Shivaji University
Vidyanagar, Kolhapur - 416 004, Maharashtra.

Department of Technology

As per NEP2020 guidelines

MDM Featured B. Tech (Chemical Engineering) First to Final Year Curriculum Structure, w.e.f 2023-24

Shivaji University, Kolhapur

Department of Technology

First Year B. Tech (All Programs), Semester- I

Physics Group : Teaching and Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC111	Engineering Physics	03	-	02	05	04	30:70	50:00
2.	Basic Science course	BSC112	Engineering Mathematics –I	03	01	-	04	04	30:70	50:00
3.	Engineering Science Courses	ESC111	Elements of Mechanical and Electronics Engineering	04	-	02	06	05	30:70	50:00
4.	Engineering Science Courses	ESC112	Engineering Mechanics	03	-	02	05	04	30:70	50:00
5.	Engineering Science Course	ESC113	Computer Programming for Engineers	02	-	02	04	03	30:70	50:00
6.	Indian Knowledge System	IKS111	Yoga and Meditation	01	-	-	01	01	-	50:00
				-	-	-	-	**21**	**500**	**300**
7.	Humanities & Social Sciences, Management, Environment Courses	HSMEC111	Professional Communication (English)-I	02	-	-	02	IE at Course in charge end		
8.	Vocational and Skill Enhancement Courses	VSEC111	Design Thinking and Innovation-I	01	01	-	02	IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

Note: After the first semester, all the F.Y. B. Tech students will undergo 10 days Social Internship and its evaluation will be done in the Second Semester.

Shivaji University, Kolhapur

Department of Technology

First Year B. Tech (All Programs), Semester- I

Chemistry Group : Teaching and Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC111	Engineering Chemistry	03	-	02	05	04	30:70	50:00
2.	Basic Science Course	BSC112	Engineering Mathematics –I	03	01	-	04	04	30:70	50:00
3.	Engineering Science Course	ESC111	Elements of Civil and Electrical Engineering	04	-	02	06	05	30:70	50:00
4.	Engineering Science Course	ESC112	Engineering Graphics	03	-	02	05	04	30:70	50:00
5.	Engineering Science Course	ESC113	Electrical-Electronic Components and Devices	02	-	02	04	03	30:70	50:00
6.	Indian Knowledge System	IKS111	Yoga and Meditation	01	-	-	01	01	-	50:00
				-	-	-	-	**21**	**500**	**300**
7.	Humanities & Social Sciences, Management, Environment Courses	HSMEC 111	Professional Communication (English)-I	02	-	-	02	IE at Course in charge end		
8.	Vocational and Skill Enhancement Courses	VSEC111	Design Thinking and Innovation-I	01	01	-	02	IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

Note: After the first semester, all the F.Y. B. Tech students will undergo 10 days Social Internship and its evaluation will be done in the Second Semester.

Shivaji University, Kolhapur

Department of Technology

First Year B. Tech (All Programs), Semester- II

Chemistry Group : Teaching and Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC121	Engineering Chemistry	03	-	02	05	04	30:70	50:00
2.	Basic Science Course	BSC122	Engineering Mathematics – II	03	01	-	04	04	30:70	50:00
3.	Engineering Science Course	ESC121	Elements of Civil and Electrical Engineering	04	-	02	06	05	30:70	50:00
4.	Engineering Science Course	ESC122	Engineering Graphics	03	-	02	05	04	30:70	50:00
5.	Engineering Science Course	ESC123	Electrical-Electronic Components and Devices	02	-	02	04	03	30:70	50:00
6.	Indian Knowledge System	IKS121	Human Rights and Constitution	01	-	-	01	01	-	50:00
				-	-	-	-	**21**	**500**	**300**
7.	Humanities & Social Sciences, Management, Environment Courses	HSMEC121	Professional Communication (English)-II	02	-	-	02	IE at Course in charge end		
8.	Vocational and Skill Enhancement Courses	VSEC121	Design Thinking & Innovation-II	01	01	-	02	IE at Course in charge end		
9.	Project Seminar Internship	PSI 121	Social Internship*	10 Days Duration*				IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

*Note: After Semester I, 10 days social internship completed by all students will be the evaluated in this semester.

Shivaji University, Kolhapur

Department of Technology

First Year B. Tech (All Programs), Semester- II

Physics Group : Teaching and Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC121	Engineering Physics	03	-	02	05	04	30:70	50:00
2.	Basic Science Course	BSC122	Engineering Mathematics – II	03	01	-	04	04	30:70	50:00
3.	Engineering Science Course	ESC121	Elements of Mechanical and Electronics Engineering	04	-	02	06	05	30:70	50:00
4.	Engineering Science Course	ESC122	Engineering Mechanics	03	-	02	05	04	30:70	50:00
5.	Engineering Science Course	ESC123	Computer Programming for Engineers	02	-	02	04	03	30:70	50:00
6.	Indian Knowledge System	IKS121	Human Rights and Constitution	01	-	-	01	01	-	50:00
				-	**-**	**-**	**-**	**21**	**500**	**300**
7.	Humanities & Social Sciences, Management, Environment Course	HSMEC121	Professional Communication (English)-II	02	-	-	02	IE at Course in charge end		
8.	Vocational and Skill Enhancement Courses	VSEC121	Design Thinking and Innovation-II	01	01	-	02	IE at Course in charge end		
9.	Project Seminar Internship	PSI 121	Social Internship*	10 Days Duration*				IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

*Note: After Semester I, 10 days social internship completed by all students will be the evaluated in this semester.

Shivaji University, Kolhapur

Department of Technology

Second Year B. Tech (Chemical Engineering), Semester- III

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC211	Applied Chemistry-I (Physical, Inorganic & Analytical)	03	-	02	05	04	30:70	50:50
2.	Basic Science course	BSC212	Engineering Mathematics – III	03	-	-	03	03	30:70	50:00
3.	Professional Core Courses	PCC 211	Fluid Flow Operations	03	01	02	06	05	30:70	50:50
4.	Professional Core Courses	PCC 212	Chemical Engineering Thermodynamics	03	01	-	04	04	30:70	00:00
5.	Engineering Science Courses	ESC211	Material Science & Engineering	03	-	-	03	03	30:70	00:00
6.	Ability Enhancement Courses	AEC211	Soft Skills Development	01	-	-	01	01	-	50:00
				-	-	-	-	**20**	**500**	**300**
7.	Project Based Learning	PBL211	Mini Project I & Industrial Visit	-	01	-	01	IE at Course in charge end		
8.	Humanities, Social Sciences, Management, Environment Course	HSMEC211	Environmental Studies	02	-	-	02	University Exam at semester end		
			Total Hours	18	03	04	**25**	-	-	-

Shivaji University, Kolhapur

Department of Technology

Second Year B. Tech (Chemical Engineering), Semester- IV

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC 221	Applied Chemistry –II (Organic)	03	-	02	05	04	30:70	50:00
2.	Professional Core Course	PCC 221	Heat Transfer Operations	03	-	02	05	04	30:70	50:50
3.	Professional Core Course	PCC 222	Mechanical Operations	03	-	02	05	04	30:70	50:50
4.	Professional Core Course	PCC 223	Inorganic Chemical Technologies	03	-	-	03	03	30:70	00:00
5.	Professional Core Course	PCC 224	Chemical Process Calculations	03	01	-	04	04	30:70	00:00
6.	MDM Course	MDM221	Multidisciplinary Minor Course I*	03	-	-	03	03	30:70	00:00
7.	Indian Knowledge Systems	IKS 221	Introduction to Performing Arts	01	-	-	01	01	-	50:00
				-	-	-	-	**23**	**600**	**300**
8.	Mandatory Audit Course	MAC221	Aptitude Enhancement Course I*	-	01	-	01	IE at Course in charge end		
9.	Project Based Learning	PBL221	Mini Project II & Industrial Visit	-	01	-	01	IE at Course in charge end		
10.	Humanities, Social Sciences, Management Environment Course	HSMEC221	Environmental Studies	02	-	-	02	University Exam at year end		
			Total Hours	21	03	06	**30**	-	-	-

*Note: The MDM course will be from the chosen Multidisciplinary Minor Title.

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (Chemical Engineering), Semester- V

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Engineering Science Course	ESC311	Thermal Engineering & Plant Utilities	03	-	-	03	03	30:70	00:00
2.	Professional Core Course	PCC311	Mass Transfer Operations-I	03	-	02	05	04	30:70	00:50
3.	Professional Core Course	PCC312	Chemical Reaction Engineering	03	01	02	06	05	30:70	50:50
4.	Professional Core Course	PCC313	Organic Chemical Technologies	03	-	02	05	04	30:70	50:50
5.	Humanities and Social Sciences , Management Environmental Course	HSMEC 311	Safety in Chemical Industry	03	-	-	03	03	30:70	00:00
6.	MDM Course	MDM 311	Multidisciplinary Minor Course II*	03	-	-	03	03	30:70	00:00
7.	Ability Enhancement Course	AEC 311	Introduction to Foreign Language	01	-	-	01	01	-	50:00
				-	-	-	-	23	600	300
8.	Mandatory Audit Course	MAC311	Aptitude Enhancement Course II	-	01	-	01	IE at Course in charge end		
9.	Project Based Learning	PBL311	Mini Project III & Industrial Visit	-	-	02	02	IE at Course in charge end		
			Total Hours	19	02	08	29	-	-	-

*Note: The MDM course will be from the chosen Multidisciplinary Minor Title.

Shivaji University, Kolhapur

Department of Technology

Third Year B. Tech (Chemical Engineering), Semester- VI

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Engineering Science Course	ESC321	Process Instrumentation & Control	03	-	02	05	04	30:70	50:00
2.	Professional Core Course	PCC321	Mass Transfer Operations-II	03	-	02	05	04	30:70	50:50
3.	Professional Core Course	PCC322	Chemical Equipment & Plant Design	03	-	02	05	04	30:70	50:00
4.	Professional Elective Course	PEC321	Elective I	03	-	-	03	03	30:70	00:00
5.	Open Elective Course	OEC 321	Open Elective –I	03	-	-	03	03	30:70	00:00
6.	MDM Course	MDM 321	Multidisciplinary Minor Course III*	03	-	-	03	03	30:70	00:00
7.	Humanities and Social Sciences , Management, Environmental Course	HSMEC 321	Industrial Safety, Health & Hazard Management	-	01	-	01	01	-	50:00
8.	Ability Enhancement Course	AEC321	Mini Project IV & Industrial Visit	-	-	02	02	01	-	50:00
				-	-	-	-	23	600	300
9.	Vocational and Skill Enhancement Course	VSEC321	Design Thinking & Innovation – III	01	-	-	01	IE at Course in charge end		
10.	Mandatory Audit Course	MAC 321	Aptitude Enhancement Course III	-	01	-	01	IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

*Note: The MDM course will be from the chosen Multidisciplinary Minor Title.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (Chemical Engineering), Semester- VII

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Program Core Course	PCC411	Process Modeling &Simulation	03	-	02	05	04	30:70	00:50
2.	Program Core Course	PCC412	Piping & Instrumentation: Design & Drawing	03	-	02	05	04	30:70	50:00
3.	Program Core Course	PCC413	Transport Phenomena	03	-	-	03	03	30:70	00:00
4.	Program Elective Course	PEC 411	Elective II	03	-	-	03	03	30:70	00:00
5.	Open Elective Course	OEC 411	Open Elective- II	03	-	-	03	03	30:70	00:00
6.	Project Seminar Internship	PSI 411	Major Project Work	-	01	02	03	02	00:00	50:100
7.	Value Education Course	VEC411	Green Technology & Sustainability	01	-	-	01	01	-	50:00
8.	Project Seminar Internship	PSI 412	MDM based Industry Internship *	One Month Duration*				03	-	50:50
							-	**23**	**500**	**400**
9.	Project Based Learning	PBL411	Major Project Lab		01	02	03	IE at Course in charge end		
			Total Hours	16	02	08	**26**	-	-	-

* The MDM based industry Internship to be completed during any winter/summer vacation slots 4th Semester onwards, before 7th Semester commencement.

Shivaji University, Kolhapur

Department of Technology

Final Year B. Tech (Chemical Engineering), Semester- VIII

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Project Seminar Internship	PSI 421	Industrial Internship (Follow up by the Department)	Report to an industry for entire Semester				10	-	100:200
2.	Program Elective Course [SWAYAM (NPTEL) or any other MOOCs]	PEC 421	Program Elective –III (Through MOOC*)	03	-	-	03	03	30:70	00:00
3.		PEC 422	Program Elective –IV (Through MOOC *)	03	-	-	03	03	30:70	00:00
4.	Indian Knowledge Systems	IKS 421	Program Specific IKS	02	-	-	02	02	30:70	50:00
5.	Project Seminar Internship	PSI 424	Plant Design & Case Studies (Online)**	01	-	-	01	01	-	50:50
6.	Value Education Course	VEC421	Professional Ethics (Through MOOC)	01	-	-	01	01	-	50:00
7.	Project Based Learning	PBL 421	MDM based Mini Project***	-	-	-	-	02	-	50:50
				-	**-**	**-**	**-**	**22**	**300**	**600**
			Total Hours (Other than Internship)	**10**	**00**	**00**	**10**	**-**	**-**	**-**

*There is an option for End Semester Examination either on respective MOOC platform or at the course teacher's end through the University System.

