demonstrates complete and accurate understanding of mechanics principles; applies laws/theorems correctly. (3)	Good understanding with minor errors. (2.5)	Partial understanding; some correct, some misapplied. (2)	Weak understanding; relies on copying. (1.5)	No conceptual clarity; irrelevant/incorrect. (<1.5)
Application & Problem Solving (5Marks) PO1,& PO2	Applies concepts to solve problems systematically; correct results with proper logic. (5)	Correctly solves most problems; minor calculation/procedure errors. (4)	Attempts problem-solving; incomplete steps or major errors. (3)	Solves only simple/partial problems; poor logic. (2.5)	Unable to solve/irrelevant solutions. (<2.5)
Presentation & Clarity (2 Marks) PO9	Well-organized answers with neat diagrams, steps, and units. (2)	Mostly clear with minor lapses in diagrams/steps (1.5)	Average presentation; some diagrams/steps missing. (1)	Poorly organized, difficult to follow. (0.5)	Incoherent, incomplete, illegible. (<0.5)

Suggested Learning Activities may include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Industry integrated learning

- Analysis of Industry / Technical / Business reports
- Group discussions
- Use of MOOCs and Online Platforms
- Any other relevant and innovative academic activity

Suggested Innovative Delivery Methods may include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play

Program Specific Course Laboratory (PSCL)

1. **C Programming Laboratory 1BPICL106/206**
2. **Basic Electronics Laboratory 1BBEEL106/206**
3. **Basic Electrical Engineering Laboratory 1BEEEL106/206**
4. **Basic Mechanical Engineering Laboratory 1BEMEL106/206**
5. **Mechanics and Materials Laboratory 1BEMML106/206**

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C Programming Laboratory		Semester	I/II
Course Code	**1BPICL106/206**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:0:2/0:0:0:2	SEE Marks	50
Total Hours of Pedagogy	2/week	Total Marks	100
Credits	01	Exam Hours	3
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	**Practical**		

Course outcome (Course Skill Set)

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

CO1: Apply the concepts of Algorithm, flowchart and basic C constructs to solve the problems

CO2: Make use of arrays & strings with modular programming concepts to solve problems.

CO3: Apply the concepts of Pointers and Structures for real world scenarios.

CO4: Develop C programs to solve practical problems, employing core programming principles and debugging techniques.

CO5: Analyse the code snippets to identify the errors and predict the output.

PART – A
FIXED SET OF EXPERIMENTS

1.Write a C program to **compute the roots of a quadratic equation** by accepting the coefficients **a**, **b**, and **c** from the user. The program should calculate the discriminant and determine the nature of the roots (real and distinct, real and equal, or complex), then compute and display the roots with appropriate messages.

Input: Three space-separated floating-point numbers representing the coefficients a, b, and c ($-10^3 \leq a, b, c \leq 10^3$ and $a \neq 0$).

Output: A message indicating the type of roots, followed by the computed roots rounded to two decimal places. If the roots are complex, display both real and imaginary parts.

2.You are developing a billing software module for an electricity supply company **"Green Volt Power Services"**. The program will help the company's customer service department quickly calculate monthly electricity bills for individual customers.

The billing follows the company's tariff policy:

i) **First 200 units:** ₹0.80 per unit
ii) **Next 100 units (201–300):** ₹0.90 per unit
iii) **Beyond 300 units:** ₹1.00 per unit
iv) **Minimum meter charge:** ₹100 for all customers (regardless of usage)
v) **Surcharge:** If the energy cost (excluding meter charge) exceeds ₹400, add a **15% surcharge** on that cost.

Input: A string representing the **customer's name** (no spaces)
Output: An integer representing the **units consumed**

3.The bank's security system needs to verify cheque numbers entered by customers. A cheque number is considered unusual if it is a **palindrome** Such numbers are rare and may be flagged for a **special security check** as they are often used for memorable or special transactions.

Input : A single positive integer n ($1 \leq n \leq 10^6$)
Output: It is a palindrome or It is not a palindrome

4. In a biometrics research lab, scientists often need to calculate the number of possible arrangements of fingerprints in a dataset. The number of arrangements for n unique fingerprints is given by the factorial of n. To make the process efficient and easier to maintain, they decide to implement the factorial calculation using a recursive function in C.
Input: A single non-negative integer n ($0 \leq n \leq 20$).
Output: A single line displaying Factorial of n = <value>.

5. In a **university library**, all book IDs are stored in ascending order in the database. When a student enters a book ID to search, the system must **quickly** check if the book exists in the catalog and display its **position** in the list if found. If the book ID does not exist, display a message indicating the book is not available.
Input:

- First line: Integer n (number of books in the catalog, $1 \leq n \leq 10^5$)
- Second line: n space-separated sorted integers (book IDs)
- Third line: Integer key (the book ID to search)

Output:

- Book found at position <index> (0-based index) if the book exists.
- Book not found if it doesn't exist.

6. The central branch of **Secure Bank** receives daily transaction amounts from its various ATMs. Before generating end-of-day reports, the transaction amounts must be sorted in ascending order for easier auditing and anomaly detection.
Input:

- The first line contains an integer n ($1 \leq n \leq 10^4$) — the number of transactions.
- The second line contains n space-separated integers representing the transaction amounts.

Output:

- A single line displaying the sorted transaction amounts in ascending order, separated by spaces.

7**.** In the TechText Data Processing Unit, software tools handle large volumes of text data received from different departments. However, some systems operate in low-memory embedded environments where built-in string library functions like strcmp, strcat, and strlen are not available. To ensure compatibility, engineers need to manually implement basic string operations using custom functions.
The operations required are:

1. String Comparison – to check if two pieces of data are identical.
2. String Concatenation – to merge two text inputs for further processing.
3. String Length Calculation – to find the size of incoming text data.

Input:

- First line: an integer choice (1 for Compare, 2 for Concatenate, 3 for Length)
- For choice 1 or 2: read two strings str1 and str2
- For choice 3: read one string str

Output:

- For Compare: print "Strings are equal" or "Strings are not equal"
- For Concatenate: print the concatenated string
- For Length: print "Length = <value>"

8. In a **railway reservation system**, the seat allocation data for each train is stored in a matrix format.

- The first matrix contains the **number of seats booked** for each coach on different routes.
- The second matrix contains the **fare per seat** for each coach type on each route.

