Government College of Engineering, Aurangabad
Department of Electrical Engineering

NEP Compliant tentative B. Tech structure

& curriculum of

FY B. Tech. (Electrical)23-24 onwards as per NEP2020

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

1. Our graduates will excel in professional careers in technology and management with appropriate consideration for safety, culture, energy optimization and environment.
2. Our graduates will excel in higher studies, research and competitive examinations.
3. Our graduates will become successful entrepreneurs.
4. Our graduates will practice good human values, professional ethics and social responsibilities

Program Outcomes

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design systems components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, social and environmental consideration. To use modern engineering IT tools to solve and model electrical engineering problems.
4. Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including predictions and modeling to complex engineering activities with an understanding of the limitations
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and consequent responsibility relevant to the professional engineering practice.
7. Environment and sustainability: Understands the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual and as a member or leader in diverse teams, and multidisciplinary settings.
10. Communications: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentations, make effective presentations and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects multidisciplinary environments.
12. Life-long learning: Recognize the need for and have preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

Program Specific Outcomes

1. Identify, formulate problems in power system domain and apply subject knowledge to provide solutions
2. Classify, make use of various electrical machines, power electronics circuits and electrical drives for engineering applications and investigate for suitability and troubleshooting
3. Analyze and apply concepts of electronics, control systems and instrumentation for engineering applications

Total Credits for the completion of B.Tech. in Electrical Engineering:

The total number of credits proposed for the four-year B.Tech Electrical Engineering with 1 Multidisciplinary minor (Compulsory) degree is **170** as per the structure given below**:**

Structure of B. Tech. in Electrical Engineering with multidisciplinary minor:

Semester		**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total Credits**
Basic Science Course	BSC	08	08		--	--	--	--	--	16
Engineering Science Course	ESC	07	07		--	--	--	--	--	14
Program Core Course (PCC)	Program Courses	--	02	14	12	08	13	04		53
Program Elective Course (PEC)	Program Elective	--	--	--	--	06	06	07	-	19
Multidisciplinary Minor (MD M)	Multidisciplinary Courses		-	04	03	04	03			14
Open Elective (OE) Other than a particular program	OE	--	--	03	02	03	--	--	--	08
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	02	02	--	02	--	02	--	--	08
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)		02	--	02	--	--	--	--	04
Entrepreneurship/Economics/ Management Courses		--		02	02	--	--	--	--	04
Indian Knowledge System (IKS)		02			--	--	--	--	--	02
Value Education Course (VEC)		--	--	02	02	--	--	--	--	04
Research Methodology	Experiential Learning Courses	--	--	--	--	--	--		02	02
Comm. Engg. Project (CEP)/Field Project (FP)		--	--	02	--	--	--	-	-	02
Project		--	--	--	--	--	--	04	-	04
Internship/ OJT		--	---			--	--		12	12
Co-curricular Courses (CC)	Liberal Learning Courses	02	02		--	--	--	--	-	04
Total Credits (Major)		**21**	**23**	**27**	**25**	**21**	**24**	**15**	**14**	**170**

Students can opt for any of the following as per the rules and regulations given by institute:

1. **B. Tech with one Multidisciplinary Minor = Total 170 Credits**
2. **B Tech with two Multidisciplinary Minors = Total 184 Credits**
3. **B. Tech with one Multidisciplinary Minor and Honor = Total 188 Credits**
4. **B. Tech with one Multidisciplinary Minor and Honor by research = Total 188 Credits**

MULTIDISCIPLINARY MINOR (MD M) and OPEN ELECTIVE (OE)
Other than particular Program

List of Multidisciplinary Minor Courses from other faculties: Total 14 Credits as per GR, Two courses of 4 credits and two courses of 3 credits. Open electives of 8 credits are offered, Two courses of 3 credits and 01 course of 02 credits.

Specialization	Dramatics	Film Making	Fine Art	Music
Multi-disciplinary Minor - 01	Dramatic Theory, Literature	Videography + Cinematography	Applied Art (Digital Art)	Theory of Indian Music
Multi-disciplinary Minor – 02	Acting	Video Editing and Lighting	Painting (Generative Art)	Ancient and Modern Poetry
Multi-disciplinary Minor – 03	Directing	Storytelling Story Boarding	Sculpture (3D-Space)	The Evolution of music
Multi-disciplinary Minor – 04	Playwriting	UI/UX and Animation	Visual Communication (Evolutionary Art)	Music and Film
Multi-disciplinary Minor – 05	Applied Interactive Theatre	Art of Visual Communication	Graphics Art (Print & Printing Art)	Introduction to Electronic and Computer Music
Multi-disciplinary Minor - 06	Technical Theatre	Film & TV Directing	Art Culture	Analysis of Tonal Music

Specialization	Management & Finance	Law	Social Science	Journalism
Multi-disciplinary Minor - 01	Microeconomics	Constitutional Law	Indian Economics	Principles of Communication
Multi-disciplinary Minor – 02	Corporate Social Responsibility	Human Rights & International Law	Introduction to Sociology	Fundamentals of Journalism
Multi-disciplinary Minor – 03	Principles of Accounting	Environmental Law	Geo-Informatics	Cyber Journalism
Multi-disciplinary Minor – 04	Business Intelligence	Civil Procedure Code (CPC)	Introduction to Political Sciences	Basics of Design & Graphics
Multi-disciplinary Minor – 05	Marketing Research	Land Laws including ceiling and other local laws	Corporate sociology	Mass Communication: Concepts and Processes
Multi- disciplinary Minor - 06	Corporate Governance and Business Ethics	Cyber Law	Modern India-Political, Economic & Social Ethos	IT and Online Journalism

In addition to above courses following Groups are offered as Multidisciplinary Minor by Electrical Engineering Department

Multidisciplinary Minor-I (Electrical Mobility)

Sr. No.	Course Code	Course Name	Pre-requisite	Credits L-T-P	Offered Semester	Suggested by dept
1	EEMDM2001	Electric Machines for EV Applications	No	3-0-0	III	Electrical Dept
2	EEMDM2010	Power Electronics & Electric Drives	No	3-0-0	IV	Electrical Dept
3	EEMDM2011	Lab-Electric Machines & Power Electronics drives	No	0-0-1	IV	Electrical Dept
4	EEMDM3001	Control & Instrumentation	No	3-0-0	V	Electrical Dept
5	EEMDM3010	Energy storage systems	No	3-0-0	VI	Electrical Dept
6	EEMDM3011	Lab-Control & Instrumentation, Energy Storage	No	0-0-1	VI	Electrical Dept

Multidisciplinary Minor-II (Renewable Energy Systems)

Sr. No.	Course Code	Course Name	Pre-requisite	Credits L-T-P	Offered Semester	Suggested by dept
1	EEMDM2002	Renewable Energy Technology	No	3-0-0	III	Electrical Dept
2	EEMDM2012	Grid Integration of Wind & Solar Systems	No	3-0-0	IV	Electrical Dept
3	EEMDM2013	Lab RET	No	0-0-1	IV	Electrical Dept
4	EEMDM3002	Energy Economics & Marketing	No	3-0-0	V	Electrical Dept
5	EEMDM3010	Energy Storage Systems	No	3-0-0	VI	Electrical Dept
6	EEMDM3012	Lab Energy	No	0-0-1	VI	Electrical Dept

In addition to above courses following courses are offered as Open Electives (OE) by Electrical Engineering Department

List of Open Elective courses # Proposed

Sr. No.	Course Code	Course Name	Pre-requisite	Credits L-T-P	Offered Semester	Suggested by dept
1	EEOEC2001	Music Engineering	No	3-0-0	III	Electrical Dept
2	EEOEC2010	Basic Engineering Economics	No	2-0-0	IV	Electrical Dept
3	EEOEC3001	Smart Building Services	No	3-0-0	V	Electrical Dept

HONORS

Student has to choose One Honor program out of the Two Honor groups provided below

A) Electrical Engg with Honors- (Electrical Power Engg)

Sr. No.	Course Code	Course Name	Credits L-T-P	Offered Semester	Suggested by dept
1	EEHNC2010	CAPSA	3-1-0	IV	Electrical Dept
2	EEHNC3001	FACTs Controller	3-1-0	V	Electrical Dept
3	EEHNC3011	Power Quality, EMI and EMC	3-1-0	VI	Electrical Dept
4	EEHNC4001	Electrical Power Distribution Systems	3-1-0	VII	Electrical Dept
5	EEHNC4010	Mini Project/ Power System Simulation Lab	0-0-2		

B) Electrical Engg with Honors- (Advanced Power Electronics and Drives)

Sr. No.	Course Code	Course Name	Credits L-T-P	Offered Semester	Suggested by dept
1	EEHNC2020	Electrical Machine Analysis and Modeling	3-1-0	IV	Electrical Dept
2	EEHNC3020	PWM Techniques for Power Converters	3-1-0	V	Electrical Dept
3	EEHNC3021	Advanced Power Electronics	3-1-0	VI	Electrical Dept
4	EEHNC4020	Control of Electric Drives	3-0-1	VII	Electrical Dept
5	EEHNC4021	Mini Project/ Power System Simulation Lab	0-0-2		

Government College of Engineering, Aurangabad
Department of Electrical Engineering

Teaching and Evaluation Scheme from year 2023-24

First Year B. Tech. Program in Electrical Engineering

Semester I

Semester I Courses				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	BSC	MABSC1002	Mathematics I [For EE and E&TC]	3	1	-	4	15	15	10	60	100
2	BSC	PHBSC1001	Optics, Acoustics and Engineering Materials	3	-	-	3	15	15	10	60	100
3	ESC	MEESC1008	Basics of Mechanical Engineering and Graphics	3	-	-	3	15	15	10	60	100
4	ESC	CSESC1005	Programming for Problem Solving	2	-	-	2	10	10	-	30	50
5	BSC	PHBSC1003	LAB PHYSICS	-	-	2	1	-	-	25	-	25
6	ESC	MEESC1009	Basics of Mechanical Engineering and Graphics	-	-	2	1	-	-	25	-	25
7	ESC	CSESC1006	Lab Programming for Problem Solving	-	-	2	1	-	-	25	-	25
8	AEC-01	INAEC1001	Communication skills	2	-		2	10	10	-	30	50
9	VSEC-01	ETVSE1002	Engineering Exploration	-	-	4	2	-	-	25	25	50
10	CC-01	INCCC1001	Yoga	-	-	4	2	-	-	50	-	50
Total				**13**	**1**	**14**	**21**	**65**	**65**	**180**	**265**	**575**

Induction Program (Mandatory)	**3 Weeks Duration**
Induction program to be completed at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

Semester II

Semester II Courses				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr. No.	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	BSC	MABSC1004	Mathematics II [For EE and E&TC]	3	1	-	4	15	15	10	60	100
2	BSC	CHBSC1002	Battery Science, Lubricants and Green Chemistry	3		-	3	15	15	10	60	100
3	ESC	EEESC1001	Fundamentals of Electrical Engineering	3		-	3	15	15	10	60	100
4	ESC	EEESC1002	Basics of Electronic Circuits	3		-	3	15	15	10	60	100
5	BSC	CHBSC1003	Lab Chemistry	-	-	2	1	-	-	25	-	25
6	PCC	EEPCC1001	Electrical Engineering Practice	1	-	-	1	-	15	10	-	25
7	PCC	EEPCC1002	Lab-Electrical Engineering Practice			2	1			25		25
8	ESC	EEESC1003	Lab Basics of Electronics Circuits	-	-	2	1	-	-	25	-	25
9	VSEC-02	EEVSE1005	Electrical Workshop			4	2	-	-	50		50
10	IKS-01	EEIKS1101	Vedic Mathematics	2			2	10	10	-	30	50
11	CC-02	NCCC 1002 NCCC 1003 NCCC 1004	NSS/ Sports/ Club Activities	2			2	-	-	50	-	50
	Total			**17**	**1**	**10**	**23**	**70**	**85**	**225**	**270**	**650**

Exit Course

Exit option : Award of UG Certificate in Major with 44 credits and an additional 8 credits from following Exit Courses				
Sr. No	**Course Code**	**Course Title**	**Mode**	**Credits**
1	EEEXC1001	Electrification of building	**Online/ Offline certification courses** work based vocational courses or internship or apprenticeship during summer vacation	4
		AND		
2	EEEXC1002	Electrical Panel Design and Implementation		4