** Though the course is to be completed online either through course coordinator or via suitable MOOC if any, the ISE will be coordinated by the course in charge and the ESE will be through University system.

*** MDM based Mini Project to be completed during 4th Semester to 8th Semester.

Shivaji University, Kolhapur

Department of Technology

B. Tech (Chemical Engineering), Minor Degree (Both MDM & Specialization)

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	MN 1	MN-Minor I	03	-	-	03	03	30:70	00:00
2.		MN 2	MN-Minor II	03	-	-	03	03	30:70	00:00
3.		MN 3	MN-Minor III	03	-	-	03	03	30:70	00:00
4.	Minor Program Based Internship	MN 4	Industrial Internship* (Minor Program Specific Industry)	One Month Internship				03	-	50:50
5.	Project Based Learning	MN 5	Minor Program Based Mini Project*	-	-	-	-	02	-	50:50
				-	-	-	-	**14**	**300**	**200**
			Total Hours	09	00	00	**09**	-	-	-

Note: The workload against the B.Tech Minors will be finalized at the Program Level considering the strength of students opting for the Minor.

For MDM, there will be three choices while there will be four choices for Specialization Minors. The credits 176 required for the B. Tech (Major) include 14 credits against the compulsory MDM, while specialization minor (SPM) will be purely an option.

*MDM based internship to be completed during vacations between 4th Semester to 7th Semester. MDM based Mini Project to be completed during 4th Semester to 8th Semester.

Shivaji University, Kolhapur

Department of Technology

MDM Featured B. Tech (Chemical Engineering), Honors (An additional but optional one)

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs Or Self-study mode with University's End Semester Examination (Program Core Courses)	HN 1	HN-Course I	03	-	-	03	03	30:70	00:00
2.		HN 2	HN- Course II	03	-	-	03	03	30:70	00:00
3.		HN 3	HN- Course III	03	-	-	03	03	30:70	00:00
4.		HN 4	HN- Course IV	03	-	-	03	03	30:70	00:00
5.		HN 5	HNR - Course V	03	-	-	03	03	30:70	00:00
6.	Ability Enhancement Course	HN-AEC1	HN-Advanced Laboratory Practice	-	-	04	04	02	-	50:50
				-	-	-	-	**17**	**500**	**100**
			Total Hours	15	00	04	**19**	-	-	-

Note: The workload against the B. Tech Honors will be finalized at the Program Level considering the strength of students opting for the Honors.

Note1: The Program will fix up these courses either through MOOCs' or from a conventional list for self-studies.

Note2: These courses / MOOCs will be different than those to be opted in the VIII semester of B. Tech Major against electives.

Note 3: B. Tech (Honors) candidate will be eligible to join the Second Year of PG program in the same or allied specialization.

Note 4: Students may earn these credits during **SY B. Tech to Final Year of their studies.**

Shivaji University, Kolhapur

Department of Technology

MDM Featured B. Tech (Chemical Engineering), Honors with Research (An additional but Optional One)

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs Or Self-study mode with University's End Semester Examination (Program Core Courses)	HNR 1	HNR -Course I	03	-	-	03	03	30:70	00:00
2.		HNR 2	HNR - Course II	03	-	-	03	03	30:70	00:00
3.		HNR 3	HNR - Course III	03	-	-	03	03	30:70	00:00
4.		HNR 4	HNR - Course IV	03	-	-	03	03	30:70	00:00
5.		HNR 5	HNR - Course V	03	-	-	03	03	30:70	00:00
6.	Ability Enhancement Course	HNR-AEC1	HNR- Advanced Laboratory Practice	-	-	04	04	02	-	50:50
7.	Project Based Learning	HNR–PBL	*Additional Research Project	-	-	06	06	03	-	50:50
				-	-	-	-	20	500	200
			Total Hours	15	-	10	25	-	-	-

Note: The workload against the B. Tech Honors with Research will be finalized at the Program Level considering the strength of students opting for the Honors with Research. ***Research Project to be treated successful upon publishing of 1 research paper in a reputed Research Journals.**

Note1: The Program will fix up these courses/MOOCs. Note2: These courses or MOOCs will be different than those to be opted in the VIII semester of B. Tech Major against the electives. Note 3: A successful B. Tech (Honors with Research) candidate will be eligible to get enrolled to PhD in same or allied field **provided the candidate's entire CGPA is 7.5 or above.** Note 4: Students may earn these credits during SY B. Tech to Final Year of their studies.

Shivaji University, Kolhapur

Department of Technology

B. Tech (Chemical Engineering), Exit After First Year (Certificate Course in Chemical Engineering)

Teaching & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs Or Face to face mode Or Self-Study Mode (Program Core Courses)	CC- CHE1	Fundamentals of Chemical Engineering	02	-	-	02	02	30:70	00:00
2.		CC- CHE2	Introduction to Distributed Control System	02	-	-	02	02	30:70	00:00
3.	Program Based Internship	CC-PBI	In plant Training	One Month				04	00:00	50:50
				-	-	-	-	**08***	**200****	**100**
			Total Hours	**04**	-	-	**04**	-	-	-

Note: The Workload against the Certificate Course will be finalised at the Program Level considering the strength of the students seeking for the Certificate. *Obtaining these credits will be in addition to 42 regular credits at FY B. Tech

** There is an option for End Semester Examination either on respective MOOC platform if any or through the University System.

Note 1: The students aspiring to exit after first year will undergo the study of courses/MOOC prior to commencement of SY B.Tech.

Note 2: Also, Program Specific Industry Internship to be completed by such students before commencement of SY B. Tech.

Shivaji University, Kolhapur
Department of Technology

B. Tech (Chemical Engineering), Exit After Second Year (Diploma in Chemical Engineering)

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs Or Face to face mode Or Self-Study Mode (Program Core Courses)	DC- CHE1	DC- Course I	02	-	-	02	02	30:70	00:00
2.		DC- CHE 2	DC- Course II	02	-	-	02	02	30:70	00:00
3.		DC- CHE 3	DC- Course III	02	-	-	02	02	30:70	00:00
4.	Program Based Internship	DC-PBI	In plant Training	One Month				04	00:00	50:50
				-	-	-	-	10*	300**	100
			Total Hours	06	-	-	06	-	-	-

Note: The Workload against the Diploma Course will be finalised at the Program Level considering the strength of the students seeking for the Diploma.

*Obtaining these credits will be in addition to 85 regular credits up to SY B. Tech. Also in such cases, acquiring certificate after First Year is mandatory.

** There is an option for End Semester Examination either on respective MOOC platform if any or through the University System.

Note 1: The students aspiring to exit after the second year will undergo the study of courses/MOOC prior to the entry in T.Y B.Tech.

Note 2: Also, Program Specific Industry Internship to be completed by such students before commencement of TY B. Tech.

Salient Features of the revision made in line with NEP 2020 Guidelines

(Major means the respective 6 UG Programs available on the Campus at the Department of Technology)

I. **B. Tech Major:** The B. Tech Major requires earning the routine no of credits i.e. 162 (First Two semesters, 21 credits each plus remaining 6 semesters @ 20 Credits=120 credits.), thus the total credits against the Major will be 42+ 120 = 162. Along with that, there will be mandatory audit courses in each semester.

II. **B. Tech Multidisciplinary Minor (MDM):** There will be at least one Multidisciplinary Minor Program for each UG Major. For that sake, extra 14 Credits are mandatory to be earned. The credit split up is as follows: 3 Courses each of 3 credits plus 3 credits against MDM based internship plus 2 credits against MDM based Mini Project.

III. With the aforesaid I & II, every enrolee under a particular UG Degree program, after the successful completion of the same will be the awardee of **B.Tech in Major Degree Title with Multidisciplinary Minor** (Minor Title Mention). *As per the National Credit Framework's mention of verticals, this particular Degree falls under the* ***fourth vertical (Level 6.0).*** Routine fees as decided by the institute will be applicable to all the enrolled students.

As usual if these graduates want to pursue PG, it will be of 2 years duration for them.

IV. The credits distribution for the MDM featured B.Tech Degree in a particular Major Program is as follows: 21+21+20+23+23+23+23+22=176. The SGPA and CGPA calculation will be as per this distribution.

V. **B. Tech (Honors):** This is purely an option to all the students. There will be additional **17** credits out of which **15** credits will be earned through successful completion of 05 courses 3 Credits each **plus 2** credits will be against a course in advanced laboratory practice from the major. (These courses could be preferably through the MOOCs. If so, these MOOCs need to be other than MOOCs of Semester VIII). The courses to be completed throughout four years starting from second year. <u>The interested students have to pay separate fees for the same.</u> *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***fifth vertical (Level 6.0).*** As per NEP 2020 guidelines, such successful candidates will be eligible to enter at the Second Year of PG in the respective specialization.

VI. **B. Tech (Honors with Research):** This is also purely an option to all the students. There will be **17 credits** earned as in case of Honors **plus** there will be **3 more credits** earned against an additional Project Work with success in publishing at least one research paper based on the research topic. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the **sixth vertical (Level 6.0)**.* As per NEP 2020 guidelines, such successful candidates will be eligible to pursue PhD studies **provided the candidate's entire CGPA is 7.5 and above.**

VII. **B. Tech Double Minor:** This is also purely an option to all the students. As mentioned in I & II, the candidate in addition to Multidisciplinary Minor (MDM) along with the Major Degree, may choose to opt for one more minor from the Pool of Specialization Minors (SPM) and earns 14 extra credits against this minor. The successful candidates will be the awardees of B.Tech in Major Degree with Double Minors. (Mention of the Multidisciplinary and Specialization Minors). The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the **seventh vertical (Level 6.0).***

VIII. **Multiple entry and multiple exit feature:**

i. **After First year,** any candidate desiring exit from first year with a claim to be an awardee of certificate course in respective specialization, the enrolee has to complete (in addition to the First Year Credits 42 in number), two, '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). These additional 08 credits to be earned by such aspirants. The details of these courses to be defined by the respective specialization and designed and well narrated to the aspirants. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the **first vertical (Level 4.5).***

ii. **After Second Year,** any candidate desiring to exit from second year with a claim to be an awardee of Diploma in respective specialization, the enrolee must have completed the courses against the Certificate. Moreover, the enrolee has to complete (in addition to the First Year and Second Year Credits 85 in number), three, '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). These additional 10 credits to be earned by such aspirants. The details of these courses to be defined by the respective specialization and designed and well narrated to the aspirants. The interested students have to pay separate fees

for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***second vertical (Level 5.0).***

iii. **After Third Year,** any candidate desiring to exit from third year will be an awardee of Bachelor's Degree in Vocation (B.Voc.) in respective specialization, provided the enrolee must have completed all the courses till T.Y B.Tech (Credits 131 in number). However, such a candidate needs to earn additional 8 credits that include any two '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). The choice of these two theory courses could be from the two courses which are listed against the exit after first year for certificate and three courses which are listed against the exit after S.Y.B.Tech with a claim for Diploma in respective specialization. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***third vertical (Level 5.5)****.*

iv. In case of multiple entry-multiple exit features, to undergo the one-month internship against the certificate and diploma, also in case of all other internships, the selection of skill imparting industry or organization will be preferably from the **AICTE approved SKPs (Skill knowledge Providers)** list.

IX. About the courses through MOOCs: In case of the non-availability of the MOOCs, the students will prepare for the course in a self-study mode under the mentorship of a teacher assigned by the respective Program Coordinator and the Director of the Department of Technology. The students also will have option to choose to appear for the End Semester Examination either by the MOOCs organizers or that by the Shivaji University.

N.B.: All the students will be mandatorily enrolled under the academic bank of credits. As regards, multiple entries, any student from same specialization who desires to join at second, third or Final Year has to have accumulation of those minimum numbers credits in the ABC account till the candidate's last year to that of the entry year.

Note: Also one more feature of this revision is that, besides the curriculum structure, as co-curricular activities, National Cadet Corps (India) i.e. NCC and National Service Scheme i.e. NSS units are available for the interested ones the selections of whom will be as per the respective norms.

Note: All other rules and regulations will be applicable as per Shivaji University, Kolhapur.

Equivalence for the curriculum revision at B. Tech Chemical Engineering

The above curriculum structure is a revised version of the entire B. Tech (Chemical Engineering) Program being conducted by Shivaji University at its Technology Department. A special mention rather feature of this revision is, ***it is aligned with New National Education Policy 2020 guidelines, and also it follows the directives of National Credit Framework.*** This curriculum is to be implemented from June 2023, (Academic year 2023-24).

The Equivalence for the Courses of Chemical Engineering at First Year B Tech Semester I to Final Year B.Tech Semester VIII of pre-revised Program under the faculty of Science and Technology is as follows.