To calculate the **total fare collected** for every coach-route combination, the system multiplies these two matrices. Write a program using functions to perform this matrix multiplication. The program should:

- Read the dimensions and elements of two matrices.
- Verify that the number of columns in the first matrix equals the number of rows in the second matrix (matrix multiplication rule).
- if valid, multiply the matrices and display the resulting matrix.
- If invalid, display "Matrix multiplication not possible".

Input:

- First line: two integers m1 and n1 ($1 \leq m1, n1 \leq 100$), the dimensions of the first matrix.
- Next m1 lines: each containing n1 space-separated integers (booked seats matrix).
- Next line: two integers m2 and n2 ($1 \leq m2, n2 \leq 100$), the dimensions of the second matrix.
- Next m2 lines: each containing n2 space-separated integers (fare per seat matrix).

Output:

- If multiplication is possible (n1 == m2), print the product matrix with m1 rows and n2 columns, each row on a new line with space-separated integers.
- Otherwise, print "Matrix multiplication not possible".

9. Use structures and write a program to manage performance data for cricket academy players, storing their ID, name, score, and skill level. The program should read details for N players, compute the overall average score, assign skill levels based on performance ranges, display the average and category-wise counts, list all players with their details, and identify the top three performers.

Input:

The first line contains an integer N representing the number of players ($1 \leq N \leq 100$). The next N lines each contain three values: an integer player_id (unique player ID), a string player_name (the player's full name, underscores allowed for spaces), and an integer score (runs scored in the match, $0 \leq score \leq 100$).

Output:

The program should display:

1. The overall average score (rounded to two decimal places).
2. The number of players in each skill level category (Elite, Advanced, Intermediate, Beginner).
3. A detailed list of all players showing ID, name, score, and skill level.
4. The top three performers with their names and scores in descending order.

10. In a **manufacturing quality control system**, engineers measure the **lengths** of n machine parts in millimeters to ensure they meet design specifications.To analyze production consistency, the system must compute:

1. The **total length** of all measured parts.
2. The **average length** (mean).
3. The **standard deviation** to determine variation in part sizes.

Write a C program using **pointers** to store the measurements in an array and perform all calculations using **pointer arithmetic**.

Input:

- First line: An integer n ($1 \leq n \leq 1000$) — number of parts measured.

- Second line: n space-separated real numbers representing the lengths of the parts (in mm).

Output:

- Sum = <value>
- Mean = <value>
- Standard Deviation = <value>(All values rounded to two decimal places.

PART – B

OPEN ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

1. Control structures
2. Arrays, Strings, Functions
3. Structures, Pointers

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Text books:

- Computer Science : A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F .Gilberg, Third Edition, Cengage India Private Limited, ISBN 9788131503638, January 2007.

Reference books / Manuals:

- Brian W. Kernighan and Dennis M. Ritchie, **"The 'C' Programming Language"**, Prentice Hall of India.
- Computer fundamentals and programming in c, **"Reema Thareja",** Oxford University, Second edition, 2017.
- Jeff Szuhay , "Learn C Programming" Pact Publishing,June 2020.

Web links and Video Lectures(e-Resources):

1. elearning.vtu.ac.in/econtent/courses/video/BS/15PCD23.html
2. **Introduction to Programming in C** [https://onlinecourses.nptel.ac.in/noc23_cs02/preview]
3. **C for Everyone: Programming Fundamentals** [https://www.coursera.org/learn/c-for-everyone]
4. **Computer Programming Virtual Lab** [https://cse02-iiith.vlabs.ac.in/exp/pointers/]
5. **C Programming: The ultimate way to learn the fundamentals of the C language** [https://www.pdfdrive.com/c-programming-the-ultimate-way-to-learn-the-fundamentals-of-the-c-language-e187584209.html]
6. **C Programming: The Complete Reference** [https://viden.io/knowledge/programming-in-c-language/attachment/28313/c-the-complete-reference-herbert-schildt-4th-edition-pdf/preview]

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. 1. Flipped Classroom
2. Interactive Coding Platforms

Assessment Structure:
The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE marks awarded shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 20 marks. For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for CIE – Continuous assessment:

Rubrics for Practical continuous assessment				
Performance Indicators	**Excellent**	**Very Good**	**Good**	**Satisfactory**
Fundamental Knowledge (4) (PO1)	The student has well depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation. (3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output. (3)	Student will be able to run the program but not able to analyze the output. (1-2)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)
Rubrics for Practical continuous assessment(Test/SEE)				

Performance Indicators	Excellent	Very Good	Good	Satisfactory
Fundamental Knowledge (15)(Viva) (PO1)	The student has well depth knowledge of the topics related to the course (13-15)	Student has good knowledge of some of the topics related to course (09-12)	Student is capable of narrating the answer but not capable to show in depth knowledge (04-08)	Student has not understood the concepts clearly (01-03)
Implementation (20) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (17-20)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (13-16)	Student is capable of implementing the design with proper explanation. (06-12)	Student is capable of implementing the design. (01-05)
Result &Analysis (15) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (13-15)	Student will be able to run the program for all the cases. (09-12)	Student will be able to run the code for few cases and analyze the output. (04-08)	Student will be able to run the program but not able to analyze the output. (01-03)

Rubrics for SEE / CIE Test:

- To pass the **CIE component**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE component**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

Basic Electronics Laboratory		Semester	1/II
Course Code	BBEEL107/207	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	26	Total Marks	100
Credits	01	Exam Hours	03
Scheme	2025	Academic Year	2025-56
Examination type (SEE)	**Practical**		

Course outcome (Course Skill Set)

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

1. Apply the operating principles of diodes, transistors, and MOSFETs to construct and test basic analog circuits.
2. Implement operational amplifier configurations such as inverting, non-inverting, integrator, and differentiator for analog signal processing applications.
3. Analyze the functionality of logic gates and combinational circuits including adders, subtractors, and code converters using digital ICs.
4. Investigate amplitude modulation to explore fundamental analog communication techniques.
5. Develop solutions to open-ended electronic design problems by selecting appropriate components, constructing circuits, and interpreting results to meet defined objectives.

PART – A
CORE/BASIC HARDWARE EXPERIMENTS

1. Design and Testing of Half-Wave and Full-Wave Rectifiers with and without Filter for determining Ripple Factor, Voltage Regulation, and Efficiency.
2. Design and Testing of Bridge Rectifier with and without Filter for determining Ripple Factor, Voltage Regulation, and Efficiency.
3. Analysis of Input and Output Characteristics of a Bipolar Junction Transistor in Common Emitter Configuration
4. Investigation of Op-Amp in Inverting and Non-Inverting Modes with Gain Measurement
5. Study of Truth Tables for OR, AND, NOT, NAND, and NOR Gates Using Basic and Universal Gates
6. Realization of Half adder and Full Adder and Subtractor using Logic Gates.