Second Year B. Tech. Program in Electrical Engineering

Semester III

Semester III Courses				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	PCC	EEPCC2000	Mathematics for Electrical Engineering	3	-	-	3	15	15	10	60	100
2	PCC	EEPCC 2001	Network Analysis	3		-	3	15	15	10	60	100
3	PCC	EEPCC2002	Electrical Machines-I	3		-	3	15	15	10	60	100
4	PCC	EEPCC 2004	Lab Network Analysis	-	-	2	1			25	25	50
5	PCC	EEPCC 2005	Lab Electrical Machines-I			2	1			25	25	50
6	PCC	EEPCC2003	Electrical Measurement & Instrumentation	2	-	-	2	10	10	-	30	50
7	PCC	EEPCC2006	Lab Electrical Measurement & Instrumentation	-	-	2	1		-	25	25	50
8	MDM-1			4			4	15	15	10	60	100
9	OE- I			3	-	-	3	15	15	10	60	100
10	EEM	EEEEM2001	Consumer Psychology	2			2	10	10	-	30	50
11	VEC-I	CEVEC0010	Environmental Studies	2			2	10	10	-	30	50
12	CEP	EECEP2001	Community Engg Project			4	2			50		50
Total				**22**	**-**	**10**	**27**	**105**	**105**	**175**	**465**	**850**

Semester IV

Semester IV Courses				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr.No.	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	PCC	EEPCC2011	Electromagnetic Field	3	-	-	3	15	15	10	60	100
2	PCC	EEPCC2012	Electrical Machines-II	3	-	-	3	15	15	10	60	100
3	PCC	EEPCC2013	Power System I	3	-	-	3	15	15	10	60	100
4	PCC	EEPCC2014	Digital Circuits	2	-	-	2	10	10	-	30	50
5	PCC	EEPCC2015	Lab Electrical Machines-II	-	-	2	1	-	-	25	25	50
6	AEC	EEAEC2010	Technical Communication	2			2	10	10	-	30	50
7	MD M-2			3			3	15	15	10	60	100
8	OE- II	EEOEC2012		2	-	-	2	10	10		30	50
9	VSEC-I	EEVSE2010	Lab Digital Circuit	-	-	2	1	-	-	25	25	50
		EEVSE2011	Lab Numerical Computational Techniques	1		2	1				25	25
10	VEC	INVEC1001	Universal Human Values II	2			2	10	10		30	50
11	EEM	EEEEM2010	Electricity Market and Management	2			2	10	10		30	50
	Total			**23**	**-**	**06**	**25**	**110**	**110**	**115**	**465**	**800**

- **Students admitted in direct second year have to complete bridge course of two credits**

Exit Course

Exit option : Award of UG Diploma in Major with 88 credits and an additional 8 credits from following Exit Courses

Sr. No	Course Code	Course Title	Mode	Credits
1	EEEXC2001	**Repairing and maintenance of Electrical Appliances**	Online/ Offline certification courses/ Skill based courses/ internship/ mini projects etc. offered during summer vacation	**4**
		And		
2	EEEXC2002	**Industrial Electrical Systems Installation and Maintenance**		**4**

Third Year B. Tech. Program in Electrical Engineering
Semester V

Semester V Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	PCC	EEPCC3001	Control System-I	3	-	-	3	15	15	10	60	100
2	PCC	EEPCC3002	Power System- II	3		-	3	15	15	10	60	100
3	PEC-I			3	-	-	3	15	15	10	60	100
4	PEC-II			3	-	-	3	15	15	10	60	100
5	MDM-3			4	-	-	4	15	15	10	60	100
6	OE-III			3	-	-	3	15	15	10	60	100
7	PCC	EPCC3003	Lab Control Systems	-	-	2	1	-	-	25	25	50
8	PCC	EEPCC3004	Lab Power System- II	-	-	2	1	-	-	25	25	50
			Total	**19**	**-**	**04**	**21**	**105**	**105**	**120**	**470**	**800**

- For B Tech with single minor and Honors, one theory course of 4 credits will be added in this semester.

Semester VI

Semester VI Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	PCC	EEPCC3010	Control System -II	3	-	-	3	15	15	10	60	100
1	PCC	EEPCC3011	Microcontroller & Applications	3	-	-	3	15	15	10	60	100
2	PCC	EEPCC3012	Power System Protection	3	-	-	3	15	15	10	60	100
3	PCC	EEPCC3013	Power Electronics	3	-	-	3	15	15	10	60	100
4	PCC	EEPCC3014	Lab-Power System Protection			2	1			25	25	50
5	PEC-III			3	-	-	3	15	15	10	60	100
6	PEC-IV			3	-	-	3	15	15	10	60	100
7	MD M-4			3			3	15	15	10	60	100
8	VSEC-II	EEVSE3001	Lab Microcontroller & Applications	-	-	2	1	-	-	25	25	50
9	VSEC–II	EEVSE002	Lab Power Electronics	-	-	2	1	-	-	25	25	50
			Total	**21**	**-**	**06**	**24**	**105**	**105**	**145**	**495**	**850**

For B Tech with single minor and Honors, one theory course of 4 credits will be added in this semester.

Exit courses

Exit option : Award of B. Vocational in Major with 132 credits and an additional 8 credits from following Exit Courses				
Sr. No	**Course Code**	**Course Title**	**Mode**	**Credits**
1	EEEXC3001	Installation of Transformer	**Online/ Offline certification courses/ Skill based courses/ internship/ mini projects etc. offered during summer vacation**	4
AND				
2	EEEXC3002	Industrial Electrical Systems		4

Semester VII

Teaching and Evaluation Scheme from year 2026-27

Final Year B. Tech. Program in Electrical Engineering
for B Tech (with single minor and Honors with research)

Semester VII Course				Teaching scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	PCC	EEPCC4001	Electric Drives	3	-	-	3	15	15	10	60	100
2	PEC-V			3	-	-	3	15	15	10	60	100
3	PEC-VI			3			3	15	15	10	60	100
4	PEC-VII (Lab)			-		2	1	-		25	25	50
5	PCC	EEPCC4002	Lab Electric Drives	-	-	2	1	-	-	25	25	50
6	Project				-	8	4	-	-	50	50	100
	Total			**09**	**-**	**12**	**15**	**45**	**45**	**130**	**280**	**500**

- For B Tech with single minor and Honors, one theory course of 4 credits and one mini project of 2 credits will be added in this semester.
- For B Tech with single minor and Honors with research project, 6 credits are added in this semester.

Semester VIII

(One semester long internship in industry/Research Organisation students**)

B Tech (Electrical with Single minor) Total Credits- 170

Semester VIII Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	RM**		Research Methodology	2			2	10	10	-	30	50
2	INT		Internship			24	12			200	200	400
	Total			**02**		**24**	**14**	**10**	**10**	**200**	**230**	**450***

**To be completed online mode or allied courses from MOOCs by the students who go for one semester long internship in Industry/Research Organization outside Chh.Sambhaji Nagar (Aurangabad). However, students doing internships in industry/ research organizations in or around Chh.Sambhaji Nagar (Aurangabad) will complete these courses in offline mode in college.

Semester VIII

(One semester long internship in industry/Research Organisation students**)

B Tech (Electrical with double minors) Total Credits- 170 +14= 184)

Semester VIII Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	RM**		Research Methodology	2			2	10	10	-	30	50
2	INT		Internship			24	12			200	200	400
	Total			**02**		**24**	**14**	**10**	**10**	**200**	**230**	**450***

*Total marks will be 450 plus marks of second minor courses (for 14 credits)

**To be completed online mode or allied courses from MOOCs by the students who go for one semester long internship in Industry/Research Organization outside Chh.Sambhaji Nagar (Aurangabad). However, students doing internships in industry/ research organizations in or around Chh.Sambhaji Nagar (Aurangabad) will complete these courses in offline mode in college.

Semester VIII

(One semester long internship in industry/Research Organisation students**)

B Tech (Electrical with Single minor and with Honors) Total Credits- 170 +18= 188)

Semester VIII Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	RM**		Research Methodology	2			2	10	10	-	30	50
2	INT		Internship			24	12			200	200	400
3	Honors**		Honors									
	Total			**02**		**24**	**14**	**10**	**10**	**200**	**230**	**450***

*Total marks will be 450 plus marks of Honors courses

**To be completed online mode or allied courses from MOOCs by the students who go for one semester long internship in Industry/Research Organization outside Chh.Sambhaji Nagar (Aurangabad). However, students doing internships in industry/ research organizations in or around Chh.Sambhaji Nagar (Aurangabad) will complete these courses in offline mode in college.

Semester VIII

(One semester long internship in industry/Research Organisation students**)

B Tech (Electrical with Single minor and Honors with research) Total Credits- 170 +18= 188)

Semester VIII Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	RM**		Research Methodology	2			2	10	10	-	30	50
2	INT		Internship/ Academic Project			24	12			200	200	400
3	Research Project		Research Project			24	12			200	200	400
	Total			**02**		**48**	**26**	**10**	**10**	**400**	**430**	**850**

*Total marks will be 450 plus marks of Research Project courses

**To be completed online mode or allied courses from MOOCs

List of Professional Electives Proposed

Courses	1-Electric Mobility	2- Electrical Machines	3-Power Systems	4-Control Systems	5-Renewable Energy
PE I EEPEC 3001-3005	Electric Mobility	Renewable Energy Technology	Utilization of Electrical Energy	Nonlinear control	Energy Conservation & Management
PE II EEPEC 3006-3010	Industrial Drives	Electrical Machine Design	Power Quality & Its Mitigation	Optimization Techniques	Electrical Power Distribution system
PE III EEPEC 3011-3015	Energy Storage Systems	Reliability & Condition Monitoring	Power Systems Dynamics & Control	Motor Control for EV	
PE IV EEPEC 3016-3020	Converters for EVs	HVDC & FACT	Energized Irrigation System	Machine Learning	Smart Grid Technology
PE V MOOCs EEPEC 4001-4005	Electrical Vehicle	Machine Modeling	High Voltage Engineering		Control and Integration of Renewable Energy Sources
PE VI (LAB) EEPEC 4006-4010	Lab Industrial Electrical Systems	Lab for Special machines	Lab High Voltage Engineering	Lab Internet of Things	Lab Renewable Energy Technology
PE VII EEPEC 4011-4015	Industrial Electrical Systems	Applications of Drives	EHV AC Transmission	Digital Signal Processing	Restructured Power Systems

Course Category Wise credit distribution

Sr. No.	Course Category	Credits
1	Basic Science Courses (BSC)	16
2	Engineering Science Courses (ESC)	14
3	Program Core Course (PCC)	53
4	Program Elective Course (PEC)	19
5	Open Elective other than particular program (OE)	08
6	Minors (MDM)	14
6	Vocational and Skill Enhancement Course (VSEC)	8
7	Humanities Social Science and Management (HSSM) AEC EEM IKS VEC	 4 4 2 4
8	Experiential Learning (EL) RM CEP/FP Project Internship	- 2 2 4 12
9	Co-curricular And Extracurricular Activities(CCA)	4
10	**Total Credits**	**170**

Curriculum of First Year B. Tech 2023-24

First Year B. Tech. Program in Electrical Engineering

Semester I

Semester I Courses				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	BSC	MABSC1002	Engineering Mathematics-I	3	1	-	4	15	15	10	60	100
2	BSC	PHBSC1001	Optics, Acoustics & Engineering Materials	3	-	-	3	15	15	10	60	100
3	ESC	MEESC1008	Basics of Mechanical Engineering and Graphics	3	-	-	3	15	15	10	60	100
4	ESC	CSESC1005	Programming for Problem Solving	2	-	-	2	10	10	-	30	50
5	BSC	PHBSC1003	Lab Physics	-	-	2	1	-	-	25	-	25
6	ESC	MEESC1009	Basics of Mechanical Engineering and Graphics	-	-	2	1	-	-	25	-	25
7	ESC	CSESC1006	Lab Programming for Problem Solving	-	-	2	1	-	-	25	-	25
8	AEC-01	INAEC1001	Communication skills	2	-		2	10	10	-	30	50
9	VSEC-01	ETVSE1002	Engineering Exploration	-	-	4	2	-	-	25	25	50
10	CC-01	INCCC1001	Yoga	-	-	4	2	-	-	50	-	50
Total				**13**	**1**	**14**	**21**	**65**	**65**	**180**	**265**	**575**