SEM – I

Sr. No.	First Year B. TechSemester I Pre-revised syllabus	First Year B. TechSemester I Revised syllabus	Remark
1.	Engineering Mathematics–I	Engineering Mathematics–I	Content is revised
2.	Engineering Physics (Theory & Lab)	Engineering Physics (Theory & Lab)	Content is revised
3.	Basics of Mechanical Engineering (Theory & Lab)	-	-
4.		Elements of Mechanical and Electronics Engineering (Theory & Lab)	Two courses of the previous version are clubbed.
5.	Engineering Mechanics (Theory & Lab)	Engineering Mechanics (Theory & Lab)	Content is revised
6.	Basic Electronics Engineering (Theory & Lab)	-	Clubbed with other course.
7.	Computer Programming (Lab)	Computer Programming for Engineers (Theory & Lab)	Content is revised
8.	Workshop Practice (Lab)	-	A new course called Design thinking & Innovation is introduced in lieu.
9.	-	Professional Communication (English)-I (Theory)	Content is revised, split in I & II, It is as an audit course.
10.	-	Design Thinking and Innovation-I	Newly introduced audit course.
11.	-	Yoga and Meditation	Newly introduced Credit course.

SEM – II

Sr. No.	First Year B. TechSemester II Pre-revised syllabus	First Year B. TechSemester II Revised syllabus	Remark
1.	Engineering Mathematics–II	Engineering Mathematics–II	Content is revised.
2.	Engineering Chemistry (Theory & Lab)	Engineering Chemistry (Theory & Lab)	Content is revised.
3.	Engineering Graphics (Theory & Lab)	Engineering Graphics (Theory & Lab)	Content is revised.
4.	Basic Civil Engineering (Theory & Lab)	-	-
5.	-	Elements of Civil and Electrical Engineering (Theory & Lab)	Two courses are clubbed with content revision
6.	Basic Electrical Engineering (Theory & Lab)	-	-
7.	-	Electrical-Electronic Components and Devices (Theory & Lab)	Two courses are clubbed with content revision
8.	Programming with Scilab and Matlab (Lab)	-	-
9.	ProfessionalCommunication (Lab)	Professional Communication (English)-II (Theory)	Content is revised, split in I & II, It is as an audit course.
10.	-	Design Thinking and Innovation-II	Newly introduced audit course.
11.	-	Social Internship	Newly introduced audit course
12.	-	Human Rights and Constitution	Newly introduced Credit course.

SEM – III

Sr. No.	Second Year B. Tech Semester III Pre-revised syllabus	Second Year B. Tech Semester III Revised syllabus	Remark
1.	Chemistry-I (Theory & Lab)	Applied Chemistry-I (Physical, Inorganic& Analytical) (Theory & Lab)	Content is revised, title is changed.
2.	Chemical Engineering Thermodynamics-I	Chemical Engineering Thermodynamics	Clubbed in a single course with content revision.
3.	Engineering Mathematics-III	Engineering Mathematics-III	Content is revised.
4.	Chemical Process Calculations	-	Shifted to next semester.
5.	-	Material Science & Engineering	Shifted from next Semester.
6.	Fluid Flow Operations (Theory & Lab)	Fluid Flow Operations (Theory & Lab)	Content is revised
7.	Computer Programming for ChemicalEngineers (Theory & Lab)	-	Taken care in open electives listing.
8.	Analytical Chemistry Laboratory (Lab)	-	Clubbed in other course.
9.	Environmental Studies	Environmental Studies	Modified as per University suggested content. But there are no credits. End Semester Evaluation is Split into two semesters.
10.	Soft Skills Development	Soft Skills Development	Content is revised and made it as a Credit course
11.	-	Mini Project I & Industrial Visit	Newly introduced audit course.

SEM – IV

Sr. No.	Second Year B. Tech Semester IV Pre-revised syllabus	Second Year B. Tech Semester IV Revised syllabus	Remark
1.	Chemistry-II (Theory & Lab)	Applied Chemistry-II (Organic) (Theory & Lab)	Title change with content revision
2.	Chemical Engineering Thermodynamics-II	-	Clubbed in a single course.
3.	Material Science & Technology	-	Shifted to previous semester.
4.	Heat Transfer Operations (Theory & Lab)	Heat Transfer Operations (Theory & Lab)	Content is revised.
5.	Introduction to Performing Arts	Introduction to Performing Arts	Made it as a Credit course with content revision.
6.	Mechanical Operations (Theory & Lab)	Mechanical Operations (Theory & Lab)	Content is revised.
7.	Applied Electrical & Electronics Theory,Laboratory (Lab)	-	Taken care in list of open electives.
8.	-	Inorganic Chemical Technologies	Shift of semester from TY B. Tech
9.	-	Chemical Process Calculations	Shifted from previous semester.
10.	-	Multidisciplinary Minor Course I	As per NEP feature, MDM is introduced.
11.	-	Aptitude Enhancement Course I	Newly introduced audit course.
12.	Mini Project	Mini Project II & Industrial Visit	Newly added audit course.
13.	-	Environmental Studies	Modified as per University suggested content. But there are no credits. End Semester Evaluation is Split into two semesters.

SEM – V

Sr. No.	Second Year B. Tech Semester V Pre-revised syllabus	Second Year B. Tech Semester V Revised syllabus	Remark
1	Thermal Engineering and Plant Utilities	Thermal Engineering and Plant Utilities	Content revision.
2	Inorganic Chemical Technologies	-	Shifted to IV semester.
3	-	Organic Chemical Technologies (Theory & Lab)	Shift of semester with content revision.
4	Safety in Chemical Industry	Safety in Chemical Industry	Content revision.
5	Mass Transfer Operations-I (Theory & Lab)	Mass Transfer-I (Theory & Lab)	Content revision.
6	Case Studies and Seminar	-	Shifted to last semester.
7	Chemical Reaction Engineering-I (Theory & Lab)	Chemical Reaction Engineering (Theory & Lab)	Clubbed in a single course with content revision.
8	Industrial Safety and Hazard Management (Tutorial)	-	Shift of semester.
9	Internship I	-	Shifted to last semester.
10	-	Introduction to Foreign Language	Made it as a Credit course
11	-	Aptitude Enhancement Course II	Newly introduced.
12	-	Mini Project III & Industrial Visit (Lab)	Newly introduced.
13	-	Multidisciplinary Minor Course II	As per NEP feature, MDM is introduced.

SEM – VI

Sr. No.	Second Year B. Tech Semester VI Pre-revised syllabus	Second Year B. Tech Semester VI Revised syllabus	Remark
1	Chemical Reaction Engineering-II (Theory & Lab)	-	Clubbed in a single course with content revision.
2	Organic Chemical Technologies (Theory & Lab)	-	Shifted to previous semester
3	Industrial Pollution Control	-	
4	Mass Transfer Operations-II (Theory & Lab)	Mass Transfer-II (Theory & Lab)	Content revision.
5	Micro Project	Mini Project IV & Industrial Visit	Made it as a Credit course with title change
6	Process Instrumentation and Control (Theory & Lab)	Process Instrumentation and Control (Theory & Lab)	Content revision.
7	Industrial Visits	-	Clubbed with mini project.
8	-	Chemical Equipment & Plant Design (Theory & Lab)	Content revision with title change.
9	-	Elective I	Shift of semesters.
10	-	Open Elective I	Newly added.
11	-	Industrial Safety, Health & Hazard Management (Tutorial)	Shift of semester with content revision.
12	-	Design Thinking & Innovation -III	Newly introduced.
13	-	Aptitude Enhancement Course III	Newly introduced.
14	-	Multidisciplinary Minor Course III	As per NEP feature, MDM is introduced.

SEM – VII

Sr. No.	Second Year B. Tech Semester VII Pre-revised syllabus	Second Year B. TechSemester VII Revised syllabus	Remark
1	Biochemical Engineering	-	Well taken care in Program Core Elective Pool.
2	Elective-I	-	Shift of semester.
	-	Elective-II	Added a Program Core Elective.
3	Industrial Economics and Management	-	Well taken care in Open Elective Pool.
4	Process Equipment Design (Theory & Lab)	-	Title is changed with semester shift.
5	Major Project-Phase I	Major Project Work (Lab)	Content revision.
6	Process Modeling and Simulation (Theory & Lab)	Process Modeling and Simulation (Theory & Lab)	Content Revision.
7	Internship II	-	Shifted to last semester.
8	Comprehensive Tests	-	Dropped out on account of reduction in course credits.
9	Audit Course V Introduction to Indian Constitution	Green Technology & Sustainability	Newly added Credit course.
10	-	Piping & Instrumentation: Design & Drawing (Theory & Lab)	Content revision with shift of semester.
11	-	Transport Phenomena	Content revision with shift of semester.
12	-	Open Elective- II	Newly introduced.
13	-	Major Project Lab	Content revision.
14	-	MDM based Industry Internship	Newly introduced as a part of MDM

* The MDM based industry Internship to be completed during winter/summer vacation slots 4th Semester onwards, before 7th Semester commencement.

SEM – VIII

Sr. No.	Second Year B. Tech Semester VIII Pre-revised syllabus	Second Year B. Tech Semester VIII Revised syllabus	Remark
1	Energy Resources and Utilization	-	Well taken care in Program Elective Pool.
2	Elective-II (Open Elective)	Program Elective –III Preferably on MOOC*	Newly introduced.
3	Plant Design and Drawing (Lab)	Plant Design & Case Studies (Online)*	Content revision and mode change to online.
4	Special Chemical Technologies	-	Dropped out due to reduction in credits.
5	Transport Phenomena	-	Shifted to previous semester with content revision.
6	Major Project-Phase II	-	Shifted to previous semester and clubbed in one sem.
7	Industrial Visits	-	Clubbed with Mini Projects.
8	Process Economics and Project Engineering	-	Well taken care under Open Elective Pool.
9	Piping & Instrumentation Design and Drawing	-	Shifted to previous semester.
10	Seminar	Plant Design & Case Studies (Online)	Mode is changed.
11	Audit Course VI Professional Ethics	MOOC III (Professional Ethics)	Mode is changed and made it as a Credit Course
12	-	Entire Semester Industrial Internship (Follow up by the Department)	Newly introduced.
13	-	Program Elective –IV Preferably on MOOC *	Newly introduced. Online mode.
14	-	Program Specific IKS	Newly introduced (Online Mode)
15	-	MDM Based Mini Project*	Newly introduced as a part of MDM

*MDM based Mini Project to be completed during 4th Semester to 8th Semester.

Shivaji University
Vidyanagar, Kolhapur - 416 004, Maharashtra.

Department of Technology

As per NEP2020 guidelines

MDM Featured First Year B. Tech (All Programs), Detailed Curriculum w.e.f 2023-24

A. Definition of Credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hr. Practical(Lab) per week	1 Credit

B. Credits for award of Degrees

a) A total of **176 credits** are required for all the students to get entitled for **Under Graduate Degree in Engineering (Major) with a Multidisciplinary Minor (MDM).** This feature is the **fourth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech in Major Degree Title with Multidisciplinary Minor. The routine fees will be charged for award of the degree with multidisciplinary minor**.** There will be a pool of multidisciplinary minors for each major UG Program.

b) A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree** with **Honors,** if the candidate earns an **additional 17 credits.** Out of these 17 credits, 15 credits will be against 5 different theory courses (3 credits each) pertaining to the Major Discipline while 2 credits will be against an advance laboratory practice in the respective discipline of studies. These theory credits could be acquired preferably through MOOCs the title of which will be well declared to the aspirants. This particular feature is the **fifth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech Honors in Major Degree and Multidisciplinary Minor. For this option of Honors, the interested candidates have to pay the separate fees as decided by the institute.

c) A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree having an option of Honors with Research**. For the same, the candidate, in addition to those **17** credits allotted to the Honors, has to earn an **additional of 3 credits against an extra research project.** (As regards this extra project work, it is mandatory to be successful in publishing at least one research paper based on the research topic.) This feature is the **sixth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech Honors with Research in Major Degree and Multidisciplinary Minor. The interested candidates for this option will have to pay the separate fees as decided by the institute.

d) A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree** with **additional Specialization Minor,** if the candidate earns an **additional 14 credits against one more minor from the specialization.** These will be a separate pool of the specialization minors for choice. (The courses under minors could be through MOOCs also). This is the case of double minors and it is the **seventh vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech in Major Degree with double minors. (Multidisciplinary Minor and Specialization minor.) For this option of additional specialization minor, the interested candidates will have to pay the separate fees as decided by the institute.

C. Component wise distribution of credits

(Expected range of credits as per AICTE & NEP2020 guidelines is 160-176)

All the Programs will have the details of curriculum components distribution in their curriculum document for SY B.Tech and Onwards.