PART – B
OPEN ENDED EXPERIMENTS

1. Design and Testing of Clipping and Clamping Circuits to obtain desired Transfer Characteristics
2. Design and test a single stage bipolar junction transistor amplifier to obtain desired gain and bandwidth requirements.
3. Testing of Op-Amp as voltage follower and a weighted summer with waveform analysis.
4. Design and Testing of Integrator and Differentiator Circuits using Op-Amp with Waveform Analysis
5. Amplitude Modulation using Discrete Components for Given Specifications.
6. Study of Transfer and Drain Characteristics of a MOSFET in Common Source Configuration

Suggested Learning Resources:

Text books:

1. David A Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 30th Impression, 2025.
2. Ramakanth A Gayakwad, Op-amps and Linear Integrated Circuits, 4th Edition, Pearson Education, 2015.
3. John G. Proakis, Masoud Saleh, Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014.
4. D.P Kothari and I J Nagrath, Basic electronics, Second Edition, McGraw Hill Education Pvt ltd, 2018.
5. M.Morris Mano and Michael D.Ciletti, Digital Design - With an Introduction to the Verilog HDL, VHDL and System Verilog 6th Edition, Pearson Education Inc, 2024.
6. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuit Theory", 11th Edition, PHI, 2016.

Web links and Video Lectures (e-Resources):

- Introduction to Basic Electronics: https://nptel.ac.in/courses/122106025
- Digital Electronic Circuits: https://nptel.ac.in/courses/108105132

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. While explaining each experiment, also focus on the application of that particular experiment in the electronics industry.
2. Students need not memorize pin diagrams, these can be provided to the student during CIE and SEE.

Rubrics for SEE / CIE test:

Performance Indicators	Superior	Good	Fair	Needs Improvement	Unacceptable
Fundamental Knowledge (4) (PO1)	The student has good in-depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has only marginally understood the concepts (1)	Student has not understood the concepts (0)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing the design with its merits and de-merits (5)	Student is able to explain the design, but not able to discuss all the merits and de-merits (4)	Student is capable of explaining the design (3)	Student has made correct assumptions but is barely capable of explaining the design (2)	Student has made wrong assumptions for the design (1)
Implementation (8) (PO3 & PO8)	Student effectively implements the design using the most suitable technique for an optimal solution, with clear and complete explanation of the approach. (7-8)	Student is able to implement the design using an appropriate technique and provides a satisfactory explanation of the steps taken (5-6)	Student is able to implement the design with a partially suitable approach and gives a basic explanation, though some steps may lack clarity. (3-4)	Student is able to implement the design with significant support, and explanation is minimal or lacks coherence. (2)	Student struggles to implement the design and is unable to provide a meaningful explanation (1)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output. (3)	Student will be able to run the program but not able to analyze the output. (2)	Both circuits set up and analysis are poor (1)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record is organized but some sections are unclear or incomplete. (3-4)	The lab record lacks clear organization or structure (2)	The lab record is poorly organized, with missing or unclear sections. (1)

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Basic Electrical Engineering Laboratory		Semester	**I/II**
Course Code	**1BBEEL106/206**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	02	Total Marks	100
Credits	01	Exam Hours	03
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	**Practical**		

Course outcome (Course Skill Set)

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

1. Apply **Ohm's law and Kirchhoff's laws** to analyze and verify the behavior of basic DC electrical circuits.
2. Measure **low resistance, earth resistance, and circuit parameters (R, L, Z, and power factor)** using standard laboratory methods and instruments.
3. Analyze and determine **single-phase and three-phase power** consumption of electrical loads using voltmeter–ammeter, wattmeter, and two-wattmeter methods.
4. Identify correct/faulty connections in electrical sockets based on 2-way and 3-way control of lamps.
5. **Draw meaningful conclusions** regarding performance, efficiency, and safety of electrical circuits based on the experimental data.

Note:

1. The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6-8 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum marks for the laboratory course are 100.
2. Both PART-A and PART-B are considered for CIE and SEE.
3. Students have to answer 1(one) question from PART-A and 1(one) question from PART-B.
   a. The questions set for SEE shall be from among the experiments under PART-A. It is evaluated for 70 marks out of the maximum 100 marks.
   b. The open-ended question set for SEE shall be any other open-ended question and not selected from the experiments under PART-A. It shall be evaluated for 30 marks.

PART – A
CONVENTIONAL EXPERIMENTS

1. Verification of Ohm's law and Kirchhoff's laws
2. Measurement of low range resistance using voltmeter-ammeter method. Verification of resistance value using multimeter/LCR meter
3. Measurement of earth's resistance by 3-electrode method.
4. Measurement of resistance, inductance, impedance and power factor using voltmeter, ammeter and wattmeter in single-phase AC circuits.
5. Measurement of three-phase power of an inductive load by 2-wattmeter method, when the load is (a) star connected and (b) delta connected. Calculation of resistance, reactance, impedance and power factor.
6. Wiring an appropriate electric circuit, understanding the basic principle used for 2-way and 3-way control of load.

PART – B
TYPICAL OPEN ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the

problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

1. Creation of a short circuit to determine the fusing time taken by a fuse of different length. Documenting the test data and the conclusions.
2. Trouble shooting experiments in simple DC circuits. The trouble may be due to loose connection, faulty components leading to open circuits or short circuits. Detection of fault and the reasons for that and conclusion
3. Measurement of voltage between line and neutral, ground and line, ground and neutral in respect of healthy and unhealthy 3-pin sockets. Conclusions arrived for the faulty wiring. Allowable ground voltage.
4. A 12 V battery is available. It is required to obtain 3 V from the battery to charge a mobile. Create a circuit to obtain the required voltage. Specify all the ratings of the components used.
5. Only three ammeters and standard resistance are available in the laboratory. Using the same measure the single phase power consumed by an inductive load.
6. Only three voltmeters and standard resistance are available in the laboratory. Using the same measure the single phase power consumed by an inductive load.

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Text books:

1. **Manual prepared for the conventional experiments by EEE Departments.**

Web links and Video Lectures (e-Resources):

(1) https://bes-iitr.vlabs.ac.in/List%20of%20experiments.html [Virtual Labs, an ministry of education (MOE) Govt. of India Initiative]

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1.Demonstration with hands-on practice. Perform the experiment step-by-step to reinforce understanding and skill after a demonstration.