Semester II

Semester II Courses				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr. No.	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	BSC	MABSC1004	Engineering Mathematics-II	3	1	-	4	15	15	10	60	100
2	BSC	CHBSC1002	Battery Science, Lubricants and Green Chemistry	3		-	3	15	15	10	60	100
3	ESC	EEESC1001	Fundamentals of Electrical Engineering	3		-	3	15	15	10	60	100
4	ESC	EEESC1002	Basics of Electronic Circuits	3		-	3	15	15	10	60	100
5	BSC	CHBSC1003	Lab Chemistry	-	-	2	1	-	-	25	-	25
6	PCC	EEPCC1001	Electrical Engineering Practice	1	-	-	1	-	15	10	-	25
7	PCC	EEPCC1002	Lab- Electrical Engineering Practice			2	1			25		25
8	ESC	EEESC1003	Lab Basics of Electronics Circuits	-	-	2	1	-	-	25	-	25
9	VSEC-02	EEVSE1001	Electrical Workshop			4	2	-		50		50
10	IKS-01	EEIKS1001	Vedic Mathematics	2			2	10	10	-	30	50
11	CC-02	INCCC 1002 INCCC 1003 INCCC 1004	NSS /Sports/ Club Activities	2			2	-	-	50	-	50
	Total			**17**	**1**	**10**	**23**	**70**	**85**	**225**	**270**	**650**

BSC	**16**	**IKS**	**02**	**VSEC**	**04**	**OE**	**--**	**MDM-**	**--**
ESC	**14**	**VEC**	**--**	**CC**	**04**				
PCC	**02**	**AEC**	**02**	**E.L.**	**--**	**Honors**	**--**		**--**
PEC	**-**	**HSSM**	**--**						

Exit Course

-

Exit option : Award of UG Certificate in Major with 44 credits and an additional 8 credits from following Exit Courses				
Sr. No	**Course Code**	**Course Title**	**Mode**	**Credits**
1	EEEXC1001	Electrification of building	Online/ Offline Work based vocational courses or internship or apprenticeship during summer vacation	4
		AND		
3	EEEXC1002	Electrical Panel Design and Implementation		4

MABSC1002:Mathematics I [For EE and E&TC]		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	ISE I	15 Marks
Tutorial: 01 hrs/ week	ISE II	15 Marks
Credits: 04	ISE III	10 Marks
	End Semester Examination	60 Marks

Course Description:
MABSC1002: MATHEMATICS I is a compulsory course for first year B. Tech. Electrical engineering and Electronics & Telecommunications engineering students.

Course Outcomes: After completing the course, students will be able to:

	Course Outcomes	Bloom's Taxonomy Level	Unit
CO1	Define Beta, Gamma and error functions and find the roots of Complex Numbers, Rank of Matrix, limit of function, series expansion and maxima – minima of functions, understand the basic concepts of probability and find the probabilities of events	K1	1,2,3,4,5
CO2	Summarize the Complex Numbers; Explain the Rank of Matrix, successive differentiation, Special functions (Beta and Gamma functions)	K2	1,2,3,4
CO3	Identify the real and imaginary part of logarithm of complex numbers, Eigen values and Eigen vectors.	K2	1,2
CO4	Solve the system of linear equations using Gauss elimination and Gauss Jordan Method, Leibnitz's theorem, definite integrals using Beta and Gamma functions and definite integrals using rule of Differentiation under integral sign.	K2	2,3,4
CO5	Apply DeMoivre's theorem, Cayley Hamilton theorem, knowledge of integral calculus and Apply the basic rules and theorems in probability including Bayes's theorem	K3	1,2,4,5

Detailed Syllabus:

Unit 1	**Complex Numbers** Definition of complex numbers, Argand Diagram, De-Moivre's theorem and its application to find roots of algebraic equations, expansions of trigonometric functions, Circular and Hyperbolic functions inverse Hyperbolic functions, Logarithm of complex numbers, separation into real and imaginary parts.
Unit 2	**Matrices** Rank of matrix, echelon form of matrix, normal form of matrix, algebraic system of m linear equations in n unknowns, Gauss elimination and Gauss Jordan elimination method, linear dependence and independence of vectors, orthogonal matrix, linear transformations, matrix of linear transformation, rank nulity theorem, Eigen values and Eigen vectors, Cayley Hamilton theorem and its applications.
Unit 3	**Differential Calculus** nth order ordinary derivatives of elementary functions, Leibnitz's theorem, expansion of function in power series, Taylor's series, Maclaurin's series indeterminate forms and L'hospital rule, maxima and minima, converge of sequence and series, range of convergence of power series, test of convergence – ratio test and comparison test.
Unit 4	**Integral Calculus** Beta function, Gamma function, rules of Differentiation Under Integral Sign, error function, application of definite integrals to evaluate surface area and volume of revolutions.
Unit 5	**Elementary Probability Theory** Introduction to probability, addition and multiplication law of probability, independent events, total probability, Conditional probability, Bayes' theorem, permutation and combinations.

Text Books

1. Erwin Kreyszing, Advanced Engineering Mathematics,10thEdition, Mumbai: Willey Eastern Ltd. 2015.
2. B. S. Grewal ,Higher Engineering Mathematics, 44th Edition, New Delhi: Khanna publication, 2017.
3. Ramana B.V.Higher Engineering Mathematics,11 th Reprint, New Delhi: Tata McGraw Hill, 2010.
4. David Poole, Linear Algebra: A Modern Introduction, 3rd Edition, USA: BROOKS/COLE CENGAGE Learning, 2011.
5. Ravish R. Singh, Mukul Bhatt,Engineering Mathematics- A tutorial approach, 4th Edition, New Delhi: Tata McGraw Hill Education Pvt. Ltd.2018.

Reference Books

1. Dass H.K.Advanced Engineering Mathematics, 22nd Edition, New Delhi: S. Chand publications, 2018.
2. P. N. Wartikar and J. N. Wartikar, A text book of Engineering Mathematics (Vol. 1 & 2), Reprint, Pune :Pune Vidhyarthi Griha prakashan, 2013.

Mapping of Course outcome with Program Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1									1
CO2	2	2	1									1
CO3	2	2	1									1
CO4	2	3	1		2				2			1
CO5	3	3	1		2				2			1

1-Low,2- Medium, 3- High

Assessment: ISEI, II, III (Class Test-1, Class Test-2, TA)& ESE
TA: Students will perform one or more of the following activities

1. Surprise Test
2. Assignment using Mathematical tools like Mathematica/MatLab or similar.
3. Quiz
4. Any other activity suggested by course coordinator

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I (CT-1)**	**ISE II (C T-2)**	**ISE III**	**End Semester Examination**
K1	Remember	5	5		
K2	Understand	10	10		60
K3	Apply			10	
K4	Analyze				
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

PHBSC1001: Optics, Acoustics and Engineering Materials		
Teaching Scheme	Examination Scheme	
Lectures:3hrs/week	ISEI	15Marks
Credits :3	ISEII	15Marks
	ISEIII	10Marks
	ESE	60Marks

Prerequisites: Nil

Course description: The course is mandatory course for first year B. Tech. Civil, Mechanical and Electrical Engineering programs in first semester. The course objective is to teach fundamental principles in Physics and relate the understanding to applications.

	Course Outcomes	Bloom's Taxonomy Level
CO1	Define interference, thin film interference, Fraunhofer diffraction, resolving power, polarization, double refraction, Free, damped and forced oscillations, resonance, state features of magnetic and dielectric materials, acoustical demands of building, methods of production of ultrasonic, types of energy bands.	K1
CO2	Explain the concepts interference, diffraction, polarization, dielectric and magnetic properties, semiconductors, architectural acoustics and ultrasonic, oscillations, resonance, wave motion,	K2
CO3	Illustrate the engineering applications of interference, diffraction, polarization, dielectric and magnetic properties, semiconductors and ultrasonic	K3
CO4	Identify, formulate and solve physical problems related to engineering	K4
CO5	Apply the fundamental principles of interference, diffraction, polarization, dielectric and magnetic properties, semiconductors, architectural acoustic and ultrasonic in engineering context	K5

Detailed Syllabus:

Unit1	**Optics-** Interference- Interference due to thin film of uniform thickness, wedge shaped film, Newton's rings formation and theory, Anti-reflection coating. Diffraction- Fraunhofer diffraction at single slit (geometrical method), Conditions for maxima and minima, Double slit Diffraction, Plane diffraction grating, Rayleigh's criterion of resolution, resolving power of grating. Polarization- Polarization by reflection, Polarization by double refraction, Phase difference and path difference, Quarter wave plate, Half wave plate, Superposition of e-ray and o-ray, Production of circularly and elliptically polarized light, Polaroid sheets.
Unit2	**Acoustics and ultrasonic** Acoustics- classification of sound, musical sound, noise, characteristics of musical sounds-pitch, loudness or intensity, measurement of intensity level, decibel, quality or timbre, reflection of sound, echo, reverberation, reverberation time, absorption of sound, absorption coefficient, Sabine's formula with derivation, factors affecting architectural acoustics. Ultrasonic- Production of ultrasonic waves by piezoelectric and magnetostriction method, engineering applications of ultrasonic waves.

Unit3	**Engineering Materials-** Dielectric properties of material- dielectric constant, induced dipole, permanent dipole, polarization in dielectric materials, types of polarization, polar and non-polar dielectrics, frequency dependence of dielectric constant, applications of dielectric materials. Magnetic materials- review of basic concepts magnetization, magnetic susceptibility, relative permeability, classification of diamagnetic, paramagnetic and ferromagnetic materials, domain hypothesis, hysteresis or BH curve in ferromagnetic materials, soft and hard magnetic materials, applications.
Unit4	**Semiconductors-** Band theory of Solids, Classification of solids on the basis of energy band theory, Fermi-Diracstatistics, Concept of Fermi level and its variation with temperature, Density of states, Position of Fermi level in intrinsic semiconductor (with derivation) and in extrinsic semiconductor, Conductivity of semi-conductor. Working of p-n junction from energy band diagram- forward and reverse biased, Hall effect in semiconductor.
Unit5	**Oscillations-** Free, damped and forced oscillations, resonance, theory of resonant oscillations-condition for amplitude resonance, sharpness of resonance, differential equation of wave motion, damped harmonic motion- over damped, critically damped and under damped cases, transverse vibrations of stretched string.

Text and Rereference books:

1. M.N. Avadhanulu, and P.G. Kshirsagar. *A Textbook Of Engineering Physics*, 5th ed. NewDelhi: S.Chand and company Ltd., 2014
2. R.K.Gaur, S.L.Gupta. *Engineering Physics*, 14th ed. NewDelhi: Dhanpat Rai and Sons Publications, 2012
3. M.R.Srinivasan, *Physics For Engineers*, 2nd ed. NewDelhi: New Age International Publishers, 2009.
4. D.Halliday, and R. Resnic.*Fundamentals of Physics*, 9th ed. Noida: John–Wiley and Sons, 2010
5. Arthur Beiser, *Perspectives of modern Physics*, Mc-Graw Hill, US, 1969

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2									2		
CO2	2											
CO3	2											
CO4	2											
CO5	2											

Mapping of Course outcome with Program Outcomes and Program Specific Outcome
1-Low, **11- Low, 2-Medium, 3-High**

Assessment: ISE I, ISE II (Class Test) of Maximum Marks-15

ISE III- Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / orcombination of surprise test, assignment, quiz, any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5	2	12
K2	Understand	5	5	6	18
K3	Apply	5	5	2	12
K4	Analyze				12
K5	Evaluate				6
K6	Create				
Total Marks 100		15	15	10	60

Assessment Table:

Course Outcome	CO1	CO2	CO3	CO4	CO5
Assessment Tool	K1	K2	K3	K4	K5
ISEI Class Test-I (15 Marks)	5	5	5		
ISEII Class Test-II (15 Marks)	5	5	5		
IS III TA(10 Marks)	2	6	2		
ESE Assessment (60 Marks)	12	18	12	12	6
Total Marks 100	24	34	24	12	6

PHBSC1003: LAB PHYSICS		
Teaching Scheme	**Examination Scheme**	
Practical:2Hrs/Week	**ISE III**	**25 Marks**
Credits:01		

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Demonstrate basic laws of Physics with experimental process
CO2	Conduct experiments to understand the relationship between variables in physical problems
CO3	Interpret experimental data to examine the physical laws
CO4	Illustrate the relevance between theoretical knowledge and means to imply it in a practical manner by performing various experiments
CO5	Work in teams and understand the effective team dynamics.