D. Course code and Definition

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
MDM	Multidisciplinary Minor
SPM	Specialization Minor
ISE	In Semester Examination
ESE	End Semester Examination
IE	Internal Evaluation
EE	External Evaluation
BSC	Basic Science Course
ESC	Engineering Science Course
HSMEC	Humanities and Social Sciences including Management , Environmental Course
PCC	Professional Core Course
PEC	Professional Elective Course
OEC	Open Elective Courses
VSEC	Vocational and Skill Enhancement Courses
IKS	Indian Knowledge System
AEC	Ability Enhancement Course
VEC	Value Education Courses
MAC	Mandatory Audit Course
PSI	Project, Seminar, Internship
PBL	Project Based Learning
PBL, PBI	Project Based Learning Program Based Internship
MN , HN, HNR	Minor , Honors, Honors with Research

CC, DC	Certificate Course, Diploma Course
CHE, CE,CST	Chemical Engineering, Civil Engineering, Computer Science and Technology
ETC, FT, ME	Electronics and Telecommunication Engineering, Mechanical Engineering, Food Technology

Mandatory Induction Program at FY B. Tech First Term Commencement
(3 Weeks Duration)

a) Physical activity
b) Creative Arts
c) Universal Human Values
d) Literary
e) Proficiency Modules
f) Lectures by Eminent People
g) Visits to local Areas
h) Familiarization to Dept./Branch & Innovations

Note: On the campus, besides the curriculum structure, as co-curricular activities, National Cadet Corps (India) i.e. NCC is available for the interested & selected students while National Service Scheme i.e. NSS unit is for all the volunteer students who will contribute as and when necessarily called for the services.

E. Academic Rules and Regulations for MDM featured Four-Year B. Tech. Degree

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16.	R.B.T. 16	Showing & Supplying Photocopy of the Evaluated Semester End Examination Answer Paper, Re-Evaluation, And Period of Retention
17.	R.B.T. 17	Change of Branch
18.	R.B.T. 18	Disciplines and Conduct
19.	R.B.T. 19	Details regarding B.Tech Major, Multidisciplinary Minor, Honors, Honors with Research, Specialization Minor and Multiple entry, multiple exit features

Glossary

B. Tech.: Bachelor of Technology, an Under Graduate Degree awarded from the Shivaji University, Kolhapur

Director: Director, Department of Technology, Shivaji University, Kolhapur

Program: The specialization in B.Tech (Particular Major Branch)

Program Head: The Head of the Specialized Branch of B.Tech studies

DC: Department Committee

DEC: Departmental Examination Coordinator

Semester: The academic year will be divided into two regular semesters of approximately 20 weeks' duration each. Typically, the odd semester will be from the first week of July to last week of November while the even semester will be from the first week of January to the last week of May.

This will include the period of academic delivery (14 to 15 weeks), Internal Evaluation (CIE) i.e. In Semester Examination and Assignments, End Semester Examination (ESE) assessment and declaration of results.

R.B.T.: Rule B.Tech

Course: Subject

Course Coordinator: Subject teacher

Course Credit: Weighted sum of the number of Lecture hours (L), Tutorial hours (T), and Practical hours (P) associated with the course.

Credits Earned: The sum of course credits for credit courses in which a student has passed.

Grade: Assessment of the student's performance in a course indicated by the letters, “AA”, “AB”, “BB”, “BC”, “CC”, “CD”, “DD”, “FF”, “XX”, “ABSENT”, “PP”, “NP”.

Grade Point: Number equivalent of the letter grades given by 10, 9, 8, 7, 6, 5, 4 corresponding to grades “AA”, “AB”, “BB”, “BC”, “CC”, “CD”, “DD” respectively. “FF” and “XX” carry zero grade points.

Instructor: Member of faculty who will be assigned to teach a specific course.

Semester Grade Points: The sum of the products of credits and Grade Points for each course registered by a student in a semester.

SGPA: Semester Grade Point Average

CGPA: Cumulative Grade Point Average

ATKT: Allowed to Keep Terms.

R.B.T. 1 Admission:

At the Department of Technology, Shivaji University, candidates are admitted to all the available specialized B. Tech Programs according to norms and conditions prescribed as per AICTE, New Delhi and DTE, Mumbai, Maharashtra.

R.B.T. 2 Award of Degree:

Following rules prevail for the award of degree:

1. B. Tech Degree will be awarded to the student, who has registered and earned all the credits of prescribed courses under the general departmental requirements.
2. In addition to the credit requirement prescribed above for the Degree award, each student will have to complete the requirements of Audit Course (AC) during the programme. All the students will receive certification as PP *(for Passed),* and NP *(for not passed)* in AC, in the mark sheet. While obtaining certification as PP is a mandatory requirement for the Degree award of a student, this will not be taken into account for computing the final Cumulative Grade Point Average.
3. A student has obtained CGPA ≥ 4.5.
4. A student has paid all the institute dues and satisfied all the requirements prescribed.

5. A student has no case of indiscipline pending against him/her.
6. University authorities will recommend the award of B. Tech. Degree to a student who is declared to be eligible and satisfies the said norms.

R.B.T. 3 Attendance Rule:

All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other such contingencies, the attendance requirement will be a minimum of 75% of the classes actually held. A student with less than 75% attendance in a course during the semester, in lectures, tutorials and laboratories taken together (as applicable), will be awarded an 'XX' grade in that course irrespective of his/her performance in the tests.

Attendance record will be maintained based upon roll calls (or any equivalent operation) in every scheduled lecture, tutorial and practical class. The course coordinator will maintain and consolidate attendance record for the course (lectures, tutorials and laboratories together, as applicable).

R.B.T. 4 Academic Progress Rules (ATKT Rules)

1. If a candidate fails in any number of courses (subject heads) of Semester I, will be allowed to proceed to Semester II.
2. A candidate, who earns 50% of total credits of Level 4.5 (FY B.Tech), will be allowed to keep terms in Level 5.0 (SY B.Tech).
3. If a candidate fails in any number of courses (subject heads) of Semester III, will be allowed to proceed to Semester IV.
4. A candidate, who earns 50% of total credits of Level 5.0 (SY B.Tech), will be allowed to keep terms in Level 5.5 (TY B.Tech).
5. No candidate will be allowed to proceed to Semester V (TY B.Tech), unless candidate has passed in all courses of Level 4.5 (FY B.Tech).
6. If a candidate fails in any number of courses (subject heads) of Semester V, will be allowed to proceed to Semester VI.
7. A candidate, who earns 50% of total credits of Level 5.5 (TY B.Tech), will be allowed to keep terms in Level 6.0 (Final Year B.Tech).
8. No candidate will be allowed to proceed to Semester VII (Final Year B.Tech), unless candidate has passed in all courses of Level 5.0 (SY B.Tech).

9. If a candidate fails in any number of courses (subject heads) of Semester VII, shall be allowed to proceed to Semester VIII.

10. In case, if the rules of any Apex body differ from these rules, then the rules of that apex body will be applicable. However under the National Education Policy, the rules extended by University from time to time regarding ATKT will be applicable.

11. While considering the passing heads, for a year (both the semesters), 45 % aggregate score is mandatory failing to which the same will be considered as one more passing head. Any such student needs to improve the score in either of the courses to maintain 45 % aggregate for the year through appearing in re-examination or repeated examination. In such cases, the award of grade for calculation of SGPA and CGPA will be as per the table no.3 from clause R.B.T 12 with the consideration of one grade penalty as mentioned under the clause R.B.T 15, f.

12. A student who has obtained 'FF' grade in ESE of a regular semester and has obtained 'FF' grade in 2nd attempt of ESE will be eligible to choose one of the two options below to clear the backlog:

i. Re-registration for the next regular semester course whenever that course is offered.

ii. Application for Repeated Examination.

13. A student who has been detained in a regular semester and obtained 'XX' grade can Re-register for the next regular semester whenever it is offered.

14. The maximum duration for getting B. Tech. degree for students admitted in the first semester of U.G. program will be 16 semesters (eight academic years) while for lateral entry students admitted in the third semester will be 14 semesters (seven academic years) from their date of admission. The maximum duration of the program includes the period of withdrawal, absence and different kinds of leaves permissible to a student but excludes the period of rustication of a student from the department.

15. If a student is unable to gain all credits of first year in three years from the date of the admission, then the candidate will be declared as "Not Fit for Engineering" leading to discontinuation of candidate's registration with the department.

16. Depending upon the academic progress of a student, department may take a decision regarding continuation or discontinuation of candidate's registration with the institute.

R.B.T. 5 Academic Flexibility

1. Flexibility in deciding curriculum structure and contents of curriculum with reasonable frequency for changes in the same.
2. Continuous assessment of student's performance with newly adopted NEP 2020 Credit system based on Award of Grade.
3. Credits are quite simply a means of attaching relative values to courses different components. These are a currency of learning, and in general regarded as a measure of the time typically required to achieve a given curricular outcome.
4. All courses (year-wise) under each program/discipline are unitized

R.B.T. 6 Credit system:

Education at the Institute is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to candidate's ability or convenience, subject to fulfilling minimum requirements for continuation.

A student's performance/progress is measured by the number of credits that the candidate has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the program. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. All programs are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

R.B.T. 7 Features of Credit System at Department of Technology, Shivaji University, Kolhapur:

Every course is allotted credits based on its academic importance/weightage.

1. All courses may not have same credits.
2. 21 credits / semester for First Year B.Tech while 20 credits /semester for remaining 6 semesters. Thus there are 162 credits against the B.Tech Major plus additional 14 credits against the chosen Multidisciplinary Minor. So the total credits of this Multidisciplinary Minor (MDM) Featured B.Tech Degree is 176. The particular Degree falls under the **fourth vertical** (Level 6.0) as per the National Credit Framework.

3. Absolute grading System with 7 passing Grades viz. AA, AB, BB, BC, CC, CD, DD and FF for failure.
4. Standardization of courses; with few exceptional cases, each course is of 6 units.
5. In Semester Examination (ISE) and End Semester Examination (ESE), both having (30:70) weightage in the student's performance in course work/laboratory work and other activities. A student's performance in a subject will be judged by taking into account the results of In Semester Examination and End Semester Examination together. Students must score 40% marks in ESE irrespective of the ISE marks.

   (Note: The ISE will be conducted as In Semester Exam and assignments throughout the semester on dates announced in advance by the department and its results to be made known to the students from time to time. However, the dates for the ESE will be fixed at the University level.)
6. Continuous internal evaluation consists of 'In Semester Examination' of 20 marks and assignment of 10 marks handled by Department of Technology and setting of question papers should be done by course coordinator. Assignments may be of varied nature for each course based on the need of the course coordinator.
7. End Semester Examination (ESE) to be conducted by the Department of Technology however setting of question papers will be as per University Rules. The ESE will include a written examination for theory courses and practical/design/drawing examination with built-in oral part for laboratory/ design/drawing courses.

   7.1 End Semester Examination (ESE) of the courses offered for the MOOCs will be conducted by MOOC offering Institute. The credits earned by the students will be communicated to the University and to be converted as per the weightage of the said course in the structure. Student may get failure in the said MOOC or the examination may get delayed by the MOOC offering institute, in either cases, ESE of the said course will be conducted as per the University rules.
8. In case the candidate is absent on the scheduled ISE, request for separate In Semester Examination for the students representing in co-curricular, extracurricular activities or on medical grounds will only be considered. On receipt of application from the student, the DC will take decision for the conduct of the In Semester Examination.

9. Care will be taken to ensure that the total numbers of days for academic work are ≥180 per year.
10. Academic schedule prescribed will be strictly adhered and applicable to all the UG Programs.

R.B.T. 8 Course credits assignment:

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weightage is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

Sample Example: Course: Fluid Flow Operations: 05 credits (3-1-2)

The credits indicated for this course are computed as follows:

3 hours/week lectures = 3 credits

1 hours/week tutorial = 1 credit

2 hours/week practical = 2 × 0.5 = 1 credit

Also, (3-1-2) **5** credit course = (**3** hr. Lectures + **1** hr. Tutorial + **2** hr. Practical) per week

= **6** contact hours per week = **5** credits

R.B.T. 9 Detailed Evaluation Scheme:

1. Out of total 100% theory weightage, 30% weightage is allotted for In Semester Examination (ISE). Appearing for ISE is must and student must submit the assignments to become eligible for End Semester Examination (ESE) of respective course.

ISE (30% weightage) includes:

a. In Semester Examination of 20 Marks of one Hour
b. Assignments of 10 Marks during entire semester

2. For the End Semester Examination (ESE), 70 marks question paper will be set in which student must secure 40% (28 Marks out of 70) as university examination pass head and candidate must be appeared for ISE to become eligible for ESE of respective course.

3. Final theory marks (out of 100) will be the addition of ISE (30 Marks) and ESE (70Marks).

4. Final laboratory letter grade will be awarded (100%) will be the addition of IE (50%) and EE (50%) as applicable to the course.

5. End Semester Examination (ESE) for laboratory consists of internal evaluation (IE) and External Evaluation (EE). Nature of the evaluation as viva-voce or practical will be as applicable to the course which will be well mentioned in the course description.

6. There will be no EE for laboratory courses of the First Year. The entire assessment of a student will be based on IE 100% weightage and a minimum performance of 40% in IE will be required to obtain the passing grade. IE of laboratory work will be based on turn-by-turn supervision of the student's work and the quality of the candidate's work as prescribed through laboratory journals and the candidate's performance in oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IE of the concerned course. Non submission of the term work and the IE score below 40% marks will lead to term not grant (TNG). The TNG cases must be promptly communicated by the course teacher to the examination cell of the Department of Technology. The Departmental Examination Coordinator (DEC) will communicate the same to the office of the Director, Board of Examinations and Evaluation, Shivaji University, Kolhapur for further actions.