2.Problem-based learning (PBL) Students to work individually or in groups to analyse the situation, design solutions, and present their findings.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE marks awarded shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 20 marks. For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for CIE – Continuous assessment:

Performance Indicator	Superior	Good	Fair	Needs Improvement	Unacceptable
Fundamental Knowledge (5) (PO1)	The student has an in depth knowledge of the topics	Student has ample knowledge of the topics	Student has good amount of knowledge but not in detail. (3)	Student has some knowledge. (1-2)	Student has very less knowledge. (0)

	related to the course. (5)	related to course. (4)			
Design of Experiment (5) (PO2 & PO3)	Student can conceive more than one design for the problem statement and capable of proving the best suitable design. (5)	Student is capable of discussing few designs for the problem statement but not certain about its suitability.(4)	Student is capable of discussing one of the designs and explain completely. (3)	Student is not capable of completing the design to its logical end. (1-2)	Student is unable to complete the design.(0)
Implementation (5) (PO3 & PO8)	Student is capable of implementing the design with ease to obtain optimal solution. (5)	Student is capable of implementing the design successfully, along with a solution and explanation. (4)	Student is capable of implementing the design with a solution and average explanation. (3)	Student is capable of implementing the design, but unable to justify the result. (1-2)	Student is unable to implement the design, but unable to justify the result. (1-2)
Result & analysis (5) (PO4)	Student is able to get the expected results with justifications. (5)	Student is able to get the expected results and able to justify only partially. (4)	Student is able to get the expected results and unable to justify (3)	Student is able to get the expected results but unable to justify (1-2)	Student is unable to get the expected results.(0)
Demonstration (10) (PO9)	The lab record is well organized, with clear sections (e.g., introduction, Theory, Method, Results, Conclusions. (9-10)	The lab record is organized, with clear sections, but some sections are not well defined. (7-8)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (5-6)	The lab record is poorly organized, with missing or unclear sections. (3-4)	The lab record is is not organized and very poor submission. (1-2)

Rubrics for SEE / CIE Test:

- To pass the **CIE component**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE component**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

Rubrics suggested for Practical continuous assessment				
Performance Indicators	**Excellent**	**Very Good**	**Good**	**Satisfactory**
Fundamental Knowledge (4) (PO1)	The student has an in-depth knowledge of the topics related to the course (4)	Student has good knowledge of some of the topics related to course (3)	Student is capable of narrating the answer but not capable to show in depth knowledge (2)	Student has not understood the concepts clearly (1)
Design Of Experiment (5) (PO2 & PO3)	Student is capable of discussing more than one design for his/her problem statement and capable of proving the best suitable design with proper reason (5)	Student is capable of discussing few designs for his/her problem statement but not capable of selecting best (4)	Student is capable of discussing single design with its merits and de-merits (3)	Student is capable of explaining the design (1-2)
Implementation (8) (PO3 & PO8)	Student is capable of implementing the design with best suitable algorithm considering optimal solution. (7-8)	Student is capable of implementing the design with best suitable algorithm and should be capable of explaining it (5-6)	Student is capable of implementing the design with proper explanation. (3-4)	Student is capable of implementing the design. (1-2)
Result &Analysis (5) (PO4)	Student is able to run the program on various cases and compare the result with proper analysis. (5)	Student will be able to run the program for all the cases. (4)	Student will be able to run the code for few cases and analyze the output. (3)	Student will be able to run the program but not able to analyze the output. (1-2)
Demonstration (8) (PO9)	The lab record is well-organized, with clear sections (e.g., Introduction, Method, Results, Conclusion). Transitions between sections are smooth. (7-8)	The lab record is organized, with clear sections, but some sections are not well-defined. (5-6)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (3-4)	The lab record is poorly organized, with missing or unclear sections. (1-2)

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MECHANICS AND MATERIALS LABORATORY		Semester	I/II
Course Code	**BCIVL2071**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	12	Total Marks	100
Credits	01	Exam Hours	02 Hrs
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	**Practical**		

Course outcome (Course Skill Set)

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

1. Analyse coplanar force systems by analytical and graphical methods.
2. Compute support reactions in simply supported beams.
3. Understand the properties of various construction materials.

Note:

1. The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6-8 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum marks for the laboratory course are 100.
2. Both PART-A and PART-B are considered for CIE and SEE.
3. Students have answer 1(one) question from PART-A and 1(one) question from PART-B.
   a. The questions set for SEE shall be from among the experiments under PART-A. It is evaluated for 70 marks out of the maximum 100 marks.
   b. The open-ended question set for SEE shall be any other open-ended question and not selected from the experiments under PART-A. It shall be evaluated for 30 marks.

PART – A
CONVENTIONAL EXPERIMENTS

1. Verification of Lami's Theorem.
2. Equilibrium of concurrent forces.
3. Parallel force system- simply supported beam.
4. Verification of Varignon's theorem.
5. Particle size distribution of Soil-Graphical representation of the gradation curve.
6. Visual identification of building materials:
   Bricks, Stones, Tiles, M-Sand, Bitumen, Fly-Ash, GGBS, Steel Bars of Various Sizes.

PART – B
TYPICAL OPEN ENDED EXPERIMENTS

1. Calculation of Volume of Brick work.
2. Determination of Centre of gravity of planar figures
3. Determine the reactions of a simply supported beam for various loading conditions
4. Particle size distribution of the given material
5. Determine the specific gravity of the given material.

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Reference books / Manuals:

1. Meriam J. L. and Kraige L. G, Engineering Mechanics-Statics, Vol I–sixth Edition,2008, Wiley publication.
2. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, third edition, 2015,,Laxmi Publications, ISBN: 9789380856674
3. Ramamrutham, Engineering Mechanics, Dhanpat Rai Books, 2013,ISBN: 9789352164271,
4. Bureau of Indian Standards (BIS). IS 4031 (Parts 1 to 15): Methods of Physical Tests for Hydraulic Cement. New Delhi: BIS, 1988 (Reaffirmed 2019).
5. Bureau of Indian Standards (BIS). IS 383: 2016 – Coarse and Fine Aggregate for Concrete – Specification (Third Revision). New Delhi: BIS, 2016.
6. Bureau of Indian Standards (BIS). IS 2720 (Parts 1 to 41): Methods of Test for Soils. New Delhi: BIS, 1973 (Reaffirmed 2021).
7. Bureau of Indian Standards (BIS). IS 2386 (Parts 1 to 8): Methods of Test for Aggregates for Concrete. New Delhi: BIS, 1963 (Reaffirmed 2016).