List of the Experiments

The student shall perform minimum eight experiments of the following:

S.N.	Title of the Experiments	Skill / Knowledge Level	CO
1	e/m by Thomson's method.	S1/K2	CO3
2	Determination of radius of curvature of Plano-convex lens by Newton's ring.	S1/K1	CO1
3	Determination of the wavelength of light of a given source using diffraction grating.	S1/K2	CO1
4	Resolving power of telescope.	S1/K2	CO3
5	Study of C.R.O (amplitude and frequency measurement).	S1/K1	CO5
6	Specific rotation of sugar solution by Laurent's half shade polarimeter.	S1/K2	CO4
7	Determination of band gap of a semiconductor.	S1/K2	CO3
8	To study temperature dependence of resistivity of a semiconductor using four probe method.	S1/K2	CO3CO5
9	To determine the Hall coefficient of a semiconductor material and then evaluate carrier type and its density of charge carrier.	S1,S3/K2	CO1
10	Study of solar cell characteristics.	S1/K1	CO2CO5
11	Determination of wavelength of Laser using grating.	S1,S2/K2	CO3
12	Determination of numerical aperture of an optical fiber.	S1,S3/K2	CO3
13	To plot the hysteresis loop of a given magnetic material (iron).	S1/K2	CO2
14	To study characteristics of photovoltaic cell.	S1/K2	CO3

15	Study of divergence of Laser beam.	S2,S3/K2	CO2CO5
16	To measure thickness of fine wire and grating element with the help of Laser source.	S1/K2	CO1
17	To draw V/I characteristics of forward & reverse biased P-N junction diode.	S1,S3/K2	CO3
18	Determination of velocity of sound through water using ultrasonic interferometer.	S1,S3/K2	CO3

Assessment: ISE I-Continuous Assessment of individual student in a batch during each experiment Maximum Marks-25

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**
K1	Remember	10
K2	Understand	15
K3	Apply	
Total Marks		25

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**
S1	Imitation	15
S2	Manipulation	05
S3	Precision	05
Total Marks		25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2					3			
CO2	3			2								
CO3	3	3	2	2								
CO4	3	3	2	2								
CO5									2			

1-Low, 2-Medium, 3-High

MEESC1008: Basics of Mechanical Engineering and Graphics (For Electrical Engineering)		
TeachingScheme	**Examination Scheme**	
Lectures:03Hrs / Week	ISEI	15Marks
Credits:03	ISEII	15Marks
	ISEIII	10Marks
	ESE Examination	60Marks

Prerequisites:Nil

Course Description: After completing this course student will have a fundamental understanding of the thermodynamics, thermal machine source of energy, power transmission elements, identify manufacturing process and machines

Course Outcomes: After completing the course students will able to

Course Outcomes	
CO1	Explain basic concepts to be used in Mechanical Engineering
CO2	Apply the principles of thermodynamics to solve numerical problems
CO3	Compare the working principles of Energy conversion devices with their application in Mechanical Engineering
CO4	Explain the working principles and basic operating safety procedures of various transmission elements employed in Mechanical Engineering.
CO5	Develop the ability to visualize and draw Orthographic and Isometric projection of Solids.

Detailed Syllabus:

Unit 1	**Fundamentals of Thermodynamics** Pressure and pressure measurement, Temperature, Forms of energy, work transfer ,heat transfer, Laws of thermodynamics, First law for cyclic and non-cyclic process, Concept of Heat Engine, Refrigerator and Heat pump, Statement and explanation of Fourier's law of heat conduction, Overall heat transfer coefficient, Newton's law of cooling, Stefan Boltzmann's law, Concept of heat exchanger, types of heat exchanger ,and concept of effectiveness, Refrigeration – Definitions – Refrigerating effect, Ton of Refrigeration, COP, Relative COP, unit of Refrigeration. Principle and working of vapor compression refrigeration.
Unit 2	**Energy Conversion Devices** Steam generation process, Boiler: Mountings and accessories, working principles of Internal combustion Engine, two stoke and four stroke engines, Introduction and Working principle of Steam Turbines, Gas turbine, Hydraulic turbines: and classification of steam, gas and hydraulic turbine, Working of Pelton wheel and Francis turbine, Principles and working of steam power plant and nuclear power plant.
Unit 3	**Fundamentals of Power Transmitting Elements** Working principles of shaft, Axle and Spindles. Couplings-types of couplings, Friction clutches, Bearing- types of bearing, Brakes – types of brakes, Drives- Belt drive: Flat and V belt drive, Open and Cross belt drive, Chain drive, Gears-classification of gears, Terminology of Spur gears.
Unit 4	**Fundamentals of Manufacturing Process** Fundamentals of manufacturing process and their application, Casting, forging, soldering, Brazing and welding. Differences between soldering, brazing and Welding. Description of Electric Arc Welding and Oxy-Acetylene Welding.
Unit 5	**Orthographic and Isometric Projection** Orthographic views of different machine parts, Sectional orthographic projection of different machine elements, Principles of Isometric projection, Isometric scale and Isometric views.

Text andReferenceBooks

1. Nag P. K., *"Engineering Thermodynamics",* 3rd ed. Tata-McGraw Hill Publications, 2013.
2. Rajput R. K., *"Engineering Thermodynamics",* 4th ed. Laxmi Publications, 2014.
3. HajraChoudhary, Bose, *"Work Shop Technology* (Vol.-I &JI)", 3rd ed. MPP publication, 2018.
4. Bhandari V. B., *"Machine Design ",* 3rd ed. Tata-McGraw Hill Publications, 2019.
5. Khurmi R. S., *"Machine Design* ",4th Edition. Eurasia Publishing House, 2019.
6. Domkundwar V. M., *"Engineering Thermodynamics",* 4th ed. Dhanpatrai Publication, 2020.
7. Rao P. N., *"Manufacturing Technology* Volume J", 3rd ed. Tata-McGraw Hill Publications, 2019
8. Bansal R. K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd. New Delhi 14
9. Holman J. P., "Heat transfer", McGraw Hill Publishing, New York
10. Bhatt N. D. and Panchal V. M., "Engineering Drawing", Charotar Publishing House, Anand
11. Dabhade M. L., "Engineering Graphics", Vol-I and Vol-II, Vision Publication, Pune.

Mapping of Course outcomes with Program outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											
CO2	2	1					1					
CO3	1						1					
CO4	1						1					
CO5			2									

1 – Low, 2 – Medium, 3 – High

MEESC1009: Lab Basics of Mechanical Engineering and Graphics (For Electrical Engineering)		
Teaching Scheme	**Examination Scheme**	
Practical:02Hrs /Week	ISEIII	25Marks
Credit:01		

Course Description: After completing this course student will have a fundamental understanding of the thermodynamics, thermal machine, source of energy, power transmission elements, identify manufacturing process and machines and orthographic and isometric projections

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Understand the operation of water tube boiler
CO2	Understand the operation of IC engine
CO3	Understand the operation of Refrigerator
CO4	Understand the operation of Brakes, clutch and welding process
CO5	Develop the ability to visualize and draw Orthographic and Isometric projection

List of the Experiments:

Sr. No.	Title of the Experiments
1	Study and Demonstration of Babcock and Wilcox Boiler
2	Study and Demonstration of two stroke petrol and Diesel Engine
3	Study and Demonstration of Four stroke petrol and Diesel Engine
4	Study of Domestic Refrigerator
5	Study of Power Transmission Devices
6	Performing simple welded joint
7	Drawing two problems based on orthographic projection
8	Drawing two problems based on Isometric projection

Mapping of Course outcomes with Program outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											
CO2	1	1			1							
CO3	1	1			1							
CO4	1		2		1							
CO5	1		2									

CSESC1005 : Programming for problem Solving		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs./ week	ISE I	10 Marks
Credits:02	ISE II	10 Marks
	End Semester Examination	30 Marks

Prerequisites: Nil

Course Objectives

- To understand the fundamentals of computer systems and programming.
- To understand the basic programming paradigms.
- To learn the conditional branching, and iteration.
- To learn methodology which are essential for developing C programs.

Course Outcomes

Students will be able to:

CO1	Understand fundamentals of computer systems and programming.
CO2	Able to define data types and use them in simple data processing applications also he/she must be able to use the concept of pointers, array of structures
CO3	Develop confidence and ability for life-long learning needed for Computer language.

Detailed Syllabus:

Unit 1	**Introduction to programming:** Components of a computer system: Memory, processor, I/O Devices, storage, operating system. Idea of Algorithm: Representation of Algorithm, Flowcharts. Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C.
Unit 2	**Introduction to C Language fundamentals:** The C character set, variables and constants, data types, keywords, expressions, statements, precedence, operators- arithmetic operators, sizeof(),relational & logical operators, conditional operators, type conversions , type casting.
Unit 3	**Conditional Branching, Loops and Functions:** if, nested if, it else, nested if else switch, goto statement, Loop execution – For loop, while loop, Do while loop. Functions - Defining a function, passing arguments to functions, call by value, idea of call by reference, returning values from function. Array's definition (1-D, 2-D). Introduction to structure and union. Introduction to Pointers.

Text and Reference Books

1. E. Balagurusamy; Programming in C, 3rd ed, Tata McGraw Hill.
2. K. R. Venugopal and S R Prasad, Mastering C, 3rd edition,Tata McGraw Hill.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd, Prentice Hall of India.
4. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
5. Let Us C By Yashwant P. Kanetkar.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1					3		2		
CO2	1		2					2	1	2		
CO3	1	3	1							2		

CSESC1006 : Lab Programming for Problem Solving		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE III**	**25 Marks**
Credits:01		

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Understand the development environment for compiling, debugging, linking and executing a C program with the help of flowcharts and algorithms.
CO2	Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs
CO3	Apply the in-built functions and customized functions for solving the problems.

List of the Experiments:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Developing Flowchart and algorithm.	K2	CO1
2	Creating Pseudo code for C program.	K3	CO1
3	Simple program using scanf() and printf()	K3	CO1
4	Program using Control Statements	K3	CO2
5	Program using Loops	K3	CO2
6	Program to generate Fibonacci series and/or factorial of a number	K3	CO3
7	Using arrays for sorting numbers -Write a C program to input elements in array and display the elements.	K3	CO3
8	Program which shows use of call by value and call by reference	K3	CO3
9	Program to accept and display student information using structure.	K3	CO2
10	Menu driven program for matrix addition and subtraction	K3	CO3

The student shall perform minimum ten experiments of the following using TURBO C&C++/ Code Blocks

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1							3	2	2		
CO2		1	1					2	1	2		
CO3	1	1						3	2	2		

INAEC1001: COMMUNICATION SKILLS		
Teaching Scheme	**Examination Scheme**	
Lectures:02hrs/week	**ISEI**	**10 Marks**
Credits:2	**ISEII**	**10 Marks**
	ESE	**30 Marks**

Course description:

Communication Skills (INAEC1001) is a one semester compulsory course for the first year students of all disciplines.

The course is aimed at introducing the basic of the communication skills. The goal of the course is to improve listening, speaking, reading and writing skills. Thus focus of syllabus is primarily on the development of communicative skills and fostering of ideas.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Analyze the situation and overcome the barriers in speaking English and get the ability to communicate in professional as well as day to day life.
CO2	Develop personality through corporate etiquettes and take active participation in Discussion and other academic activities as well.
CO3	Apply proper words and structure in speaking English language and develop Vocabulary and use of correct English.
CO4	Express them through oral as well as written communication and develop written Communication for professional and business purpose.
CO5	Use of E-Communication in day to day as well as professional life

Detailed Syllabus:

Unit1	**Communication Skills & Soft Skills** Basic concept, factor's, process and types of communication, principles of effective communication, barriers of communication, and how to overcome these barriers, basics of soft skills.
Unit2	**Non verbal Communication and Corporate Etiquettes** Body language and its different aspects, voice dynamics & voice modulation, professional appearance, clothing etiquettes and corporate dressing.