7. The assessment of laboratory courses from the 3rd semester onwards will be carried out in two parts.

i. ISE of laboratory will be based on turn-by-turn supervision of the student's work and the quality of candidate's work as prescribed through laboratory journals and the performance in oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IE of the concerned course. Non submission of IE will lead to term not grant (TNG).

ii. ESE of laboratory will be based on performing an experiment followed by an oral examination or a written examination.

iii. The relative weightage for IE and EE for assessment of laboratory courses will be 50% and 50% respectively from second year onwards and a minimum

performance of 40% in both IE and EE separately will be required to obtain the passing grade.

iv. EE for laboratory course will normally be held one week before the ESE for theory courses and will be conducted by a panel of examiners consisting of external and internal examiner. This activity will be coordinated by Department Examination Coordinator (DEC) in consultation with Coordinator of the respective Program.

8. A student failed in EE of a laboratory course in a regular semester will be eligible to appear for examination conducted along with ESE of laboratory courses of the subsequent semester. Such examination will be fairly comprehensive (generally of 3 hours similar to EE i.e. External Examinations) to properly judge candidate's practical skill and theoretical knowledge for that laboratory course. The candidate will suffer a grade penalty as per Table 3.

9. Assessment of Seminar, Mini-project, Major Project, internship etc.:

i. The Seminar/Project report must be submitted by the prescribed date usually two weeks before the end of academic session of the semester.

ii. It is desirable that the topics for seminar/project be assigned by the end of previous semester.

iii. The seminar report and the presentation of seminar will be evaluated by panel of three departmental faculty members (decided by Branch Coordinator).

iv. The mini-project will be evaluated jointly by a panel of three Internal Examiners.

v. The report on field training will be evaluated by a panel of three Internal Examiners.

vi. The assessment of B. Tech major project work will be carried out in two phases as follows:

For IE, there will be

a) Departmental Committee (To approve synopsis submission based on seminar)

b) Project work assessment by Guide

Departmental Committee constitution will be as follow:

(1) Director- Chairman

(2) Branch Coordinator from respective branch – member

(3) Senior faculty from respective branch – member

(4) Guide/Course Coordinator- member

EE consists of progress seminar and presentation to be evaluated by panel of internal and external examiners. The process will be as below:

a) Project work assessment by Guide

b) Report submission based on seminar which will be evaluated by Departmental Committee

c) EE (Viva-voce and presentations): Evaluation by panel of external and internal examiners.

vii. The evaluation of industrial internship: Students will undergo industrial internship for one semester (8^{th} Semester). Students have to prepare a report related to the work carried out during this internship. This may include study of the new science/technology, applications of the technology/development of the technology and its implementation /designing/obtaining practical or numerical solution etc. By the Program, there will random and surprise visits to the place of internship so as to record the attendance and performance of the interns. The evaluation will be as per the university examination similar to the project evaluation.

10. The duration of End Semester Examination will be 2.5 hrs. however there might be few courses having duration of End Semester Examination as 3 hrs.

11. In respect of IE and Laboratory work, a target date will be fixed for the completion of each sheet, job, Project, experiment or assignment and the same either complete or incomplete will be collected on the target date and assessed immediately at the respective departments by the concerned teachers and % marks (or grades) will be submitted to the Co-ordinator. The Co-ordinator of the Department of Technology will communicate this % of marks (or grades) to the University.

12. In respect of IE of the audit (Non Credit) courses, the respective course in charge will organise and plan activities for the conduct of the evaluation. Preferably, the teacher will announce 5 assignments each one carrying 10 marks. So based on the assignments submitted by the candidate, there will be evaluation out of 50 marks.

The passing is for 20 marks. The passing is mandatory for every student. However, the course in charge will communicate to the examination section whether the student has passed the audit course or not. As mentioned earlier, in case of audit courses, the result will appear over the mark sheet and certificate as either PP for passed and NP for not passed.

R.B.T. 10 Earning credits:

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade (≥40% minimum grade DD), the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that the candidate has earned and by the weighted grade point average.

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

As regards earning credits against certificate or Diploma award (exit after the first year and the second respectively) also through Honors, Honors with Research, Specialization Minors, all these are the optional for the interested ones. The earning of credits for certificate and diploma is mandatory to take place immediately within 45 days from the last day of respective even End Semester Examination. In case of the credits against the Honors, Honors with Research, Specialization Minor, interested candidates need to plan for the same from SY B. Tech to Final Year B. Tech completion. As per the list of interested students to opt for these features, the Department of Technology will plan the activities regarding conduct/mentoring of the course/s by such students. Further from time to time, the Department will communicate the details of such students to the University Examination section. The students will have their respective End Semester Examination in continuation to the End Semester Examination of the Majors.

The details regarding credits assigned against all these features are elaborated in R.B.T. 19.

R.B.T. 11 CGPA Improvement Policy for award of degree:

A student getting CGPA ≤ 4.50 with grade 'DD' in any course or grade 'FF' in any course will have the possibility to repeat one or more 'DD' graded courses along with the failed courses, /are being offered in a semester.

An opportunity will be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.50, to improve his/her grade by allowing him/her to appear for SEE of maximum two theory courses of seventh and eighth semester.

R.B.T. 12 Evaluation System:

1. **Semester Grade Point Average (SGPA)**

$$= \frac{\sum(\textbf{Course credits in passed courses} \times \textbf{Earned Credits})}{\sum(\textbf{Course credits in registered courses})}$$

2. **Cumulative Grade Point Average (CGPA)**

$$= \frac{\sum(\textbf{Course credits in passed courses} \times \textbf{Earned Credits})\textbf{of all Semesters}}{\sum(\textbf{Course credits in registered courses})}$$

   i. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. I to Sem. VIII for regular students.

   ii. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. III to Sem. VIII for lateral entry students.

3. At the end of B. Tech Program, student will be placed in any one of the divisions as detailed below:

   Ist Division with distinction : CGPA $\geq$ 7.5 and above

   Ist Division : CGPA $\geq$ 6.0 and < 7.5

   IInd Division : CGPA $\geq$ 5.5 and < 6.0

New gradation suggested as follows.

Table 1

Grade Points	Equivalent Range
5.5	55%
6.0	60%
6.5	65%
7.0	70%
7.5	75%

Conversion of CGPA to percentage marks for CGPA **≥ 4.5** can be obtained using equation.

Percentage marks = (CGPA x 10)

An example of these calculations is given below (It's a sample calculation):

Typical academic performance calculations - I semester

Table 2

Course no.	Course credits	Grade awarded	Earned credits	Grade points	Points secured
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6 (col4 *col5)
MALXXX	5	CC	5	6	30
CSLXXX	4	CD	4	5	20
PHLXXX	4	AA	4	10	40
PHPXXX	2	BB	2	8	16
MELXXX	4	FF	0	0	00
TTNXXX	2	AB	2	9	18
Total	21		17	38	124

1. Total Points earned for this semester = 124

$$\textbf{Semester Grade Point Average (SGPA)} = \frac{124}{21} = 5.90$$

2. Cumulative Grade Point Average (CGPA) =

Cumulative points earned in all passed courses = 124 (past semesters) + 124 (this semester) = 248

Cumulative earned credits = 23 (past semesters) + 21 (this sem.) = 44

$$\textbf{Cumulative Grade Point Average (CGPA)} = \frac{\Sigma(124+124)}{\Sigma(23+21)} = 5.63$$

Table 3: System of Evaluation

Grade	Grade Points	Marks obtained (%)			Description of Performance
		Regular Semester	Re-examination	Repeated Examination	
AA	10	90-100	--	--	Outstanding
AB	09	80-89	90-100	--	Excellent
BB	08	70-79	80-89	90-100	Very Good
BC	07	60-69	70-79	80-89	Good
CC	06	50-59	60-69	70-79	Fair
CD	05	45-49	50-59	60-69	Average
DD	04	40-44	40-49	40-59	Poor
DD$	04	Below 40	Below 40	Below 40	Poor (Subject to Application of Ordinance 96)
FF	00	Below 40	Below 40	Below 40	Fail
XX	--	--	--	--	Detained
ABSENT	--	--	--	--	Absent

PP	--	--	--	--	Passed (Audit Course)
NP	--	--	--	--	Not Passed (Audit Course)

Note: An equivalent certificate of CGPA to percentage of marks will be provided to student on candidate's demand after remitting prescribed fees by Shivaji University.

R.B.T. 13 Entry of Students from previous credit to new Credit Pattern

A student of Department of Technology, Shivaji University, Kolhapur admitted before academic year 2023-24 and having backlogs such student will clear back log subjects as per the equivalence given by the respective program.

R.B.T. 14 Audit Courses:

Additional courses are included as audit courses in each semester. While the performance of the student in audit courses will be included in the Grade Card, these grades do not contribute to SGPA or CGPA of the concerned student. However the passing in Audit Courses is mandatory for every student.

R.B.T. 15 Awards of Grades for Re-Examination:

a) A student who has obtained grade 'FF' in regular semester will be eligible to appear for re-examination conducted before the commencement of the next regular semester.
b) In such cases In Semester Examination performance of a student will not be wiped out.
c) A student will apply for re-examination before the last date of such application and will appear for re-examination.
d) 70% weightage similar to ESE will be given to re-examination.
e) A student who is eligible for re-examination but remains absent for re-examination will be given grade 'Absent'.
f) A student will be awarded a grade between 'AB' to 'DD', or 'FF' or 'XX' as given in Table 3 depending upon the cumulative marks obtained by him/her in IE and Re-examination of ESE. Here a student has to suffer a grade penalty by accepting one grade lower as compared with the regular grades.

R.B.T. 16 Showing Evaluated Semester End Examination Answer Papers, Re-evaluation, and applying for revaluation:

The evaluated answer book will be shown to the student immediately as per the timetable prepared by the exam cell of Department of Technology before the declaration of result.

The grievances regarding the incorrect total and assessment of the not assed questions will be done by the respective faculty. A student having doubt regarding the grade declared in a course can apply for the photocopy of the answer book by remitting the prescribed fee as specified; a student can also apply for rechecking of his/her SEE answer book as per Shivaji University rules. There is no provision for showing of evaluated answer book, photocopy, rechecking and revaluation of the re-examination.

R.B.T. 17 Change of Branch:

Students will be eligible to apply for Change of Branch after completing the first two semesters. The change of branch will be permitted strictly on merit basis subject to the rules and regulations prescribed by Directorate of Technical Education, Maharashtra State/Admission Regulatory authority, Maharashtra State time to time.

R.B.T. 18 Disciplines and Conduct:

i. Every student will be required to observe discipline and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the Department.

ii. Any act of indiscipline of a student reported to the Department will be referred as per Shivaji University norms.

iii. If a student while studying in the institute is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government, the candidate will be liable to be expelled from the Department without any notice.

iv. If a student is involved in any kind of ragging, the student will be liable for strict action as per Maharashtra anti-ragging act 1999, which is in effect from 15th May 1999.

v. If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission will be cancelled and the candidate will be expelled from the institute and fees paid will be forfeited.

vi. Student once admitted in the Department of Technology will follow instructions issued from time to time.

vii. If a student is found guilty of malpractice in examinations then the candidate will be punished as per the recommendations of the Shivaji University, Kolhapur.

viii. Every admitted student will be issued photo identification (ID) card which must be retained by the student while the candidate is registered at Department of Technology. The student must have valid ID card with him/her while in the Department of Technology.

ix. Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another student will be subjected to disciplinary action.

x. The valid ID card must be presented for identification purpose as and when demanded by authorities. Any student refusing to provide an ID card will be subjected to disciplinary action.

R.B.T. 19 Details regarding B. Tech Major, Multidisciplinary Minor, Honors, Honors with Research, Specialization Minor and Multiple entry, multiple exit features:

(Major means the respective 6 UG Programs available on the Campus at the Department of Technology)

I. **B. Tech Major:** The B. Tech Major requires earning the routine no of credits i.e. 162 (First Two semesters, 21 credits each plus remaining 6 semesters @ 20 Credits=120 credits.), thus the total credits against the Major will be 42+ 120 = 162. Along with that, there will be mandatory audit courses in each semester.

II. **B. Tech Multidisciplinary Minor (MDM):** There will be at least one Multidisciplinary Minor Program for each UG Major. For that sake, extra 14 Credits are mandatory to be earned. The credit split up is as follows: 3 Courses each of 3 credits plus 3 credits against MDM based internship plus 2 credits against MDM based Mini Project.

III. With the aforesaid I & II, every enrolee under a particular UG Degree program, after the successful completion of the same will be the awardee of **B.Tech in Major Degree Title with Multidisciplinary Minor** (Minor Title Mention). *As per the National Credit Framework's mention of verticals, this particular Degree falls under the* ***fourth vertical (Level 6.0).*** Routine fees as decided by the institute will be applicable to all the enrolled students.

As usual if these graduates want to pursue PG, it will be of 2 years duration for them.

IV. The credits distribution for the MDM featured B.Tech Degree in a particular Major Program is as follows: 21+21+20+23+23+23+23+22=176. The SGPA and CGPA calculation will be as per this distribution.