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/112103109/

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Team-Based Learning (TBL)
2. Hands-On Experiments and Simulations

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE marks awarded shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 20 marks. For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for CIE – Continuous assessment:

	Performance Indicators	Excellent ≥ 90%	Very Good (70-89)%	Good (60-69)%	Satisfactory 50-59%
Experiment Conduction and Inference (18 Marks) **PO1 and PO2**	Student is capable of conducting the assigned experiment systematically using proper procedure, with accurate observation and correct inference. (17-18)	Student is capable of conducting the experiment systematically with proper procedure and explanation, but minor errors in inference. (13-16)	Student is capable of conducting the experiment with some guidance and provides partial explanation of results. (11-12)	Student is capable of performing only basic steps of the experiment with limited understanding of inference. (9-11)	Student is unable to conduct the experiment properly, makes major procedural errors, observations are missing/incorrect, and inference is absent. < 9
Write-up (6 Marks) **PO9**	The lab record is complete, well-structured (Aim, Apparatus, Procedure, Observations, Calculations, Results, Conclusion), and neatly presented. (6)	The lab record is complete with clear structure, but lacks neatness or minor details. (4.5)	The lab record is partially complete, with missing sections or unclear presentation. (4)	The lab record is poorly maintained, with incomplete or missing sections. (3)	The lab record is not submitted or lacks essential content, structure, and presentation. (<3)
Fundamental Knowledge (Viva Voce) (6 Marks) **PO1**	Student demonstrates strong conceptual knowledge of mechanics and materials, and explains experiment principles, applications, and calculations clearly. (6)	Student has good understanding of the experiment principles and answers most questions correctly. (5)	Student shows limited knowledge; able to answer basic questions but lacks depth. (4)	Student has poor understanding of the experiment and unable to answer basic questions. (3)	Student fails to demonstrate fundamental knowledge, cannot answer even basic questions, and shows no conceptual clarity. (<3)

Rubrics for SEE / CIE Test:

Performance Indicators	Excellent ≥ 90%	Very Good (70-89)%	Good (60-69)%	Satisfactory 50-59%	Unsatisfactory <50%
Experiment Conduction and Inference (60 Marks) **PO1 and PO2**	Student is capable of conducting the assigned experiment systematically using proper procedure, with accurate observation and correct inference.	Student is capable of conducting the experiment systematically with proper procedure and explanation, but minor errors in inference.	Student is capable of conducting the experiment with some guidance and provides partial explanation of results.	Student is capable of performing only basic steps of the experiment with limited understanding of inference.	Student is unable to conduct the experiment properly, makes major procedural errors, observations are missing/incorrect, and inference is absent.
Write-up (20 Marks) **PO9**	The lab record is complete, well-structured (Aim, Apparatus, Procedure, Observations, Calculations, Results, Conclusion), and neatly presented. (19-20)	The lab record is complete with clear structure, but lacks neatness or minor details.	The lab record is partially complete, with missing sections or unclear presentation.	The lab record is poorly maintained, with incomplete or missing sections.	The lab record is not submitted or lacks essential content, structure, and presentation.
Fundamental Knowledge (Viva Voce) (20 Marks) **PO1**	Student demonstrates strong conceptual knowledge of mechanics and materials, and explains experiment principles, applications, and calculations clearly.	Student has good understanding of the experiment principles and answers most questions correctly.	Student shows limited knowledge; able to answer basic questions but lacks depth.	Student has poor understanding of the experiment and unable to answer basic questions.	Student fails to demonstrate fundamental knowledge, cannot answer even basic questions, and shows no conceptual clarity.

- To pass the **CIE component**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE component**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

AEC (NCMC) -Non Credit Mandatory Course.,
AEC -Ability Enhancement Courses
Humanities, Social Sciences, and Management Courses,

1. **Soft Skills 1BSS107**
2. **Innovation and Design Thinking 1BIDTL108**
3. **Samskrutika Kannada /Balake Kannada 1BSK109/1BBK109**
4. **Professional English Communication 1BPECL206**
5. **Indian Constitution and Engineering Ethics 1BIC207**
6. **Interdisciplinary Project 1BPRJ208**

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SOFT SKILLS		Semester	I/II
Course Code	1BSS107/207	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	--
Total Hours of Pedagogy	30	Total Marks	100
Credits	00	Exam Hours	--
Scheme	2025	Academic Year	2025-26

Course outcome (Course Skill Set)

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

CO1: Apply social skills for clear communication, persuasion, self-awareness, and active listening.

CO2: Use emotional skills to build confidence, manage stress, and adapt to change.

CO3: Set ambitious goals, practice empathy, and apply creativity for problem-solving.

CO4: Demonstrate discipline, time management, and structured problem-solving.

CO5: Work in teams, negotiate, resolve conflicts, and think critically.

Module-1

Social Skills

Communication: Principles of clear and effective exchange of ideas in professional and social contexts.

Persuasion: Techniques to influence and convince through logical, emotional, and ethical appeals.

Self-Awareness: Identifying personal strengths, weaknesses, opportunities, and challenges (SWOC analysis).

Active Listening: Paraphrasing, questioning techniques, and demonstrating attentiveness.

Number of Hours: 6

Module-2

Emotional Skills I

Emotional Intelligence (EI): Recognizing and managing emotions, empathy, relationship management, and conflict resolution.

Stress Management: Identifying stress triggers, relaxation techniques, work-life balance strategies, and mindfulness practices.

Time Management: Prioritization (Eisenhower Matrix), setting SMART goals, avoiding procrastination, and effective scheduling.

Adaptability & Resilience: Handling change, bouncing back from setbacks, and developing a growth mindset. Number of Hours: 6

Module-3

Emotional Skills II

Ambition & Goal Setting: Defining personal and professional aspirations, creating SMART goals, and aligning actions with long-term vision.

Sympathy & Empathy: Understanding emotional perspectives, differentiating between the two, and applying them in workplace and social interactions.

Creativity & Innovation: Generating original ideas, problem-solving, and applying creative thinking techniques (mind-mapping, SCAMPER). Number of Hours: 6

Module-4

Professional Skills I

Problem Solving: Identifying root causes, analysing options, and implementing solutions using methods like 5 Whys and Fishbone Diagram.

Discipline: Building consistency, accountability, and professional habits.

Time Management: Prioritizing tasks (Eisenhower Matrix), scheduling, avoiding procrastination. Number of Hours: 6

Module-5

Professional Skills II

Collaboration & Teamwork: Working effectively in diverse teams, fostering trust, and achieving shared goals.