Unit3	**Remedial Grammar and Vocabulary Building** Parts of speech, types of tense, use of articles, synonyms and antonyms, Find out the grammatical errors in the given sentences.
Unit4	**Writing Skills and Business Correspondence** Letter writing, office documents like circulars, notices, minutes, agenda and memos report writings- technical report, academic report, accident report, resume writing
Unit5	**E-Communication** Introduction to multi-cultural, global cultural traits, email communication and email etiquettes

Text and Reference Books

1. S.M.Rai and Urmila Rai, *Business Communication*, 1st ed, NewYork, USA, New royal book Company Publication, 2010
2. Leena Sen, *Communication skills*, 2nd Revised ed, Publisher- PHI Learning, 2007
3. William Sanborn, *Technical communication*, Delhi, Pearson publications, 2014
4. McGraw Hill briefcase books, *Presentation Skills for Managers*, United states, John A. Hill, 1888
5. Pravil S. R. Bhatia and S. Bhatia, *Professional Communication Skill*, 8th Revised ed, S Chand Publications, 2001
6. Daniel G. Riordan and Steven E. Pauley, *Technical Report Writing Today*, 10th ed, USA, Michael Rosenberg Publisher
7. B. N. Basu, *Technical Writing*,1st ed, NewDelhi, Prentice hall of India,2008
8. M.A Pink and S. E. Thomas., *English Grammar Composition & Effective Business Communication*, 12th ed, S Chand Publication, 1998
9. Sarah Freeman, *Written Communication in English*,1st ed, Orient Blackswan publication, 1996

MappingofcourseoutcomewithProgramoutcomesandprogramspecificoutcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1						1				3		
CO2						1				3		
CO3						1				3		
CO4									3	3		
CO5					3					3		1

1-Low,2-Medium,3-High

	ETVSE1002: Engineering Exploration	
Teaching Scheme: 04Hrs/ Total Credits:2 Contact Hours 40		Examination Scheme ISE II:25 Marks ISE III:25 Marks

Prerequisites: NIL

Course Outcomes : As an outcome of completing the course, students will be able to:

CO1	Explain the role of an Engineer as a problem solver
CO2	Identify multi-disciplinary approach required in solving an engineering problem
CO3	Build simple mechanisms using engineering design process
CO4	Interface different peripherals to Arduino
CO5	Apply basics of engineering project management skills
CO6	Analyze engineering solutions from ethical & sustainability perspectives

Engineering Exploration is a Project-based learning (PBL) based course wherein students will apply their technical knowledge, practical skills to develop a project in a team. A group of 5 students (max) normally will be permitted in a team. A set of need statements will be prepared by team members with the help of course coordinators. These need statements will be converted to Problem Statements. Students will follow the Engineering Design process to develop conceptual design and detailed design.

Few of the activities which can be carried out are:

- Catapult design, weight bearing structure using newspapers, bridge making, activity with straws, colored paper, box of straws, football with papers, paper plane.
- How do you think Engineering design case studies for designing PaniPuri/ tea/ coffee vending/pan making vending machines, grass cutter/mower machine, winding machines, chips making machine, home automation etc (block diagram and components in different blocks), Pugh chart examples.
- Building mechanisms using gears and other components, design mechanisms using linkages, auto inventor for model designing.
- Arduino based experimentation and programming.
- Preparation of timelines for project management.
- Presentation of case studies for ethics, sustainability, and carbon footprint.

Detailed Syllabus:

	Contents
Module 1	**Introduction to Engineering and Engineering Study** **2 Hrs** Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes.

Module 2	**Engineering Design** **15 Hrs** Engineering Design Process, Multidisciplinary facet of design, Pairwise comparison chart, Introduction to mechatronics system, generation of multiple solution,Pugh Chart, Motor and battery sizing concepts, introduction to PCB design
Module 3	**Mechanisms 4 Hrs** Basic Components of a Mechanism, Degrees of Freedom or Mobility of a Mechanism,4 Bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism.
Module 4	**Platform Based Development** **12 Hrs** Introduction to various platform-based development (Arduino) programming and its essentials, Introduction to sensors, transducers and actuators and its interfacing with Arduino, Introduction to Data Acquisition and Analysis
Module 5	**Project Management** **3 Hrs** Introduction to Agile practices, Significance of teamwork, Project management tools: Checklist, Timeline, Gantt Chart, Significance of documentation
Module 6	**Sustainability and Ethics in Engineering** **4 Hrs** Introduction to sustainability, Sustainability leadership, carbon footprint Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers, Identifying Ethical Dilemmas in different tasks of engineering, Plagiarism check for research papers
Total Contact Hours	**40 Hrs**
Course Project Reviews Evaluation of group projects	**08 Hrs**

1 – Low, 2 – Medium ,3 – High

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	1				2	1	1	1	1		
CO2	2	2				2	1	1	1	2		
CO3	2	1				1	2	1	1	1	1	
CO4		2				2	1	1	1	1	1	1
CO5		2				2	2	1	1	1	1	1

Evaluation Scheme			
Name of the Module	Hours	Marks	Evaluation
1.Introduction to Engineering & Engineering Study	02	3	ISE - II
2. Engineering Design	15	10	
3. Mechanisms	04	2	
4. Platform based development	12	10	
5. Project Management	03	5	ISE - III
6. Sustainability and ethics in Engineering	04	5	
7. Course Project Reviews	08	10	
8.Honor code	-	5	
TOTAL	48	50	

	CO1	CO2	CO3	CO4	CO5	CO6	Total
ISE II	03	10	02	10			25
ISE III		05		05	05	10	25

INCCC1001: YOGA Co Curricular Course (Liberal Learning Course)
Teaching Scheme
Lectures: 2 hrs./ week
Tutorial: 00 hrs./ week
Credits: 02

Course Description: Yoga - In today's life, there is much more need to experience relaxation and remain focused. The inner connection is very much needed to retain stability. Beyond physical exercise there is much more to do in the field of Yoga. The content of this course includes Relaxation, meditation, rejuvenation and connection with our own self. The introduction of such an experiential course helps to boost self confidence and with regulation of mind through meditation improves concentration. Meditation is basically training the mind to stay on one thought and helps to regulate it. Along with experiential learning, the students are also exposed to learning contained in the supported literature.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand and perform Yoga Asanas
CO2	Apply the concept of Mediation in everyday life and studies.
CO3	Gain knowledge about Pranayama

Syllabus:

(1) Perfection in at least 3 types of Yoga-asana, Name of Yoga Asanas shall be mentioned
(2) Perfection in at least 3 types of Pranayama, Name of Yoga Asanas shall be mentioned
(3) Regular practice of Yoga Asanas and meditation for 10 minutes during the allotted periods as per the time table and daily at home.

Text Books:

1)TheHeartfulness way", HeartfulnessKamlesh Patel and Joshua Pollock
2) The Yoga Sutras of Patanjali — Sri Swami Satchidananda
3)TheYamas and Niyamas — Deborah Adele

Assessment:

The evaluation is based on participation and performing Yoga and meditation regularly and perfectly under the guidance by Yoga Teachers in a class as per schedule. Meditation trainers will observe intrinsic goodness , the right attitude and a happy and joyous way of doing things.

Semester II

MABSC1004:Mathematics II [For EE and E&TC]		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	ISE I	15 Marks
Tutorial: 01 hrs/ week	ISE II	15 Marks
Credits:04	ISE III	10 Marks
	End Semester Examination	60 Marks

Course description:
MABSC1004: Mathematics-I is compulsory course for Electrical engineering and Electronics & Telecommunications students.

Course Outcomes: After completing the course, students will be able to:

	Course Outcomes	Bloom's Taxonomy Level	Unit
CO1	Define first order first degree ordinary differential equations, orthogonal trajectories; partial derivatives, Jacobian, Multiple integrals; Fourier Series, basic concepts of probability distributions.	K1	1,2,3,4,5
CO2	Summaries the First order First degree Linear Differential Equations; Partial, Total Derivatives; methods of solving Multiple Integrals; Fourier Series and Half Range Fourier series Expansion. Explain probability distribution.	K2	1,2,3,4,5
CO3	Identify Order of Differential Equation and exactness; Homogeneous function; Even and odd functions, Euler's coefficients for the Fourier Series.	K2	1,2,4,
CO4	Solve the First order Linear Differential Equations, Jacobians, Maxima and Minima of functions of two variables; Double and Triple Integrations;	K2	1,2,3
CO5	Apply knowledge of Differential equation to different Engineering Problems, Partial derivative;Multiple Integrals to find area and volume of solids, Fourier Series to Harmonic Analysis.	K3	1,2,3,4.

Detailed Syllabus:

Unit 1	**First order ordinary differential equations and its applications** Exact, linear and Bernoulli's equations, application of first order ordinary differential equations: orthogonal trajectories, simple electrical circuit, D'Alembert's principle, one dimensional conduction of heat.
Unit 2	**Multivariate Calculus [Differentiation]** Limit, continuity, partial derivatives, Euler's theorem on homogeneous functions, implicit functions, composite functions, total derivatives, Jacobians and their applications, error and approximations, maxima and minima of functions of two variables, saddle points, Lagrange's method of undermined multipliers.
Unit 3	**Multiple integrals and its applications** Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, change of variables (Cartesian to polar), applications: to find area and volume.
Unit 4	**Fourier Series** Fourier Series (Dirichlet's conditions), Periodic functions, convergence of the Fourier series, Euler's formula, Fourier series expansion with period 2π, 2L,Fourier series of even and odd functions, Half range sine and cosine series, applications to harmonic analysis.
Unit 5	**Probability Distribution** Discrete probability distributions - Binomial distribution, Poisson distribution, Continuous Distribution - Normal distribution, Uniform distribution, Exponential distribution.

Text Books

1. Erwin Kreyszing, Advanced Engineering Mathematics, 10thEdition, Mumbai: Willey Eastern Ltd. 2015.
2. B. S. Grewal ,Higher Engineering Mathematics, 44th Edition, New Delhi: Khanna publication, 2017.
3. Ramana B.V.Higher Engineering Mathematics,11 th Reprint, New Delhi:Tata McGraw Hill, 2010.
4. David Poole, Linear Algebra: A Modern Introduction, 3rd Edition, USA: BROOKS/COLE CENGAGE Learning, 2011.
5. Ravish R. Singh, Mukul Bhatt,Engineering Mathematics- A tutorial approach, 4th Edition, New Delhi: Tata McGraw Hill Education Pvt. Ltd.2018.

Reference Books

1. Dass H.K.Advanced Engineering Mathematics, 22nd Edition, New Delhi: S. Chand publications, 2018.
2. P. N. Wartikar and J. N. Wartikar, A text book of Engineering Mathematics (Vol. 1 & 2), Reprint, Pune :Pune Vidhyarthi Griha prakashan, 2013.

Mapping of Course outcome with program outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1									1
CO2	2	2	1									1
CO3	2	2	1									1
CO4	2	3	1		2							1
CO5	3	3	1		2							1

(Values in the mapping tables: 1-Low,2- Medium, 3-High)

Assessment:ISEI, II, III (Class Test-1, Class Test-2, TA)& ESE
TA: Students will perform one or more of the following activities

1. Surprise Test, 2. Assignment using Mathematical tools like Mathematica/ MatLab or similar, 3. Quiz, 4. Any other activity suggested by course coordinator

CHBSC1002: Battery Science, Lubricants and Green Chemistry			
Teaching Scheme		**Examination Scheme**	
Lectures	3Hrs/Week	**ISE I**	15 Marks
TotalCredits	3	**ISE II**	15 Marks
		ISE III	10 Marks
		ESE	60 Marks

Prerequisites: Nil

Course description: The course is mandatory course for first year B. Tech. Civil Engineering, Mechanical Engineering and Electrical Engineering programs in first semester. The course objective is to teach fundamental principles in Chemistry and relate the understanding to applications.