V. **B. Tech (Honors):** This is purely an option to all the students. There will be additional **17** credits out of which **15** credits will be earned through successful completion of 05 courses 3 Credits each **plus 2** credits will be against a course in advanced laboratory practice from the major. (These courses could be preferably through the MOOCs. If so, these MOOCs need to be other than MOOCs of Semester VIII). The courses to be completed throughout four years starting from second year. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the **fifth vertical (Level 6.0).*** As per NEP 2020 guidelines, such successful candidates will be eligible to enter at the Second Year of PG in the respective specialization.

VI. **B. Tech (Honors with Research):** This is also purely an option to all the students. There will be **17 credits** earned as in case of Honors **plus** there will be **3 more credits** earned against an additional Project Work with success in publishing at least one research paper based on the research topic. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the **sixth vertical (Level 6.0)**.* As per NEP 2020 guidelines, such successful candidates will be eligible to pursue PhD studies **provided the candidate's entire CGPA is 7.5 and above.**

VII. **B. Tech Double Minor:** This is also purely an option to all the students. As mentioned in I & II, the candidate in addition to Multidisciplinary Minor (MDM) along with the Major Degree, may choose to opt for one more minor from the Pool of Specialization Minors (SPM) and earns 14 extra credits against this minor. The successful candidates will be the awardees of B.Tech in Major Degree with Double Minors. (Mention of the Multidisciplinary and Specialization Minors). The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the **seventh vertical (Level 6.0)**.*

VIII. **Multiple entry and multiple exit feature:**

i. **After First year,** any candidate desiring exit from first year with a claim to be an awardee of certificate course in respective specialization, the enrolee has to complete (in addition to the First Year Credits 42 in number), two, '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). These additional 08 credits to be earned by such aspirants. The details of these courses to be defined by

the respective specialization and designed and well narrated to the aspirants. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***first vertical (Level 4.5)****.*

ii. **After Second Year,** any candidate desiring to exit from second year with a claim to be an awardee of Diploma in respective specialization, the enrolee must have completed the courses against the Certificate. Moreover, the enrolee has to complete (in addition to the First Year and Second Year Credits 85 in number), three, '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). These additional 10 credits to be earned by such aspirants. The details of these courses to be defined by the respective specialization and designed and well narrated to the aspirants. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***second vertical (Level 5.0)****.*

iii. **After Third Year,** any candidate desiring to exit from third year will be an awardee of Bachelor's Degree in Vocation (B.Voc.) in respective specialization, provided the enrolee must have completed all the courses till T.Y B.Tech (Credits 131 in number). However, such a candidate needs to earn additional 8 credits that include any two '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). The choice of these two theory courses could be from the two courses which are listed against the exit after first year for certificate and three courses which are listed against the exit after S.Y.B.Tech with a claim for Diploma in respective specialization. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***third vertical (Level 5.5)****.*

iv. In case of multiple entry-multiple exit features, to undergo the one-month internship against the certificate and diploma, also in case of all other internships, the selection of skill imparting industry or organisation will be preferably from the **AICTE approved SKPs (Skill knowledge Providers)** list.

IX. About the courses through MOOCs: In case of the non-availability of the MOOCs, the students will prepare for the course in a self-study mode under the mentorship of a teacher assigned by the respective Program Coordinator and the Director of the Department of Technology. The students also will have option to choose to appear for

the End Semester Examination either by the MOOCs organisers or that by the Shivaji University.

N.B.: All the students will be mandatorily enrolled under the academic bank of credits. As regards, multiple entries, any student from same specialization who desires to join at second, third or Final Year has to have accumulation of those minimum numbers credits in the ABC account till the candidate's last year to that of the entry year.

Note: Also one more feature of this revision is that, besides the curriculum structure, as co-curricular activities, National Cadet Corps (India) i.e. NCC and National Service Scheme i.e. NSS units are available for the interested ones the selections of whom will be as per the respective norms.

Note: All other rules and regulations will be applicable as per Shivaji University, Kolhapur.

F. Engineering Graduate Attributes

1. Domain specific Engineering Knowledge
2. Problem Analysis Ability
3. Acquiring Skills that enable them to Design & Develop Solutions to the Problems
4. Capacity to investigate Complex Problems
5. Familiarity of using Modern Tools
6. Understanding Engineer's role and connectivity towards Society
7. Awareness about Environment & Sustainability
8. Practicing ethics and values
9. Ability to work as an Individual & in a Team also
10. Acquiring Communication skills
11. Becoming well verse with task of Project management & Finance aspects
12. Developing Lifelong Learning attitude

(Note: For every program, there are its own Program Educational Objectives (PEOs) while there are 12 Program Outcomes (POs) which are aligned with these graduate attributes for the engineers.)

G. Fees structure for Multiple Entry/Exit, Minor, Honors, Honors with Research

Sr. No.	Component	Total additional Credits	Fees to be charged* INR
1.	Exit After FY B.Tech claiming Certification in respective specialization	08	8000/-
2.	Exit After SY B.Tech claiming Diploma in respective specialization	10	10000/-
3.	Exit After TY B.Tech claiming Bachelor's Degree in Vocation (B.Voc.) in respective specialization.	08	8000/-
4.	B.Tech Double minor (Only for Specialization Minor)	14	14000/-
5.	B.Tech (Honors)	17	17000/-
6.	B.Tech (Honor with Research)	20	20000/-

*For these optional features, the fees calculation is based on INR1000 Per Credit. These fees against the additional optional features are applicable to the batch enrolled in the year 2023-24. All these fees will be in addition to the management approved total tuition fees per year for the MDM featured B.Tech Majors plus the admissible and payable other fees.

Shivaji University, Kolhapur
Department of Technology

First Year B. Tech (All Programs), Semester- I

Physics Group : Teaching and Evaluation Scheme

Sr.No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC111	Engineering Physics	03	-	02	05	04	30:70	50:00
2.	Basic Science course	BSC112	Engineering Mathematics –I	03	01	-	04	04	30:70	50:00
3.	Engineering Science Courses	ESC111	Elements of Mechanical and Electronics Engineering	04	-	02	06	05	30:70	50:00
4.	Engineering Science Courses	ESC112	Engineering Mechanics	03	-	02	05	04	30:70	50:00
5.	Engineering Science Course	ESC113	Computer Programming for Engineers	02	-	02	04	03	30:70	50:00
6.	Indian Knowledge System	IKS111	Yoga and Meditation	01	-	-	01	01	-	50:00
				-	-	-	-	**21**	**500**	**300**
7.	Humanities & Social Sciences, Management, Environment Courses	HSMEC 111	Professional Communication (English)-I	02	-	-	02	IE at Course in charge end		
8.	Vocational and Skill Enhancement Courses	VSEC111	Design Thinking and Innovation-I	01	01		02	IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

Note: After the First Semester of F.Y. B. Tech, the students will undergo 10 days Social Internship and its evaluation will be done in the Second Semester.

Shivaji University, Kolhapur
Department of Technology

First Year B. Tech (All Programs), Semester- I

Chemistry Group : Teaching and Evaluation Scheme

Sr.No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC111	Engineering Chemistry	03	-	02	05	04	30:70	50:00
2.	Basic Science Course	BSC112	Engineering Mathematics –I	03	01	-	04	04	30:70	50:00
3.	Engineering Science Course	ESC111	Elements of Civil and Electrical Engineering	04	-	02	06	05	30:70	50:00
4.	Engineering Science Course	ESC112	Engineering Graphics	03	-	02	05	04	30:70	50:00
5.	Engineering Science Course	ESC113	Electrical-Electronic Components and Devices	02	-	02	04	03	30:70	50:00
6.	Indian Knowledge System	IKS111	Yoga and Meditation	01	-	-	01	01	-	50:00
				-	-	-	-	**21**	**500**	**300**
7.	Humanities & Social Sciences, Management, Environment Courses	HSMEC 111	Professional Communication (English)-I	02	-	-	02	IE at Course in charge end		
8.	Vocational and Skill Enhancement Courses	VSEC111	Design Thinking and Innovation-I	01	01		02	IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

Note: After the First Semester of F.Y. B. Tech, the students will undergo 10 days Social Internship and its evaluation will be done in the Second Semester.

Shivaji University, Kolhapur
Department of Technology

First Year B. Tech (All Programs), Semester- II

Chemistry Group : Teaching and Evaluation Scheme

Sr.No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC121	Engineering Chemistry	03	-	02	05	04	30:70	50:00
2.	Basic Science Course	BSC122	Engineering Mathematics – II	03	01	-	04	04	30:70	50:00
3.	Engineering Science Course	ESC121	Elements of Civil and Electrical Engineering	04	-	02	06	05	30:70	50:00
4.	Engineering Science Course	ESC122	Engineering Graphics	03	-	02	05	04	30:70	50:00
5.	Engineering Science Course	ESC123	Electrical-Electronic Components and Devices	02	-	02	04	03	30:70	50:00
6.	Indian Knowledge System	IKS121	Human Rights and Constitution	01	-	-	01	01	-	50:00
				-	-	-	-	**21**	**500**	**300**
7.	Humanities & Social Sciences, Management, Environment Courses	HSMEC121	Professional Communication (English)-II	02	-	-	02	IE at Course in charge end		
8.	Vocational and Skill Enhancement Courses	VSEC121	Design Thinking & Innovation-II	01	01	-	02	IE at Course in charge end		
9.	Project Seminar Internship	PSI121	Social Internship*	10 Days Duration*				IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

*Note: After Semester I, 10 days social internship completed by all students will be the evaluated in this semester.

Shivaji University, Kolhapur
Department of Technology

First Year B. Tech (All Programs), Semester- II

Physics Group : Teaching and Evaluation Scheme

Sr.No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC121	Engineering Physics	03	-	02	05	04	30:70	50:00
2.	Basic Science Course	BSC122	Engineering Mathematics – II	03	01	-	04	04	30:70	50:00
3.	Engineering Science Course	ESC121	Elements of Mechanical and Electronics Engineering	04	-	02	06	05	30:70	50:00
4.	Engineering Science Course	ESC122	Engineering Mechanics	03	-	02	05	04	30:70	50:00
5.	Engineering Science Course	ESC123	Computer Programming for Engineers	02	-	02	04	03	30:70	50:00
6.	Indian Knowledge System	IKS121	Human Rights and Constitution	01	-	-	01	01	-	50:00
				-	-	-	-	**21**	**500**	**300**
7.	Humanities & Social Sciences, Management, Environment Course	HSMEC 121	Professional Communication (English)-II	02	-	-	02	IE at Course in charge end		
8.	Vocational and Skill Enhancement Courses	VSEC121	Design Thinking and Innovation-II	01	01	-	02	IE at Course in charge end		
9.	Project Seminar Internship	PSI121	Social Internship*	10 Days Duration*				IE at Course in charge end		
			Total Hours	19	02	08	**29**	-	-	-

*Note: After Semester I, 10 days social internship completed by all students will be the evaluated in this semester.

Year,Program, Semester	F.Y. Part I (All Programs) Semester I and II							
Course Code	BSC111/ BSC121							
Course Category	Engineering Science Course							
Course title	**Engineering Physics (Theory)**							
Teaching Scheme and Credits	L	T	P	Total Contact Hours		Total Credits		
	03	-	-	03		03		
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total	
	30	70	-	-	-	-	100	
Pre-requisites (if any)	-							
Course Rationale	The Engineering Physics course for FY B.Tech students offers a comprehensive understanding of fundamental and advanced concepts in ultrasonics, optics, lasers, fibre optics, crystallography, material physics, and energy systems. It bridges theoretical knowledge with practical applications, preparing students for technological innovations and research. The inclusion of a study tour to a space observatory enhances real-world learning and exposure to cutting-edge satellite and radar technology.							
Course Objectives	The course is aimed at - 1. To study the basic concepts of physics and engineering applications of physics. 2. To develop an ability to identify, formulate and solve physics and engineering problems.							
Course Outcomes	Upon completion of this course, student should be able to- 1. Apply the concepts of physics in various engineering applications. 2. Use the techniques, skills, and modern tools necessary for physics and engineering careers. 3. Understand and apply the concepts of optical fibers in light wave communication systems and in holography. 4. Understand the use of lasers as light sources for low and high energy applications. 5. Understand the nature and characteristics of ultrasonic waves and its various engineering applications.							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-

CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Ultrasonic** Introduction, production of ultrasonic waves- piezo-electric generator, detection of ultrasonic waves, properties of ultrasonic waves, use of ultrasonic for non-destructive testing, Industrial and medical applications of ultrasonic.	07
II	**Optics Interference** Superposition of waves, spatial and temporal coherence, interference in thin films by reflection, Diffraction – Fresnel and Fraunhofer diffractions, Diffraction grating, Determination of wavelength using diffraction grating. Polarization– Types of polarization, polarization by reflection and polarization by scattering	07
III	**Lasers** Introduction, characteristics of lasers, spontaneous and stimulated emission of radiation, Einstein's coefficients, population inversion, Ruby laser, Helium-Neon laser, Applications of lasers in Industrial, scientific and medical fields. Holography – Basic principles and applications of holography. **Fibre optics:** Principle of optical fibre, cross sectional view of optical fibre, acceptance angle, acceptance cone (no derivation), numerical aperture, step index fibre, graded index fibre, transmission of light in step and graded index fibre, attenuation in optical fibre, applications of optical fibre(medical, military, communication)	07
IV	**Crystallography** Basics of crystal structure-space lattice & point lattice, Unit cell, number of atoms per unit cell, coordination number, seven crystal systems, packing fraction for close packed systems, Miller indices. X-Ray diffraction and Bragg's law.	07
V	**Physics of Materials** Superconductivity- General properties, Meissner effect, Type I and Type II superconductors, applications of superconductors Nanoscience: Nano Scale, nanostructured materials, properties of materials at Nano scale: Surface to Volume Ratio, Quantum Confinement effect.	07
VI	**Nuclear and Solar energy Nuclear fission** Discovery of fission, binding energy curve, chain reaction (fission of U235), essentials of nuclear reactor. Nuclear fusion – Thermonuclear reactions, p-p chain, C-N-O cycle. Introduction to particle physics. Solar energy – solar spectrum, Ways of harnessing	06

	solar energy-solar photovoltaic and solar thermal devices. In addition a study tour to space observatory at Panhala: study the operations of Indian Regional Navigation Satellite System (IRNSS) programme. (Satellite signal receiver has been installed at Panhala, space centre) or MF RADAR facility, Shivaji University campus, Kolhapur	
Text Books		
1.	M. N. Avadhanulu and P. G. Kshirsagar “Engineering Physics”, S. Chand Publication.	
2.	R. K. Gaur and Gupta S. L, “Engineering Physics”, Dhanapat Rai and Sons Publication.	
3.	V. Rajendran, “Engineering Physics”, Tata McGraw Hill Company Ltd, New Delhi.	
4.	Malik and Singh, “Engineering Physics”, Tata McGraw Hill Company Ltd, New Delhi.	
5.	Naidu, “Engineering Physics”, Pearson.	
6.	N.K. Bajaj, The Physics of waves and Oscillations , Tata McGraw Hill Company Ltd, New Delhi.	
Reference Books		
1.	A. Ghatak, “Optics”, S. Chand and Company Ltd.	
2.	Brijlal and Subramanian, “Optics”, 5006, 23rd Edition.	
3.	B. L. Theraja, “Modern Physics”, S. Chand & Company Ltd., Delhi.	
4.	Charles Kittle, “Introduction to Solid State Physics,” Wiley India Pvt.	
5.	L. Tarasov, “Laser Physics and Applications,” Mir Publishers.	
6.	P.K. Palanisamy, “Solid State Physics”, SciTech Publications (India) Pvt. Ltd.	
Useful web links		
1.	**https://archive.nptel.ac.in/courses/122/107/122107035/**	

<table>
<tr><td>Year,Program, Semester</td><td colspan="8">F.Y. Part I (All Programs) Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="8">BSC111/ BSC121</td></tr>
<tr><td>Course Category</td><td colspan="8">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="8">Engineering Physics (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="3">Total Contact Hours</td><td colspan="2">Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td colspan="3">02</td><td colspan="2">01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="8">-</td></tr>
<tr><td>Course Rationale</td><td colspan="8">The Laboratory Course provides hands-on experience with advanced techniques such as diffraction grating measurements, XRD pattern analysis, SEM studies, and laser beam divergence. It also explores nanofluid properties, polarimetry, dielectric constant measurement, thermal conductivity, and lattice constant calculation, bridging theoretical concepts with practical skills.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The course is aimed at -
1. To study the basic concepts of physics and engineering applications of physics.
2. To develop an ability to identify, formulate and solve physics and engineering problems.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">Upon completion of this course, student should be able to-
1. Apply the concepts of physics in various engineering applications.
2. Use the techniques, skills, and modern tools necessary for physics and engineering careers.
3. Use various scientific instruments viz. Spectrometer, polarimter, laser, ultrasonic interferometer for various measurements.
4. Test optical components using principles of interference and diffraction of light.
5. Use ultrasonic interferometer for measuring velocity of ultrasound in various liquids.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-

CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1.	Diffraction grating - measurement of grating element.	02
2.	Diffraction grating - measurement of wavelength of LASER.	02
3.	XRD pattern of thin films and its analysis.	02
4.	Scanning Electron Microscopy (SEM) studies.	02
5.	Divergence of LASER beam.	02
6.	Study of properties of Nano fluids – effect of concentration & temperature.	02
7.	Determination of specific rotation of sugar solution using Polarimeter.	02
8.	Dielectric constant of materials.	02
9.	Thermal conductivity in Nano fluids.	02
10.	Calculation of lattice constant from the given powder XRD pattern.	02
Reference Books and web links		
1.	Arthur Beiser, "Concepts of Modern Physics," McGraw-Hill Education.	
2.	William D. Callister Jr., "Materials Science and Engineering: An Introduction," Wiley.	
3.	R.K. Gaur and S.L. Gupta, "Engineering Physics," Dhanpat Rai Publications.	
4.	**https://www.digimat.in/nptel/courses/video/122104016/L26.html**	
5.	**https://www.digimat.in/nptel/courses/video/122107035/L15.html**	

<table>
<tr><td>Year, Program, Semester</td><td colspan="8">F.Y. Part I (All Programs) Semester I</td></tr>
<tr><td>Course Code</td><td colspan="8">BSC112</td></tr>
<tr><td>Course Category</td><td colspan="8">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="8">Engineering Mathematics-I (Differential Calculus) (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="3">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>03</td><td>01</td><td>-</td><td colspan="3">04</td><td colspan="2">04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>50</td><td>-</td><td>-</td><td>-</td><td>150</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="8">Basics of Derivatives and Integration.</td></tr>
<tr><td>Course Rationale</td><td colspan="8">The Engineering Mathematics I course provides a strong foundation in differential calculus, partial differentiation, differential equations, and complex variable functions. It equips students with analytical techniques essential for solving engineering problems and introduces them to numerical methods and programming with Scilab for practical applications. This course bridges theoretical concepts with computational skills, preparing students for advanced studies and professional challenges in engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The course is aimed at -
1. To familiarize the students with differential Calculus.
2. To teach Mathematical methodologies and models.
3. To develop mathematical skills and enhance logical thinking power of students.
4. To provide students with skills in differential calculus, complex variable which would enable them to devise engineering solutions for given situations they may encounter in their profession.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">Upon completion of this course, student should be able to-
1. Understand and apply the knowledge of differential Calculus to solve the mathematical problems.
2. Determine partial derivatives and its application in related field of engineering.
3. To understand methods for solution of differential equations of first order and first degree.
4. Evaluation and analysis of analytic function.
5. Understand the features of the Scilab software and its applications.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Differential Calculus** Successive differentiation, Leibnitz's Theorem and its applications, Taylor and Maclaurin series, Indeterminate forms.	07
II	**Partial Differentiation** Partial derivatives of first and higher order, total differentials, differentiation of composite and implicit functions. Euler's Theorem on Homogeneous functions with two and three independent variables. Deductions from Euler's Theorem, Jacobian, Properties of Jacobian.	08
III	**Differential Equations of first order and first degree and its Applications** Exact differential equations, Equations reducible to exact equations, Linear differential equations, Equations reducible to Linear equations, Applications to Orthogonal trajectories and to Simple Electrical Circuits	07
IV	**Numerical solutions of Differential Equations of first order and first degree** Taylor's series method, Picard's method, Euler's method, Modified Euler's method, Runge-Kutta fourth order formula.	06
V	**Functions of Complex Variables: Differentiation** Algebra of complex number, Circular and hyperbolic functions, Functions of complex variable, Cauchy-Riemann equations, Analytic functions, Harmonic functions.	06
VI	**Programming with Scilab** Introduction, Installation, Basic functions of Scilab, Differentiation, Solutions of differential equations of first order and first degree, Basic operations on Complex numbers, Algebra of complex number.	06
	Suggested list of Assignments- 1. Successive differentiation 2. Applications of Leibnitz theorem	

	3. Indeterminate form 4. Partial differentiation 5. Euler's Theorem on Homogeneous functions 6. Exact differential Equations 7. Linear differential equations 8. Applications of Differential equations 9. Numerical solutions of Differential equations 10. Analytic Functions 11. Harmonic Functions **General Instructions:** 1. Each Student has to write at least 6 assignments on entire syllabus and at least 4 assignments on Scilab programming (including print out). Students must be encouraged to write mathematical programs in tutorial class only. 2. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches. 3. Scilab assignments will be based on i. Differentiation ii. Partial Differentiation iii. Solutions of differential equations of first order and first degree, iv. Basic operations on Complex numbers v. Algebra of complex number.	

Text Books	
1.	B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons.
3.	B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi.
4.	B. S. Grewal, "Scilab Textbook Companion for Higher Engineering Mathematics", Khanna Publishers, New Delhi.
Reference Books	
1.	C. R. Wylie, "Advanced Engineering Mathematics", McGraw Hill Publication, New Delhi.
2.	Shanti Narayan, "Differential Calculus" S. Chand and company, New Delhi.
3.	S. S. Sastry, "Engineering Mathematics (Volume-I)", Prentice Hall Publication, New Delhi.
4.	M. K. Jain, S. R. K. Iyengar, R. K. Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd.
5.	H. K. Dass, "Advanced Engineering Mathematics", S. Chand Publishing.
6.	N. P. Bali, Iyengar "A text book of Engineering Mathematics by", Laxmi Publications (P)Ltd., New Delhi.
7.	M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education.
Useful web links	
1.	**https://nptel.ac.in/courses/111105121**

2.	**https://nptel.ac.in/courses/111106100**
3.	**https://nptel.ac.in/courses/111107119**
4.	**https://nptel.ac.in/courses/111105134**

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="7">ESC111/ ESC121</td></tr>
<tr><td>Course Category</td><td colspan="7">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="7">Elements of Mechanical and Electronics Engineering (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>04</td><td>-</td><td>-</td><td colspan="2">04</td><td colspan="2">04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td>30</td><td colspan="2">70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7">Basic Physics and Mathematics, Introduction to Engineering, Basic Mechanics, Thermodynamics.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The course offers practical knowledge and skills for understanding and applying various instruments, devices, and systems in real-world scenarios. It provides interdisciplinary perspectives, exploring fields like mechatronics, robotics, and biomedical applications. With a focus on energy sources and sustainability, the course prepares students to tackle the global energy crisis and contribute to environmentally friendly solutions. Studying this course enhances technical competence, critical thinking, problem-solving abilities, and adaptability to evolving technologies in mechanical engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. Developing the fundamental understanding of various mechanical engineering devices and their applications.
2. Developing the awareness about energy crisis, understanding various non-conventional energy sources.
3. Informing the students about the various roles, responsibilities and job opportunities mechanical engineering graduates have in different sectors.
4. Developing the fundamental understanding of various electronics engineering devices and their applications.
5. Developing the fundamental knowledge of semiconductor devices with applications.
6. Provide fundamental knowledge about transistor and power device.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to -
1. Recognise the mechanical engineering applications, machines, mechanisms in day to day life.
2. Explain different non-conventional energy sources.
3. Think critically and apply product design procedures to design product with different considerations.
4. Recognise the basics of electronic engineering and their practical use</td></tr>
</table>

	5. Apply the concepts of diode in rectifiers, filter circuits. 6. Understand the concept and use of SCR and power devices.

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Mechanical Engineering Applications** a) Introduction to various instruments and devices in day to day life – Pumps, Compressors, Gears, Belt drives [types, classification, construction and working, applications] b) Introduction to IC engines (Construction, working, classification of 2 stroke, 4 stroke SI and CI engines), Refrigeration and air conditioning, Vapour compression refrigeration cycle, advantages, applications	07
II	**Conventional and non-conventional energy sources** a) Energy crisis, Sources of Energy and its classifications, Renewable energy sources, classification and system Power generation using - Solar energy, wind energy, tidal energy, geothermal energy, hydroelectric power plant. (Construction and working)	07
III	**Horizontals and verticals of Mechanical Engineering** a) Role and job profiles of Mechanical Engineer in various branches of engineering- Mechanical, Civil, Electronics, Computer and Chemical Engineering. b) Interdisciplinary branches of Mechanical Engineering – Mechatronics and Robotics, Biomedical Applications. Energy balance. Energy audit. Industry 4.0 c) Product, product design steps, tools, aesthetic, ergonomic considerations, concurrent engineering	07
IV	**Semiconductors** Conductivity of insulators, metals, and semiconductors in terms of energy bands, the chemical bond in Si and Ge, conductivity of intrinsic semiconductors, extrinsic semiconductors: n-type and p-type semiconductors, Hall Effect in semiconductors,	07

	Mechanism in current flow: drift and diffusion, V-I characteristics of PN-junction diode. Diode equivalent circuit, diode as a switch, diode testing.	
V	**Rectifier and Zener Diode** Need of rectifier, types of rectifier-half wave rectifier voltage (no derivation), ripple, ripple factor ,Need of filters ,types of filters **Zener diode -** Breakdown mechanism, Zener versus Avalanche Break down, V-I characteristics, application, photo diode and varactor diode.	07
VI	**Introduction to Transistors and Power devices** Transistor construction, Types of transistor (NPN & PNP), Transistor operation and amplifying action. Transistor Characteristics for CB, CE, CC configuration and comparison. **Power devices** - Need of power devices, comparison between low and high power semiconductor devices, Structure, Operation, V-I Characteristics & application of SCR, Triac and diac.	06

Text Books

1.	G. D. Rai, “Non-Conventional Energy Sources”, Khanna Publisher, 4th Edition 2014.
2.	Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3.	Arora C P, “Refrigeration and Air Conditioning”, Tata McGraw Hill.
4.	C.M. Agrawal and Basant Agrawal, “Basic Mechanical Engineering”, Wiley, 2008.
5.	R.P.Jain,"Modern Digital Electronics",Tata McGraw Hill,4th edition 2009.
6.	Robert Boylestad and Louis Nashelsky, “Electronic Devices and Circuits”,Pearson,11th edition, 2015.