Negotiation & Conflict Resolution: Strategies to resolve differences and reach win– win outcomes.

Critical Thinking: The ability to analyse, evaluate, and synthesize information to make well-reasoned decisions. Number of Hours: 6

Suggested Learning Resources

Text books / Reference books / Manuals:

1. Principles of Scientific and Technical Writing, 1e, By Pratap K. J. Mohapatra, Sanjib Moulick, © 2025 | Published: December 23, 2024
2. Soft Skills, 1e, By Soma Mahesh Kumar © 2024 | Published: June 8, 2023
3. Effective Technical Communication, 3e, By Ashraf M. Rizvi, Priyadarshi Patnaik, © 2024 | Published: September 12, 2024
4. Yadav, D. P. (2022). *A course in English pronunciation*. Notion Publications.
5. Oxford Advance Learners Dictionary
6. Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar
7. *Developing Employability* – A practical guide for UG / PG students by V M Ramalingam and R L Nandeshwar

Web links and Video Lectures (e-Resources):

- Google Docs + Voice Typing - https://docs.google.com
- LearnEnglish – https://learnenglish.britishcouncil.org/
- TakeIELTS - https://www.britishcouncil.in/exam/ielts
- British Council Apps - **bbcLearnEnglishonline Grammar**
  LearnEnglish Podcasts
  IELTS Word Power
  Bbclearningenglishgrammer online Sounds Right (Phonemic Chart)

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach
2. Quiklrn.com - Lab

Assessment Structure:

The assessment for the course is only Continuous Internal Evaluation (CIE)

Notwithstanding the above, a student is considered to have passed the course, provided the total of CIE is at least 40 out of 100 marks.

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Innovation and Design Thinking		Semester	I/II
Course Code	**1BIDTL108**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	26	Total Marks	100
Credits	01	Exam Hours	3
Scheme	2025	Academic Year	2025-26
Examination type (SEE)	**Practical Viva Voce**		

Course outcome (Course Skill Set)

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

1. Demonstrate the concept of understanding in design thinking.
2. Illustrate observation phase for design thinking problems.
3: Describe define phase for design thinking problems.
4. Apply ideate process for design thinking problems.
5. Develop prototype and test.

Part-A: PROBLEM SPACE

Part A1: UNDERSTAND PHASE

Objectives of the Understand Phase, Search field determination, Questionnaire to clarify the problem (Andler) problem clarification (Kepner/Tregore), the blind spot of knowledge and awareness. PESTEL Analysis, Ishikawa diagram. Other methods followed for understanding in understanding phase, Conclusion of Understand Phase. (Week 1and 2)

Part A2: OBSERVATION PHASE

Objectives of the Observation Phase, Tips for observing, Nine dimensions of descriptive observation, five factors of a customer experience, Empathy Map, Cognitive walkthrough, Heuristic Evaluation, Critical-Incident Techniques, other observation methods followed in observation phase. Field Visit and customer/target group interaction, Conclusion of Observation Phase (Week 3 and 4)

Part A3: DEFINE PHASE

Objectives of the Define Phase, Point-of-view phase, Persona, checklist for identifying customer problems, checklist for the identification of customer needs/wishes, Cognitive ladder of Means-end approach, Conclusion of Define Phase, Sustainability Development Goals considered in Problem Space.

Problem Space project presentation and review (Week 5, 6 and 7)

Part-B: SOLUTION SPACE

Part B1: IDEATE PHASE

Objectives of Ideate Phase, Osborn Checklist, TRIZ: ideality formula, checklist ideality. innovation checklist, Resource analysis and resource checklist. Evaluation of ideas: Proc-Cons lists, SWOT analysis, Other ideation process followed. Conclusion of Ideate Phase.

(Week 7 and 8)

Part B2: PROTOTYPE PHASE

Objectives of Prototype and Testing Phase, Prototype phase, Prototype model, development of Prototype, description of each component of protype, working of prototype, Lean startup method for prototype development, other prototype methods followed, Conclusion of Prototype Phase. (Week 9 and 10)

Part B3: TEST PHASE

Focus groups/usability tests, Test Phase: Criteria to analyse the customer feedback, tips for prototyping testing, desirability toolkits: quality, ease of use and social/emotional, Agility for design thinking: the Scrum Guidelines, Other testing methods followed. Conclusion of Testing Phase, Sustainability Development Goals considered in Solution Space.

Solution Space project presentation and review. (Week11,12 and13)

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Text books:

1. Christian Mueller-Roterberg, Handbook of Design Thinking, Tips & Tools for how to design thinking, Kindle Direct Publishing, 2018

Reference books / Manuals:

2. A Nil Hasso Plattner, Christoph Meinel and Larry Leifer (, Design Thinking: Understand – Improve – Apply, Springer, 2011.
3. Idris Mootee, Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, John Wiley & Sons 2013.

Web links and Video Lectures (e-Resources):

1. https://web.stanford.edu/~mshanks/MichaelShanks/files/509554.pdf
2. https://designthinking.ideo.com/new-applications
3. www.designthinkingformobility.org/wp-content/
4. https://www.nngroup.com/articles/design-thinking/
5. https://onlinecourses.nptel.ac.in/noc22_mg32/preview
6. https://www.youtube.com/watch?v=GeUXQ_L-35M
7. https://www.youtube.com/watch?v=kXnYTzdnCMc
8. https://www.youtube.com/watch?v=Et26kh_OYIs

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Activity Based Learning
2. Group discussion, Presentations.
3. Brainstorming interactions.
4. Innovation warm-up activities.

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

CIE Marks Distribution (50 Marks)

Problem Space review and presentation	:25 Marks
Solution Space review and presentation	: 25Marks
Total CIE Marks	**: 50 Marks**

SEE Marks Distribution (50 Marks)

Project Viva Voce

Understand, Observe and Define Phase	: 25 Marks
Ideate, Prototyping & Testing Phase	: 25 Marks
Sustainable Development Goals	: 15 Marks
Presentation and communication	: 10 Marks
Question and Answers	: 10 Marks
Working in groups	: 05 Marks
Project Report	: 10 Marks
Total project Viva Voce Marks	**: 100 Marks**

(Project Viva Voce is conducted for 100 Marks and is reduced to 50 Marks)

Rubrics for SEE / CIE Test:

- To pass the **CIE component**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE component**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.