	Course Outcomes	Bloom's Taxonomy Level
CO1	Understand fundamentals of chemistry relevant to engineering field.	K1
CO2	Differentiate between primary and secondary battery as well as battery and fuel cell.	K2
CO3	Toequippedwithbasicknowledgeofpolymerreinforcedcomposites,applications of semiconductor conducting polymers in energy harnessing.	K2
CO4	To understand Basic Principals of Green chemistry for minimizing waste.	K1
CO5	To apply the principles of water softening to hard water and understand consequence of water quality degradation.	K3

	Course Contents	CO
Unit1	**Battery Science** Introduction – Classification of batteries, Primary and secondary batteries, reserve batteries with examples, battery components and their role- Characteristics of Battery. Batteries and their importance, basic requirements for commercial batteries, construction, working and applications of Ni-Cd, and Lithium ion battery, fuel Cells- Differences between battery and fuel cell, electrical vehicle battery construction, working advantages and disadvantages of EV Car.	CO1, CO2
Unit2	**Electrochemistry** Single electrode potential, sign convention, reversible and irreversible cells measurements, specific conductance, equivalent conductance, variation of equivalent conductance with dilution, migration of ions Nernst equation and application, determination of EMF of cell, applications of EMF series. **Chromatographic techniques** Basics and applications of chromatographic technique- thin layer chromatography, flame photometry potentiometric titrations, conductometry, PH metry	CO1, CO2

Unit3	**Lubricants** Introduction, mechanisms of lubrication-fluid film, boundary film &extreme pressure, types of lubricants–solid lubricants–molybdenum disulphide, graphite. Liquid lubricants– vegetable, animal, mineral& synthetic oils, semisolid lubricants, greases, lubricating emulsions– oil in water, Water in oil, properties of lubricants & its significance– physical properties and significances viscosity& viscosity index, flash & fire point, cloud& pour point, acid value, saponification value, steam emulsification number **Conducting Polymers:** Definition- classification- intrinsic and extrinsic, mechanism of conduction in doped poly acetylene –applications synthesis & mechanism of conduction in poly-acetylene **Composites:** Basics of composites, Composition and Characteristic properties of composites. Types of Composites: Particle, Fiber, Reinforced, Structural, applications. **Nanomaterials:** Introduction, fullerenes, carbonnanotubes, nanowires, electronic and mechanical properties, synthesis of nanomaterials, applications of nanomaterials-Catalysis, Electronics & Telecommunication, Medicines, Energy sciences.	CO1, CO3
Unit4	**Energy sciences& Green Chemistry:** **Green Chemistry:** Introduction- definition of green chemistry, need of green chemistry, basic principles of green 12 principles of green chemistry principles of green chemistry, waste minimization and atom economy, reduction of materials and energy requirement, significance, concept of sustainability, industrial applications of green chemistry **Fuels:** Fuel- classification, characteristics of good fuel, comparison between solid, liquid, gaseous fuel, alternative and non conventional fuels, calorific value, low and high calorific value, units of calorific value, determination of calorific value by Bomb calorimeter, fuel cells, solar cell and polymer cell, hydrogen-oxygen fuel cell, advantages and applications.	CO1, CO4
Unit5	**Water treatment:** Introduction, sources and impurities in water, portable water; meaning and specifications(WHO standards), hardness of water types, determination of hardness using EDTA titration and numerical, softening of hard water by ion-exchange process. numerical problems on hardness of water, biological oxygen demand(BOD)and chemical oxygen demand(COD), determination of COD of industrial waste water, purification of water for town supply, principal wastage treatment – industrial wastewater	CO1, CO5

TextBooks	
1.	F.W.Billmeyer,Text Book of Polymer Science,JohnWiley&Sons,15th Edition,2020.
2.	B.K.Sharma, AtextbookofIndustrial Chemistry,15th Edition,2020.G.A.Ozin& A.C. Arsenault,"Nanotechnology A Chemical Approach to Nanomaterials", RSC Publishing, 5th Edition, 2020.
ReferenceBooks	
1.	Uppal M. M, Jain and Jain, Engineering Chemistry, Khanna Publishers, 45th Edition, 2020.
2.	P. C. Jain and Monica Jain, A textbook of engineering chemistry, Dhanpat Rai Publications,NewDelhi, 20th Edition, 2020.

3.	S. S. Dara, A textbook of Engineering Chemistry, S Chand & Company Ltd.,15th Edition, 2020.

Mapping of Course Outcome with Program Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO1 2**
CO1	3	2	2	2		1	1					1
CO2	3	1	1	1								1
CO3	3	2	2	2		1	1					1
CO4	3	2	2	2	2	1	1					1
CO5	3	2	2	2		1	1					1

1–Low,2–Medium,3–High

CHBSC1003: Lab Chemistry		
Teaching Scheme	**Examination Scheme**	
Practical:02Hrs/Week	**ISE III**	**25Marks**
Credits : 1		

Course Outcomes: After completion of this course students will be able to:

	Course Outcomes
CO1	Perform qualitative and quantitative determination of physical and chemical properties of lubricants, polymers and water used for domestic and industrial application.
CO2	Explain the objectives of experiments, perform the experiments, appropriately record the data and analyze the results with accuracy and precision.
CO3	Demonstrate laboratory skills by use of relevant instrument or modern analytical methods for analysis of chemical compounds.
CO4	Work effectively and safely in a laboratory environment in teams as well as independently.
CO5	Recognize the issues of safety regulations, ethical, societal, economical and environmental issues in the use of chemicals in their laboratory work.

List of the Experiments–Any eight from the following

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Determination of hardness of water by EDTA method.	S3/K2	CO3, CO4, CO2
2	Determination of BOD and COD of water sample	S3/K2	CO3, CO5, CO2
3	Determination of Cell Constant.	S3/K2	CO3, CO2
4	Determination of Acid Value of lubricant.	S1/K1	CO1, CO5, CO2
5	Determination of chloride content of water by Mohr's method	S1/K1	CO1, CO5, CO2
6	Determination of Viscosity of lubricating oils by Redwood Viscometer.	S3/K2	CO3, CO4, CO2
7	Determination of Flash & Fire point of lubricant oil.	S3/K2	CO3, CO4, CO2
8	To Determination P^H value of solutions by indicator, Paper and by P^H meter	S1/K1	CO3, CO5, CO2
9	Preparation of Phenol Formaldehyde Resin (Bakelite) /Urea formaldehyde resin.	S2/K2	CO2, CO4, CO5
10	Determination of Iron by colorimetric method.	S3/K2	CO3, CO2
11	Separation of chemicals by thin layer chromatography.	S2/K2	CO3, CO2
12	Dermination of strength of acids by Potentiometric titrations	S2/K2	CO1, CO4, CO5, CO2
13	Determination of Cloud & Pour point of lubricant oil.	S3/K2	CO3, CO2
14	To verify Lambert Beer's Law calorimetrically.	S3/K2	CO3, CO2

15	To determine Rf value and identify phenyl alanine & Glycine mixture by ascending paper chromatography.	S3/K2	CO3, CO2
16	Demonstration Of TLC/Paper chromatography	S2/K2	CO3, CO2
17	To determine conduct metrically, the strength of given HCl solution by titrating with standard NaOH solution.	S3/K2	CO3, CO2
18	To determine the empirical formula of ferric-5 sulpho salicylate complex by Jobs method.	S3/K2	CO3, CO2

Mapping of Course Outcome with Program Outcomes

Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**
CO1	1											
CO2	1			1	1		1	2			1	
CO3	1	2	2	2	3	2	1		2			2
CO4	2	3	1	3	2	1						2
CO5	1	2	2		3	1				2		2

1-Low,2-Medium,3-High

SYLLABUS : ELECTRICAL BRANCH		
EEESC1001 :Fundamentals of Electrical Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 hrs/ week	ISE I	15 Marks
Tutorial: --0	ISE II	15 Marks
Credits: 3	ISE III	10 Marks
	End Semester Examination	60 Marks

Prerequisites: -Nil

Course description:

This is the basic course in Electrical Engineering which introduces the basic concepts, different theorems and laws, Electrical circuits to the students.

The objectives of the course are to

1. Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency
2. Acquaint with basic laws and theorems of electrical networks
3. Explain fundamentals of magnetic circuits and alternating current circuits and solve the circuit problems
4. Understand the fundamentals and concept of electrical energy storage devices, wiring fundamentals, safety devices and metering

	Course Outcomes
CO1	Explain the fundamentals of circuit theorems and apply to solve the DC network.
CO2	Understand and analyze the electromagnetic circuits.
CO3	Explain and analyze single phase and three phase AC circuits.
CO4	Demonstrate the various parameters required for the battery storage system and its applications.
CO5	Demonstrate various Electrical wiring systems and its accessories and Energy consumption calculations.

Detailed Syllabus:

Unit I	**D.C. Circuit :** Introduction of circuit active and passive parameter of electrical circuit, Kirchhoff current and voltage laws, Source conversion, series and parallel circuit, current and voltage division rule, Delta-Star and Star-Delta conversion, Node Analysis and Mesh Analysis methods Network Theorem: Superposition theorem, Thevenin's and Norton's theorems Maximum power transfer theorem, Charging and discharging of capacitor, Time constant for RC circuit
Unit II	**Electromagnetic Induction:** Faraday's laws, statically and dynamically induced emf , self and mutual inductance, coefficients of coupling, dot convention, inductance in series and parallel, Magnetic Circuits: Terms related with magnetic circuits, Magnetization curve, Magnetic leakage and fringing, Leakage coefficient, Series and parallel circuits, magnetic hysteresis, and eddy current loss, Rise and decay of current in inductive circuit, Time constant for RL circuit
Unit III	**Single phase and Three phase AC Circuits:** Brief description of electrical energy Generation, Transmission and Distribution system, Concept of single phase supply, Terms related with A.C. quantities , pure resistive, inductive and capacitive circuits, Complex and phasor representation of AC quantities, R-L-C series and parallel circuits, resonance in series and parallel circuits, Q-factor of coil ,Three phase AC Circuits: Concept of Three phase supply, star and delta connections line and phase values, three phase balanced star and delta loads and their phasor diagrams.
Unit IV	**Energy Storage Systems:** Types of storage battery (Lead Acid , Lithium Battery etc.) , Charging of a cell, SoC, Discharging of cell Current, Capacity of the Cell, Depth of Discharge (DOD) of the cell, Capacity of a Secondary Cell, Efficiency of the Cell. Applications of batteries. Super capacitors: Fundamental, Construction and application. Calculation of Inverter Capacity as per total load, Calculation Battery Back-up Time,
Unit V	**Electrical Wiring , Accessories and Metering Devices :** Accessories used for electrical wiring, Types of insulated wires & wiring systems, Concealed conduit electrical wiring systems ,Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Concept of earthing, Power rating of different domestic appliances, KWh (Unit) / Energy consumption calculations. Types of lamps- Light Emitting Diode (LED) Lamps, Fluorescent Lamps and Compact Fluorescent Lamps (CFL), Principle and working of Energy meter, Concept of KVAh Billing system, and kWh billing system

Text and Reference Books

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011
2. Vincent Del Toro, Electrical Engineering Fundamentals, Prentice Hall India, 2nd Edition, 2013.
3. Kothari D. P, Nagrath I. J., Basic Electrical Engineering, Tata McGraw Hill, 2010
4. M. S. Naidu, S. Kamakshaiah, Introduction to Electrical Engineering,Tata McGraw-Hill Education, 1995
5. J. P. Tiwari, *Basic Electrical Engineering*, New Age Publication, 2013
6. Mahmood Nahvi and Joseph A. Edminister, Electric Circuits, Schaum's Outline Series, McGraw Hill, (2002)
7. E. Hughes, Electrical and Electronics Technology, Pearson, 2010
8. T. Minami, M. Tatsumisago, M. Wakihara, C. Iwakura, S. Kohijiya, Solid state ionics for batteries, Springer Publication, 2009
9. Sandeep Dhameja, Electric Vehicle Battery Systems, New age publication, 2001.
10. Bard, Allen J. and Larry R. Faulkner. Electrochemical Methods: Fundamentals and Applications. 2nd Ed.,Wiley– VCH, Verlag, GmbH, 2000
11. D. Linden and T. S. Reddy, Handbook of Batteries, 3rd Edition, McGraw-Hill, 2002.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	1	2	1	1	--	--	1	--	--	2
CO2	3	2	1	2	--	1	--	--	1	--	--	2
CO3	3	2	1	1	1	1	--	--	1	--	--	3
CO4	2	2	1	1	1	1	2	--	1	--	--	2
CO5	2	1	1	1	--	1	--	1	1	--	--	2

3 - High 2 – Medium 1 – Low

Assessment:

ISE I and ISE III will be based on one of the /or combination of the few of the following-following- 1. Declared Test,2-Surprise Test,3-MCQ Test, 4-Home Assignments,PPT presentation,Quiz,Fabrication of working model

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		15
K2	Understand	5	5	5	15
K3	Apply	5	5	5	20
K4	Analyze				10
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K2	K3	K3	K3	K2
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)			7	8	
ISE III (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	15	15	10	10	10
Total Marks 100	24	25	19	20	12

Designed By
Dr. SunandaGhanegaonkar, Prof. S. S. Mopari

EEESC1002 : Basics of Electronics Circuits		
Teaching Scheme	**Examination Scheme**	
Theory: 3 Hrs/Week	ISE I	15 Marks
Tutorial:0 hrs	ISE II	15 Marks
Credits: 3	ISE III	10 Marks
	ESE	60 Marks