A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

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ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ Samskrutika Kannada		Semester	I/II
Course Code	1BSK109/209	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01
Scheme	2025	Academic Year	2025-26

Course outcome (Course Skill Set)

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ನಂತರ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ:

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಕುರಿತು ಅರಿವು ಮೂಡಿರುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಕುರಿತು ಹೆಚ್ಚಿನ ಓದಿಗೆ ಮತ್ತು ಜ್ಞಾನಕ್ಕೆ ಸ್ಫೂರ್ತಿ ಮೂಡುತ್ತದೆ.
3. ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯತ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆಡೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಹೆಚ್ಚಾಗುತ್ತದೆ.
4. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ತಿಳಿದುಕೊಂಡು ನಾಡಿನ ಇನ್ನಿತರ ವ್ಯಕ್ತಿಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳಲು ಕೌತುಕತೆ ಹೆಚ್ಚಾಗುತ್ತದೆ.
5. ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಘಟಕ–1

ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಲೇಖನಗಳು:

ಕನ್ನಡ ಸಂಸ್ಕೃತಿ - ಹಂಪ್ ನಾಗರಜಯ್ಯ

ಕರ್ನಾಟಕ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ–ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ

ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ–ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ.ವಿ.ಕೇಶವಮೂರ್ತಿ **3 ಗಂಟೆಗಳು**

ಘಟಕ–2

ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ:

ವಚನಗಳು–ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ

ಕೀರ್ತನೆಗಳು–ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ–ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ–ಕನಕದಾಸರು

ತತವಪದ್ಗಳು: ಸಾವಿರ ಕ ೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ

3 ಗಂಟೆಗಳು

ಘಟಕ–3

ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗ:

ಡಿ.ವಿ.ಜಿ.ಯವರ ಮಂಕು ತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು.

ಕುರುಡು ಕಾಂಚಾಣ: ಯುಗಾದಿ ವಸುಧೇಂದ್ರ

ಹೊಸ ಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು **3 ಗಂಟೆಗಳು**

ಘಟಕ–4

ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ:

ಡಾ.ಸರ್.ಎಂ.ವಿಶ್ವೆಶ್ವರಯ್ಯ:ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ–ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್

ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ–ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ **3 ಗಂಟೆಗಳು**

ಘಟಕ–5

ಸಂಸ್ಕೃತಿಕ, ಜನಪದ ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ: ಯುಗಾದಿ ವಸುಧೇಂದ್ರ **ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ** **3 ಗಂಟೆಗಳು**
ಖಿಜಥಣಭಥಠಠಞ: **ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ** ಡಾ.ಹಿ.ಚೆ ಬ ೊೀರಲಂಗಯ್ಯ ಮತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರಸಾರಾಂಗ ವಿಶ ವೀಶವರಯ್ಯ ತಾಂತಿರಕ ವಿಶವವಿದಾಯಲಯ್, ಬ ಳಗಾವಿ
CONTINUOUS INTERNAL EVALUATION (CIE) and SEMESTER END EXAMINATION (SEE) PATTERN • The Weightage of Continuous Internal Examination (CIE) is 50% and for Semester End Examination (SEE) is 50 % • The minimum passing mark for the CIE is 40% of the Maximum marks (ie 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (ie 18 out of 50 marks) A student will be declared to have passed the course if they secure a minimum of 40% (ie 40 marks out of 100) in the combined total of CIE and SEE

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Balake Kannada ಬಳಕೆ ಕನ್ನಡ		Semester	I/II
Course Code	1BBK109/209	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01
Scheme	2025	Academic Year	2025-26

Course outcome (Course Skill Set)

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

1. Appreciate the necessity of learning local language for comfortable and healthy life.
2. Listen and understand the Kannada language properly.
3. Speak, read and write Kannada language as per requirement.
4. Get engaged in correct and polite conservation in Kannada.
5. Know about Karnataka state and its language, literature and General information about this state.

Module-1

Introduction, Necessity of learning a local language, Methods to learn the Kannada language. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conversation, Listening and Speaking Activities.Key to Transcription.ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು. Personal Pronouns, Possessive Forms, Interrogative words. **3 hours**

Module-2

ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು Possessive forms of of nouns, dubitive question and Relative noun. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and Colour Adjectives, Numerals. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ (ಅ, ಅದು, ಅವು, ಅಲ್ಲಿ) Predictive Forms, Locative Case. **3 hours**

Module-3

ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು Dative cases and Numerals. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು Ordinal numerals and Plural makers. ನ್ಯೂನ/ನಿಷೇದಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ವ ಸ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು Defective /Negative Verbs and Colour Adjectives. **3 hours**

Module-4

ಅಪ್ಪಣೆ/ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು Permission, Commands, encouraging and urging words (Imperative words and sentences). ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು Accusative Cases and Potential Forms used in General

Communication. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು Helping verbs "iru and iralla" Corresponding Future and Negation Verbs. ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇದಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ Comparitive, Relationship, Identification and Negation words. **3 hours**

Module-5

ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾ ಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು, Different types of tense, time and verbs. ದ್, ತ್, –ತು, –ಇತು, –ಆಗಿ, –ಅಲ್ಲ, –ಗ್, –ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ Formation of Past, Future and Present Tense Sentences with Verb Forms. Kannada Vocabulary list: ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು-Kannada Words in Conversation **3 hours**

Textbook:
ಬಳಕೆ ಕನ್ನಡ
ಲೇಖಕರು: ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ
ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ

CONTINUOUS INTERNAL EVALUATION (CIE) and SEMESTER END EXAMINATION (SEE) PATTERN

- The Weightage of Continuous Internal Examination (CIE) is 50% and for Semester End Examination (SEE) is 50 %
- The minimum passing mark for the CIE is 40% of the Maximum marks (ie 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (ie 18 out of 50 marks)

A student will be declared to have passed the course if they secure a minimum of 40% (ie 40 marks out of 100) in the combined total of CIE and SEE

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Title of the course – Professional English Communication		Semester	I/II
Course Code	**1BPECL106/206**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	01	Exam Hours	02
Scheme	2025	Academic Year	2025-26

Course outcome (Course Skill Set)

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

CO1: Build essential verbal, non-verbal, and phonetic communication skills for clarity and effectiveness.
CO2: Use interpersonal skills in group discussions, presentations, and professional interactions.
CO3: Apply formal writing, email etiquette, and creative content development for employability.
CO4: Communicate effectively in digital platforms, following netiquette and academic integrity.
CO5: Prepare job applications, resumes, and perform confidently in interviews.