Prerequisites: Nil

Course description: Basic electronic circuits is a one-semester course compulsory to all first year engineering students of the department

Course Objectives:

- To impart knowledge of electronic circuit components and devices
- To create awareness of concepts related to CB, CE and CC types of transistor, load lines, h-parameter, oscillators, power amplifiers using BJT,
- To introduce basic concepts of Op-Amp Circuits
- To introduce basic concepts of Filters, Oscillators

Course Outcomes: After completing the course students will able to

Course Outcomes

1. Analyze the principles and working of diode with its applications, power supply
2. Describe working of transistors, analyze CE configuration
3. Describe the transistor feedback, power amplifiers
4. Explain diode wave shaping circuits, passive filters, various oscillators applications of transistor
5. Explain basic principles and applications of Op-Amp Circuits

Detailed Syllabus:

Unit 1	**Power Supplies**: Review of Semiconductor Physics: Introduction to PN- junction diode, I-V characteristics of a diode; BJT, FET and MOSFET; static characteristics of PN-Junction diode DC Power Supply: Single phase half wave, full wave and bridge rectifiers-expression for ripple factor, Efficiency, Diode Ratings, Filters: Capacitor, Inductor, LC Filters Regulated Power Supply: concept, Simple Voltage regulator, Series regulators, IC voltage regulator
Unit 2	**Small Signal Amplifiers:** Small Signal Amplifiers: Structure and I-V characteristics of a BJT, BJT as an amplifier: Concepts of CB, CE, CC configurations, Input & output characteristics of common emitter configuration, comparison of three configurations, thermal runway, and biasing, Concept of load lines, methods of coupling, concept of transistor as a switch, h-parameters, simplified CE hybrid mode, -3dB bandwidth

Unit 3	**Feedback and Power Amplifiers :** Feedback Amplifiers: Multistage amplifier, Negative and positive feedback, Types of feedback amplifiers, Voltage series/shunt, Current series/shunt amplifiers Power Amplifiers: Classification- class A, class B, class AB, class C, concept of harmonic distortion, and cross-over distortion in power amplifiers
Unit 4	**Applications of diodes and transistors:** Wave-Shaping Circuits: Pulse characteristics, RC-low pass, high pass circuits, differentiating and integrating circuits, clipping and clamping circuits using diodes Multivibrators: Astable, monostable & bistable multivibrators Oscillators: RC phase shift, LC, Hartley, oscillators (using BJT's only)
Unit 5	**Op-Amp Circuits and specialized ICs with applications:** Op-Amp Fundamentals: Symbol block diagram representation, equivalent circuit Idealized analysis of op-amp circuits. open loop Op-amp configurations, negative feedback. Practical op-amp: Input bias and offset voltage and current, thermal drift, Common mode configuration and rejection ratio. Oscillators: Phase shift oscillator and Heartley oscillator using op-amps Signal Generators: Sine, triangular and square wave generators using op-amps Special Function ICs: Timer IC 555, applications

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO3
CO1	3	2										1		2	3
CO2	3	2										1		2	3
CO3	3	2										1		2	3
CO4	2	3										1		2	3
CO5	2	3										1		2	3

1 – Low, 2 – Medium, 3 - High

Text and Reference books

1. Millman and Halkias, „Electronic Devices and Circuits", McGraw Hill
2. S. Allan Mottorshed, Electronic Devices and Circuits", Tata McGraw Hill
3. Boylestad and Nashelsky, Electronic Devices and Circuits,„ Tata McGraw
4. G. B. Clayton, "Operational Amplifiers", Butterworth & Co. Publications
5. Milkman and Halkias, Integrated Electronics, McGraw Hill
6. Schilling and Belove, Electronic Devices and Circuits
7. R. A. Gaikwad, "Op-amps and Linear Integrated Circuits Technology", PHI Publications
8. D. Roy Chaudhari, "Linear Integrated Circuits", New Age International Publishers
9. S. Franco, "Design with Operational Amplifiers and Analog ICs", Tata McGraw-Hall

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		15
K2	Understand	5	5	5	15
K3	Apply	5	5	5	20
K4	Analyze				10
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K2	K3	K3	K3	K2
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8			
ISE II (15 Marks)			7	8	
ISE III (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	15	15	10	10	10
Total Marks 100	24	25	19	20	12

Designed by Prof. V. A. Kulkarni

EEESC1003 : Lab Basics of Electronics Circuits		
Teaching Scheme	**Examination Scheme**	
Practical: 2 Hrs/Week	**ISE III**	**25 Marks**
Tutorial:0 hrs	**ESE**	**00 Marks**
Credits: 1		

Course description: Lab Analog Electronic Circuits is a one-semester course compulsory to all second year engineering students of the department

Course Objectives: The objectives of the course are to-

1. To expose the students to a variety of practical circuits using various analog circuits.
2. To acquire skills of designing and testing integrated circuits

Course Outcomes:

CO1	Use basic electronic components such as diodes for various applications
CO2	To plot and analyze transistor amplifier characteristics and describe performance of multi-vibrators
CO3	Describe the performance of transistor power amplifiers / oscillators
CO4	Perform the experiments based on linear and nonlinear op amp circuits
CO5	Construct the circuits for various applications using analog IC's

List of the Experiments

The student shall perform minimum ten experiments of the following

Sr. No.	**Title of the Experiments**
1	Regulation characteristics of half wave with and without filter
2	Regulation characteristics of full wave rectifier with and without filter
3	Measurement of line regulation and load regulation of shunt regulator
4	Measurement of line regulation and load regulation of series regulator
5	Measurement of h parameters of CE amplifier
6	Frequency response of RC coupled amplifier
7	Frequency response of Transformer coupled amplifier
8	Study of RC low pass, high pass circuit
9	Study of clipper
10	Study of clamper
11	Study of differentiator
12	Study of integrator
13	Study of IC 555
14	Build Inverting amplifier using IC 741 and plot its frequency response
15	To build Non-inverting amplifier using IC 741 and plot its frequency response
16	To build summing amplifier in inverting and non-inverting mode
17	To measure Op-Amp parameters such as Input offset voltage, input bias current, Input offset current, PSRR and CMRR
18	To measure slew rate of Op-Amp
19	Study of Phase shift Oscillator
20	Study of Hartley Oscillator

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	1	3	1		1	1	1	2			3		2	3
CO2	3	1	3	1		1	1	1	2			3		2	3
CO3	3	1	3	1		1	1	1	2			3		2	3
CO4	3	1	3	1		1	1	1	2			3		2	3
CO5	3	1	3	1		1	1	1	2			3		2	3

1 – Low, 2 – Medium, 3 - High

EEPCC1001 Electrical Engineering Practices	
Teaching Scheme Lectures : 1 Hrs/Week Total Credits : 1	**Examination Scheme** : - ISE II : 15 Marks ISEIII :10 Marks

Course Objectives:
The objectives of the course are to

1. To understand causes of shocks, their prevention and electrical safety.
2. To impart knowledge of principles of measurement
3. To analyze and minimize errors in measurement
4. To enable students to learn principles of measurement of electrical quantities

Course Outcomes: After completing the course, students will able to:

CO1	Explain causes of shocks, their prevention and implement electrical safety.
CO2	Explain basics of measurement
CO3	Demonstrate principles of measurement of electrical quantities and analyze measurement errors.

Detailed Syllabus:

Unit-I	**Introduction To Electrical Safety, Shocks And Their Prevention:** Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, principles of electrical safety, Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops
Unit 2	**Basics of Measurement Concepts relating to Measurements:** True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity. Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, Cp, Cpk
Unit 3	**Measurement of Electrical quantities:** Measurement of voltage, current, Measurement of three-phase power under balanced and unbalanced condition, Measurement of reactive power, Measurement of energy.

Text Books:

1. A.K.Sawhney&PuneetSawhney, "A Course in Electrical And Electronic Measurements and Instrumentation", 7/e, Dhanpat Rai & Co.(P) Ltd.,2005.
2. Albert D.Helfrick& William D.Cooper, "Modern Electronic Instrumentation and Measurement Technique",Low Price Edition, Pearson Education, 2005.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	2	1	--	2	1	1	--	1	--	3
CO2	3	2	1	-1	--	--	--	1	--	1	--	2
CO3	3	2	1	--	--	1	--	--	--	1	--	2

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE II**	**ISE III**
K1	Remember	5	
K2	Understand	5	5
K3	Apply	5	5
K4	Analyze		
Total Marks 25		15	10

Assessment table:

Assessment Tool	K2	K3	K3
	CO1	CO2	CO3
ISE II (15 Marks)	5	5	5
ISE III (10 Marks)	-	5	5
Total Marks 25	5	10	10

EEPCC1002 : Lab Electrical Engineering Practice		
Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	ISE III	25 Marks
Credits:1		

Course Outcomes: After completion of this course students will be able to:

CO1	Verify Network theorem to determine the electric circuit parameters
CO2	Demonstrate and verify relationship of various electric circuit parameters
CO3	Demonstrate the fundamental principle for measurement of power in single phase and three phase circuit
CO4	Calculate the different performance parameters of energy storage devices
CO5	Compare performance of various types of lamps.

Note: The students will be required to perform the 8 experiments from the above list and any other relative experiments designed on the basis course

List of the Experiments

The student shall perform minimum TEN experiments from the following list

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
1	Perform an experiment for Verification of Thevenin's theorem and Norton's theorem	K3, S2	CO1, CO3	3
2	Perform an experiment for Verification of Superposition theorem	K3, S2	CO1, CO3	3
3	Perform an experiment for Verification of Maximum power transfer theorem	K3, S2	CO1, CO3	3
4	To Perform an experiment for the demonstration of electromagnetic induction phenomenon	K2, S2	CO1, CO3	4
5	To study charging and discharging of capacitor.	K2,S2	CO1, CO3	3
6	To Perform an experiment to plot hysteresis loop/B-H curve of magnetic material	K2,S2	CO1, CO3	3
7	Measurement of L and C using a LCR meter	K3,S2	CO2	
8	Measurement of parameters of a choke coil using 3 voltmeter / 3 ammeter methods	K2,S2	CO2, CO3	
9	To perform experiment for Measurement of current, voltage and power in R-L-C series exited by single phase AC supply	K2,S2	CO2, CO3	4
10	To Study the R-L-C series resonance circuit	K2,S2	CO2, CO3	3
11	To study relation between phase and line values of voltages and currents and measurement of three phase power under balance condition for Star and Delta connected load	K3,S2	CO3, CO4	3

12	Measurement of Power in three-phase circuit using wattmeter	K3,S2	CO3, CO4	
13	To perform an experiment for fully charged and discharged conditions of a Lead-acid battery	K2,S2	CO5	3
14	To perform experiment for calculation of the battery backup time as per load capacity for residential consumer	K2,S2	CO5	3
15	Comparative study of energy consumption between LED,CFL and Solar light –A case study for residential consumer	K2,S2	CO3, CO4	4
16	To perform an Experiment on Measurement of Lumen/Lux of different lamps by lux meter	K2,S2	CO5	3
17	To perform experiment for measurement of power consumption of a LED lamp, CFL lamp	K2,S2	CO5	3

Note : The students will be required to perform the 8 experiments from the above list and any other relative experiments designed on the basis course

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III
K1	Remember	5
K2	Understand	10
K3	Apply	10
K4	Analyze	
Total Marks		25

Assessment Pattern Level No.	Knowledge Level	ISE II
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	
S5	Naturalization	
Total Marks		25

Mapping of Course outcome with Program Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	2	1	2	--	1	--	--	1	1	--	2
CO3	3	2	2	2	1	1	--	--	1	1	--	2
CO4	3	2	2	1	1	1	--	--	1	1	--	2
CO5	3	2	2	1	1	1	2	--	1	1	--	2
CO5	3	1	-	-	-	-	1	--	1	1	--	2

1- Low, 2-Medium, 3- High

Designed By
Dr. SunandaGhanegaonkar

EEVSE1005 : Electrical Workshop		
Teaching Scheme	**Examination Scheme**	
Practical: 4 Hrs/Week	ISE III	50 Marks
Credits: 2		

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Recognize electrical safety measures
CO2	Use and select various electrical tools, components and measuring instruments
CO3	Identify different types of wires, cables, light sources and switches
CO4	Explain ratings of household electrical appliances, electrical machines
CO5	Describe types of earthling, calculate energy bill

List of the Experiments

The student shall perform minimum **Twelve** experiments from the following list

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO
1	Identify different types of cables/wires and switches and their uses.	K2	CO1, CO3
2	Identify different types of fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.	K2	CO1, CO2, CO3,
3	Wiring of simple light circuit for controlling light/fan point (PVC conduit wiring).	K2	CO1, CO2, CO3, CO4
4	Wiring of light/fan circuit using Two way switches (Staircase wiring).	K2	CO1, CO2, CO3, CO4
5	Wiring of fluorescent lamps and light sockets.	K2	CO1, CO2, CO3, CO4
6	Wiring of Power circuit for controlling power device	K2	CO1, CO2, CO3, CO4
7	Go down wiring / Tunnel wiring	K2	CO1, CO2, CO3, CO4, CO5
8	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, Main switch and Energy meter.	K2	CO1, CO2, CO3, CO4
9	Measurement of voltage, current and power in a single phase circuit using voltmeter, ammeter and wattmeter.	K2	CO1, CO2, CO3, CO4
10	Calculate the power factor of the circuit.	K2	CO1, CO2, CO3, CO4, CO5
11	Wiring of backup power supply including inverter, battery and load for domestic installations.	K2	CO1, CO2, CO3, CO4
12	Demonstration and measurement of power consumption of electric iron, mixer grinder, single phase pump, exhaust fan etc.	K2	CO1, CO2, CO3, CO4

13	Demonstration of Motor winding	K2	CO1, CO2, CO3, CO4
14	Demonstration of DO fuses	K2	CO1, CO2, CO3, CO4
15	Visit to 11kV distribution transformer/substation	K2	CO1, CO2, CO3, CO4, CO5
16	Installation and maintenance of domestic solar appliances	K2	CO1, CO2, CO3, CO4, CO5
17	Installation and maintenance of electrical equipments	K2	CO1, CO2, CO3, CO4, CO5
18	Installation of domestic Earthling	K2	CO1, CO2, CO3, CO4, CO5
19	Study of Battery Maintenance	K2	CO1, CO2, CO3, CO4
20	Study of On-OFF control of electrical lighting and fans operated by remote	K2	CO1, CO2, CO3, CO4

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III
K1	Remember	15
K2	Understand	20
K3	Apply	15
K4	Analyze	
Total Marks		50

Assessment Pattern Level No.	Knowledge Level	ISE III
S1	Imitation	25
S2	Manipulation	20
S3	Precision	5
S4	Articulation	
Total Marks		50

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	1	1	-	-	2	-	1	1	1	-	3
CO2	3	1	2	1	-	1	1	1	1	1	-	2
CO3	2	2	1	1	-	-	-	1	1	1	-	**2**
CO4	3	2	1	-	-	2	-	1	1	-	-	**2**
CO5	3	2	1	1	-	2	-	1	1	1	-	2

1-Low,2-Medium, 3-High

EEIKS1101 :Vedic Mathematics		
Teaching Scheme	**Examination Scheme**	
Lectures: 2Hrs/ week	ISE I	10 Marks
Tutorial: --0Hrs	ISE II	10 Marks
Credits: 2	ISE III	0 Marks
	End Semester Examination	30 Marks

Prerequisites: - NIL

Course description:

This is the Indian Knowledge System course which introduces the basic concepts, different techniques developed in the ancient period to the students.

The objectives of the course are to

1. Enhance computation skills in students through Vedic Mathematics ·
2. Develop logical and analytical thinking
3. Promote joyful learning of mathematics
4. Discuss the rich heritage of mathematical temper of Ancient India

	Course Outcomes
CO1	To understand the techniques of high speed addition and subtraction
CO2	To understand the concept multiplication and division of two or three digits numbers
CO3	To apply reverse squaring to find square roots of numbers. and identify cube and cube roots.
CO4	To understand concepts of Algebra and Geometry of Vedic Mathematics
CO5	Appreciate the Mathematical advancements of Ancient India.

Detailed Syllabus:

Unit I	**Vedic Maths- High Speed Addition and Subtraction** Vedic Math: History of Vedic Maths and its Features, Vedic Maths formulae: Sutras and Upsutras, Addition in Vedic Maths: Without carrying, Dot Method 77, Subtraction in Vedic Math: NikhilamNavatashcaramamDashatah, Fraction -Addition and Subtraction
Unit II	**Vedic Maths- Miracle Multiplication and Excellent Division** Multiplication in Vedic Math: Base Method (any two numbers upto three digits). Multiplication by UrdhvaTiryak Sutra, Miracle multiplication: Any three-digit number by series of l's and 9's • Division by UrdhvaTiryak Sutra (Vinculum method)
Unit III	**Vedic Maths-Lightening Squares and Rapid Cubes** Squares of any two-digit numbers: Base method, Square of numbers ending in 5: EkadhikenaPurvena Sutra, Easy square roots: Dwandwa Yoga (duplex) Sutra, Square root of 2: BaudhayanaShulbasutra, Cubing: Yavadunam Sutra

Unit IV	**Vedic Maths-Enlighten Algebra and Geometry** Factoring Quadratic equation: Anurupyena, Adyamadyenantyamanty Sutra, Concept of Baudhayana (Pythagoras) Theorem, Circling a square: BaudhayanaShulbasutra, Concept of pi: BaudhayanaShulbasutra, Concept angle (8) 0o, 300, 450, 600 and 900: Baudhayana number

Text and Reference Books

1. The Essential of Vedic Mathematics, Rajesh Kumar Thakur, Rupa Publications, New Delhi 2019.
2. Vedic Mathematics Made Easy, DahavalBathia, Jaico Publishing, New Delhi 2011
3. Vedic Mathematics: Sixteen Simple Mathematical formulae from the Vedas, Jagadguru Swami Sri Bharati Krishna Trithaji, MotilalBanarsidass, New Delhi 2015.
4. Learn Vedic Speed Mathematics Systematically, Chaitnaya A. Patil 2018.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	--	--	--	--	--	--	--	--	--	--	2
CO2	2	--	--	--	--	--	--	--	--	--	--	2
CO3	2	--	--	--	--	--	--	--	--	--	--	2
CO4	2	--	--	--	--	--	--	--	--	--	--	2
CO5	3	--	--	--	--	--	--	--	--	--	--	1

3 - High 2 – Medium 1 – Low

Assessment:

ISE I and ISE III will be based on one of the /or combination of the few of the following-following-Declared Test, Surprise Test,MCQ Test, Home Assignments, PPT, presentation, Quiz, Fabrication of working model

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember				10
K2	Understand	5	5		10
K3	Apply	5	5		10
Total Marks 50		10	10		30

Assessment table:

Assessment Tool	K2	K3	K3	K3	K2
	CO1	CO2	CO3	CO4	CO5
ISE I (10 Marks)	5	5			
ISE II (10 Marks)		**3**	5	2	
ESE Assessment (30 Marks)	5	5	10	10	
Total Marks 100	10	13	15	12	

INCCC1002: NSS / INCCC1003: Sports/INCCC1004: Club Activities Co Curricular Course (Liberal Learning Course)
Teaching Scheme
04 hrs./ week
Tutorial: 00 hrs./ week
Credits: 02
ISE-III 50 Marks

Course Description: Co-curricular activities are activities that take place outside of a course's curriculum but are related to academics in some way. Although involvement is not part of classroom instruction, it does supplement and enhance a student's academic experience.

NSS: Aim of NSS activities to Gain skills in mobilizing community participation; To acquire leadership qualities and democratic attitude; To develop the capacity to meet emergencies and national disasters; To practice national integration and social harmony. Types of Activities are not limited to Cleaning, Plantation
Blood Donation Camps, Awareness Rallies, Health Care Camps, Stage shows or a procession creating awareness of such issues as social problems, education and cleanliness but decided by Institute NSS Coordinator. Students will participate in NSS Activities throughout the semester.

The evaluation is based on participation in regular NSS activities.NSS Coordinator along with departmental NSS coordinator will certify at the end of semester about participation. Program head will notify the exam section about awarding credits to the students.

Sports activity: Sporting Activities means performing or participating in the Sport in any capacity which includes, but is not limited to, participation in training, competitions, coaching or as an official.

Students will participate in Sports Activities throughout the semester. Gymkhana vice president will coordinate along with the sports coordinator of the department. The coordinators will certify at the end of semester about participation. Program head will notify the examination section about awarding credits to the students. The evaluation is based on participation in regular sports activities.

Club activities: Government Engineering College Aurangabad has various clubs that focus on specific interests such as robotics, coding, literature, environment, etc. These clubs often organize events, workshops, and competitions that provide students with opportunities to learn new skills and showcase their talents. Students will participate in Club Activities throughout the semester. Faculty coordinators will coordinate along with student bodies the activities of the club.

The Faculty coordinators will certify at the end of semester about participation of students . Program head will notify the examination section about awarding credits to the students.

Dean Students affairs and all program heads will formulate additional modalities for smooth conduction of co curricular activities as and when required.

CHBSC1102: Battery Science, Lubricants and Green Chemistry(Effective from 2024-25)		
Teaching Scheme	**Examination Scheme**	
Lectures: 3Hrs/ week	ISE I	15 Marks
Tutorial: --0Hrs	ISE II	15 Marks
Credits:32	ISE III	10 Marks
	End Semester Examination	60 Marks

Course description: The course is mandatory course for first year B.Tech. Civil Engineering, Mechanical Engineering and Electrical Engineering programs in first semester. The course objective is to teach fundamental principles in Chemistry and relate the understanding to applications.

Course Outcomes(CO):	
After successful completion of course the students will be able	
CO1	To understand fundamentals of chemistry relevant to engineering field.
CO2	To differentiate between primary and secondary battery as well as battery and fuel cell.
CO3	To equip with basic knowledge of polymer reinforced composites, applications of polymers i energy harnessing.
CO4	To acquire basic knowledge of nano-chemistry to appreciate its applications in the field of medicine, data storage devices and electronics.
CO5	To apply the principles of green chemistry in designing alternative reaction methodologies to minimize hazards and environmental degradation.

Detailed Syllabus:

	Course Contents	**CO**
Unit1	**Battery Science** Introduction–Classificationofbatteries,Primaryandsecondarybatteries,reserve batteries with examples, battery components and their role-Characteristics of Battery. Batteries and their importance, basic requirements for commercial batteries, construction, working and applications of Ni-Cd, and Lithium ion battery,fuelCells-Differencesbetweenbatteryandfuelcell,electricalVehicle Battery construction, working advantages and disadvantages of EV Car.	CO1, CO2
Unit2	**Electrochemistry** Single electrode potential, reversible and irreversible cells measurements, specific conductance, equivalent conductance, variation of equivalent conductance with dilution, migration of ions Nernst equation and application, determination of EMF of cell, applications of EMF series. **Chromatographic techniques** Basics and applications of chromatographic technique- thin layer chromatography,flamephotometrypotentiometrictitrations,conductometry,PH metry	CO1, CO2

Unit3	**Lubricants** Introduction, mechanisms of lubrication-fluid film, boundary film & extremepressure,typesoflubricants–solidlubricants–molybdenumdisulphide, graphite. Liquid lubricants– vegetable, animal, mineral & synthetic oils, semi-solid lubricants, greases, lubricating emulsions–oilinwater, Waterinoil, propertiesoflubricants&itssignificance–physicalpropertiesandsignificances viscosity&viscosityindex,flash&firepoint,cloud&pourpoint,acidvalue, saponification value, steam emulsification number	CO1, CO3
Unit4	**Energy sciences & Green Chemistry:** **Green Chemistry:** Introduction- definition of green chemistry, need of green chemistry, basic principles ofgreen 12 principles ofgreen chemistry principles of green chemistry, waste minimization and atom economy, reduction of materials and energy requirement, significance, concept of sustainability, industrial applications of green chemistry **Fuels:** Fuel- classification, characteristics of good fuel, comparison between solid, liquid, gaseous fuel, alternative and nonconventional fuels, calorific value, low and high calorific value, units of calorific value, determination of calorific value by Bomb calorimeter, fuel cells, solar cell and Polymer cell, hydrogen-oxygen fuel cell, advantages and applications.	CO1, CO4
Unit5	**Water treatment:** Introduction, sources and impurities in water, portable water; meaning and specifications (WHO standards), hardness of water types, determination of hardness using EDTA titration and numerical, softening of hard water by ion-exchange process. numerical problems on hardness of water, biological oxygen demand(BOD)and chemical oxygen demand(COD),determination of COD of Industrial waste water, purification of water for town supply	CO1, CO5