Module-1

COMMUNICATION SKILLS

Glimpses of Essential English for Engineers (General Overview). Communication Skills: Process, Verbal and Non-Verbal, Proxemics, Chronemics and Barriers. **Writing**: Word Classification, Grammar essentials-(Parts of Speech & Sentence structures). **Speaking & Listening:** Listening to English Pronunciation – English Phonemes – Intelligible Accent – Speech Organs- Syllable Structures, Stress, Intonation, and Practice. Number of Hours:6

Module-2

INTERPERSONAL SKILLS

Speaking: Role Play Exercises Based on Workplace Contexts, Introducing Oneself -PEP Talks- Personal Empowerment, Participating in Group Discussion and Debates, Giving Technical Presentation. **Reading:** Reading the Interview of an Achiever (Skimming and Scanning) (Case Studies). **Writing:** Writing a Short Biography of an Achiever based on given reflections, **Grammar:** Sentence patterns. **Vocabulary** Development: Idioms and Phrases.

Number of Hours:6

Module-3

ENGLISH FOR EMPLOYABILTY

Writing: Formal Letter writing (Enquiry, Order, and Complaint). Applied Grammar- (Tenses – Reported Speech-Voice) Email Etiquettes, Structure, Writing and Responding to Emails. Paragraph Writing (Descriptive, Argumentative, Expository, Short Story, and Narrative), Blog Writing. **Reading**: Proofreading (Spelling, Punctuation, Grammar). Error Identification Exercises. **Speaking:** Questions & Requests (non-Wh questions and Question tags).

Number of Hours: 6

Module-4

ENGLISH IN DIGITAL WORLD

Writing: Framing of search terms / keywords in search engines/ Commands for search on open AIs - Tools to support synchronous communication such as webinar platforms, and asynchronous communication such as forums and social media - Online communication - Types – pros and cons of online communication. Acceptable online roles and behaviors – Netiquettes - Etiquettes of social media. Problems and opportunities in handling digital resources -Tools to check grammar. **Writing:** Citing information accurately from source material - Plagiarism – Infringement, Importance of academic integrity. Number of Hours: 6

Module-5

APPLYING FOR JOBS

Listening: TED Talks. **Speaking:** Mock Interview, Telephone Interviews. **Reading:** Reading a Job Interview- language used in formal professional settings, formal vs. informal tone, non- verbal communication cues, Statement of Purpose, Company Profile and Completing Comprehension Exercises. **Writing:** Job Applications and Resumes. **Grammar:** Conditional Clauses, Modal verbs **Vocabulary Development:** Technical Vocabulary, Purpose Statement. Number of Hours: 6

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):

Text books:

1. Kumar, A. R. (2008). English for Engineers and Technologists. Orient BlackSwan.
2. Raman. M & Sharma S. (2015) Technical communication: Principles and practice (3rd ed) Oxford University Press.
3. Floyd K, & Cardon, P.W.(2019) Business and Professional Communication (3rd ed.) Principles of Scientific and Technical Writing,1e, by, Pratap K. J. Mahapatra, Sanjib Moulick, (2025)
4. Effective Technical Communication, (3rd ed) by, Ashraf M. Rizvi, Priyadarshi Patnaik.
5. Yadav. D.P. A course in English pronunciation. Notion publications.

Reference books / Manuals:

1.Oxford Advance Learners Dictionary

2. Cambridge English Skills Real Listening and Speaking by Miles Craven

3.Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar.

Web links and Video Lectures (e-Resources):

Google Docs + Voice Typing - https://docs.google.com
Learn English – https://learnenglish.britishcouncil.org/
TakeIELTS - https://www.britishcouncil.in/exam/ielts
British Council Apps -**bbcLearnEnglishonline Grammar**
LearnEnglish Podcasts IELTS Word Power
Bbclearningenglishgrammer
online Sounds Right (Phonemic Chart)

Assessment Structure:

The assessment for the course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

- To pass the **CIE**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(An Autonomous Institution affiliated to VTU, Belagavi)
Yelahanka, Bengaluru-560 119

Indian Constitution and Engineering Ethics		Semester	I/II
Course Code	1BICO107/207	CIE Marks	100
Teaching Hours/Week (L:T:P:S)	1:0:0:0	SEE Marks	--
Total Hours of Pedagogy	15	Total Marks	100
Credits	00	Exam Hours	--
Scheme	2025	Academic Year	2025-26

Course outcome (Course Skill Set)

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

1. Analyse the basic structure of the Indian Constitution
2. Understand the concept of Fundamental rights, Directive Principles of State Policy and Fundamental Duties of our constitution
3: Familiarise with the working of Union and State Government.
4. Appreciate the significance of election system, emergency provisions and constitutional amendments
5. Understand the significance of ethics in engineering.

Module-1

Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of Indian Constitution. 2 hours

Module-2

Fundamental rights, Directive Principles of State Policy and Fundamental Duties: Fundamental Rights and its restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building. 4 hours

Module-3

Union and State Governance: Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament – Lok Sabha and Rajya Sabha, Parliamentary Committees, Important Parliamentary Terminologies. Judicairy-Supreme Court of India, Judicial Reviews and Judicial Activism. State Executive- Governor, Chief Minister, State Legislature and High Courts. 3 hours

Module-4

Elections, Amendments and Emergency Provisions: Election Commission, Elections & Electoral Process. Amendment to Constitution (How and Why) and Important Constitutional Amendments till today. Emergency Provisions, procedure, grounds and effect. 3 hours

Module-5

Engineering Ethics: Ethics & Values. Types of Ethics. Scope & Aims of Professional & Engineering Ethics. Positive and Negative Faces of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Trust & Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering. 3 hours

Suggested Learning Resources:

Textbook:

1. "Constitution of India" (for Competitive Exams) - Published by Naidhruva Edutech Learning Solutions, Bengaluru. – 2022.

2."Engineering Ethics", M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice –Hall, 2004.

Reference Books:

1. "Samvidhana Odu" - for Students & Youths by Justice HN Nagamohan Dhas, Sahayana, kerekon.

2. "Constitution of India, Professional Ethics and Human Rights" by Shubham Singles, Charles E. Haries, and et al: published by Cengage Learning India, Latest Edition – 2019.

3. "Introduction to the Constitution of India", (Students Edition.) by Durga Das Basu (DD Basu): Prentice –Hall, 2008.

4. "The Constitution of India" by Merunandan K B: published by Merugu Publication, Second Edition, Bengaluru.

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Activity Based Learning

2.Group discussion, Presentations.

3. Brainstorming interactions.

4. Innovation warm-up activities.

Assessment Structure:

The assessment for the course is only Continuous Internal Evaluation (CIE)

Notwithstanding the above, a student is considered to have passed the course, provided the total of CIE is at least 40 out of 100 marks.