Reference Books

1.	Arora Domkundwar , “Refrigeration and Air Conditioning”, Dhanpat Rai and Sons.
2.	Heywood, “I.C. Engines Fundamentals”, McGraw Hill Publication.
3.	Bernard Grob, Basic Electronics.
4.	Madhuri Joshi , Electronics materials &components.

Alternative NPTEL/SWAYAM Course

Sr. No.	NPTEL Course Name	Instructor	Host Institute
1.	IC Engines and Gas Turbines	Dr. Vinayak Kulkarni, Prof. Pronab K. Mondal	IIT Guwahati
2.	Product Design and Innovation	Prof. Supradip Das, Prof. Swati Pal, Prof. Debayan Dhar	IIT Guwahati

Useful web links	
1.	**https://ekumbh.aicte-india.org/book.php for mechanical engineering related books by AICTE.**
2.	**https://nptel.ac.in/courses/112103262**
3.	**https://nptel.ac.in/courses/101104063**
4.	**https://nptel.ac.in/courses/107103082**
5.	**https://www.digimat.in/nptel/courses/video/108102097/L01.html**
6.	**https://nptel.ac.in/courses/122106025**

<table>
<tr><td>Year,Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="7">ESC111/ ESC121</td></tr>
<tr><td>Course Category</td><td colspan="7">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="7">Elements of Mechanical and Electronics Engineering (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td colspan="2">02</td><td colspan="2">01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td>-</td><td colspan="2">-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">-</td></tr>
<tr><td>Course Rationale</td><td colspan="7">This course aims to give a practical understanding of mechanical & electronics engineering applications in day to day life.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. Informing students about lathe and drilling machines tools and the processes used in manufacturing.
2. Demonstrating - 2 stroke and 4 stroke IC engine, refrigerator.
3. Engaging students in hands on experience of designing and product for small problem.
4. To Impart Knowledge about basics of Semiconductor Devices and its parameters.
5. To make the students familiar with suitability of various electronics components.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to -
1. Identify different parts of lathe and drilling machine.
2. Apply the design principles to offer a product design solution to small problem.
3. Identify and explain the details of IC engines and refrigerator.
4. Understand construction , V-I characteristics and application of diode.
5. Identify the applications of Diode and SCR.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1.	Study of 2 stroke and 4 stroke IC Engines.	02
2.	Study of domestic refrigerator and air conditioner.	02
3.	Study of pumps and compressors.	02
4.	Product development exercise.	02
5.	Study of lathe and drilling machine.	02
6.	Study of Characteristics of Si and Ge diodes.	02
7.	Study of performance characteristics of half wave rectifier with and without filter.	02
8.	Study of performance characteristics of full wave rectifier with and without filter.	02
9.	Study of Characteristics of Zener diode.	02
Text Books		
1.	Hajra Choudhury, Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.	
2.	Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.	
3.	V. Ganesan, “Internal Combustion Engines”, Tata McGraw Hill, Second Edition.	
4.	P.K. Nag, "Engineering Thermodynamics", Tata McGraw-Hill Publishing Co. Ltd.	
5.	Arora C P, “Refrigeration and Air Conditioning”, Tata McGraw Hill.	
6.	N.N Bharagava, D.C.Kulshreshtha & S.C Gupta(TMH)"Basic Electronics & Linear circuits "	
Reference Books		
1.	Arora Domkundwar, “Refrigeration and Air Conditioning”, Dhanpat Rai and Sons	
2.	Hawkins G. A., "Engineering Thermodynamics", John Wiley and Sons	
3.	Heywood, “I.C. Engines Fundamentals”, McGraw Hill Publication	
4.	V.K.Mehata, "Principles of Electronics ".(New Edn)	

Year,Program, Semester	F.Y. Part I (All Programs) Semester I and II
Course Code	ESC112/ ESC122
Course Category	Engineering Science Course
Course title	**Engineering Mechanics (Theory)**

Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	03	-	-	03	03

Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total
	30	70	-	-	-	-	100

Pre-requisites (if any)	Physics, Mathematics
Course Rationale	Engineering mechanics applies the principle of mechanics to design, taking into account the effects of forces.
Course Objectives	The course is aimed at- 1. To learn basic concepts and system of forces. 2. To develop skills to use the basic principles of mechanics in engineering applications. 3. To solve problems of statics and dynamics related to engineering domain using principles of mechanics.
Course Outcomes	Upon completion of this course, student should be able to - 1. Calculate resultant force for coplanar concurrent and noncurrent force system. 2. Apply static conditions of equilibrium to calculate reactive forces of structures like beams, trusses etc. 3. Determine center of gravity and moment of inertia of a lamina. 4. Apply equations of motion on a body moving along straight path and circular path to determine the motion parameters. 5. Apply dynamic condition of equilibrium on a body to calculate its motion parameters and reactive forces. 6. Apply laws of collision to find energy loss and velocity distribution due to direct and indirect impact.

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	3	-	-	-	-	-	-	-	-	-	-
CO 2	2	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-
CO 4	2	3	-	-	-	-	-	-	-	-	-	-

CO 5	2	3	-	-	-	-	-	-	-	-	-	-
CO 6	2	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Resolution and composition of force system** Introduction to Mechanics, Force system, concept of Resultant, Composition and Resolution of Forces, Equivalent force system, Moment of a force, Couple, law of parallogram, Varignon's theorem, Resultant of a concurrent and non-concurring force system	08
II	**Equilibrium of rigid body** Concept of Equilibrium, Free Body Diagram, Lami's theorem, analytical conditions of equilibrium, engineering application to beams and trusses. Friction, types of friction, laws of friction.	06
III	**Centroid and moment of Inertia** Centroid of areas, moment of inertia, radius of gyration, polar moment of inertia, theorems of moment of inertia, M.I. of a lamina.	06
IV	**Linear and circular motion of a body** Rectilinear motion, equations of motion, motion diagrams, motion in vertical direction. Circular motion, motion on curved path, supper elevation	08
V	**Kinetics of particles** Newton's second law, Work-Energy principle, Impulse- momentum principle, D'Alembert's Principle.	06
VI	**Collision of a body** Direct and indirect impact, coefficient of restitution, impact on floor and wall, law of collision, loss of kinetic energy.	06
Text Books		
1.	S. S. Bhavikattis, "Engineering Mechanics", New Age International Pvt. Ltd	
2.	S. Timoshenko, "Engineering Mechanics", McGraw Hill Education	
Reference Books		
1.	Meriam J. L., Kraige L. G., "Engineering Mechanics – Statics, Vol.1", Wiley Student Edition, (8th Edition) 2017	
2.	Meriam J. L., Kraige L. G., "Engineering Mechanics – Dynamics, Vol.2", Wiley Student Edition, (8th Edition) 2017	
3.	R.C.Hibbeler, "Engineering Mechanics", Pearson Publication(14th edition)	

4.	Beer F. P. , Johnston E. R., "Vector Mechanics for Engineers -Dynamics", Tata McGraw Hill Publishing company Ltd., New Delhi (12th Edition, SIE)
5.	Shames Irving H., "Engineering Mechanics", Prentice Hall, New Delhi (4th edition)
Useful web links	
1.	**https://www.youtube.com/watch?v=nGfVTNfNwnk**
2.	**https://www.youtube.com/watch?v=6nguX-cEsvw**
3.	**https://archive.nptel.ac.in/courses/112/106/112106286/**

Year,Program, Semester	F.Y. Part I (All Programs) Semester I and II							
Course Code	ESC112/ ESC122							
Course Category	Engineering Science Course							
Course title	**Engineering Mechanics (Practical)**							
Teaching Scheme and Credits	L	T	P	Total Contact Hours		Credits		
	-	-	02	02		01		
Evaluation Scheme	ISE		ESE	IOE	IPE	EOE	EPE	Total
	-		-	-	50	-	-	50
Pre-requisites (if any)	Physics, Mathematics							
Course Rationale	Engineering mechanics applies the principle of mechanics to design, taking into account the effects of forces.							
Course Objectives	The course is aimed at- 1. To perform experiments to verify laws of mechanics and validate the experimental results with analytical results.							
Course Outcomes	Upon completion of this course, student should be able to - 1. Perform experiments to verify laws of mechanics 2. Construct force diagrams to find resultant forces 3. Compare the analytical results with experimental results							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title	Hours
1.	Verify law of polygon of forces.	02
2.	Verify law of Moment using bell crank lever apparatus.	02
3.	Verify beam reactions using beam reaction apparatus.	02
4.	Verify triangle law of forces using Jib crane apparatus.	02
5.	Verify centrifugal law of forces using centrifugal apparatus.	02

6.	Graphics statics- Resultant force determination (concurrent forces system).	02
7.	Graphics statics- Resultant forces determination (non-concurrent forces. system)	02
8.	Graphics statics- Determination of beam reactions.	02
9.	Graphics statics- Determination of member forces of a truss.	02
10.	Assignments based on theory syllabus.	02
11.	Assignments based on theory syllabus.	02
12.	Assignments based on theory syllabus.	02
Text Books		
1.	S. S. Bhavikattis, “Engineering Mechanics”, New Age International Pvt. Ltd	
2.	S. Timoshenko, “Engineering Mechanics”, McGraw Hill Education	
Reference Books		
1.	Meriam J. L., Kraige L. G., “Engineering Mechanics – Statics, Vol.1”, Wiley Student Edition, (8th Edition) 2017.	
2.	Meriam J. L., Kraige L. G., “Engineering Mechanics – Dynamics, Vol.2”, Wiley Student Edition, (8th Edition) 2017.	
3.	R.C.Hibbeler, “Engineering Mechanics”, Pearson Publication(14th edition)	
4.	Beer F. P. , Johnston E. R., “Vector Mechanics for Engineers -Dynamics”, Tata McGraw Hill Publishing company Ltd., New Delhi (12th Edition, SIE)	
5.	Shames Irving H., “Engineering Mechanics”, Prentice Hall, New Delhi (4th edition)	

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="7">ESC113/ ESC123</td></tr>
<tr><td>Course Category</td><td colspan="7">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="7">Computer Programming for Engineers (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td colspan="2">02</td><td colspan="2">02</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td>30</td><td>70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7">Physics, Mathematics</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The Computer Programming for Engineers course introduces foundational concepts in programming methodology and the C language, covering problem-solving techniques, algorithm design, and flowcharting. It equips students with essential skills in control statements, functions, arrays, pointers, and file handling, fostering strong programming capabilities crucial for tackling engineering challenges through structured and efficient coding practices.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. Understand the basic terminology used in computer programming
2. Compile and debug programs in C and Implement data structures and algorithms in C</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to -
1. Illustrate the flowchart and design of an algorithm for a given problem and to develop C programs using operators Develop conditional and iterative statements to write C programs.
2. Design C programs with the use of Pointers to access arrays, strings , functions and Exercise user defined data types including structures and unions to solve problems.
3. Design C programs using pointers and to allocate memory using dynamic memory management and Demonstrate files concept to show input and output of files in C.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Programming Methodology** Step involving in problem solving., Problem definition, Algorithm, Characteristics, Notation of Algorithm, Flowcharts- Definition, Symbol, features, Running and debugging the program. Introduction to 'C' History, Character set and keywords, Structure of 'C' programming, constant and its type, Variable and its type (Data types), Operators- Arithmetic, logical, relational, bitwise, increment, decrement, conditional	08
II	**Control Statements and Functions** Conditional control statements- if, if else, nested if, switch, Looping – for statements, nested for, while, do-while statements, Unconditional control statements- break, continue, go to **Functions** Definition, declaration, prototype of function, Local and global variable, User defined function, Storage classes, Pre-processor Arrays and Pointers Array definition and declaration, Single and multidimensional array, String functions **Pointers** Definition and declaration, Operation on pointer, Pointer initialization, Pointer and function, Pointer and array, Pointer of pointer, Call by value and Call by reference, Dynamic memory allocation	08
III	**Structures and Union** Definition and declaration, Array of structures, Passing structure to function, Pointer to structure, Nested structure, self-referential structure, Sizeof and typedef, File Handling Standard input- getchar(), getch(), getche(), Standard output- putchar(), putch(), putche(), Formatted input- scanf(), sscanf(), fscanf(), fread(), Formatted output- printf(), sprintf(), fprintf(), fwrite(), Functions- fseek(), ftell(), fflush(), fclose(), File opening mode- open, modify, write, append, Text and binary mode.	08
Text Books		
1.	E Balguruswamy, "Programming with ANSI C", (TMH).	
2.	Kernighan and Richie, "The C Programming Language" (PHI)/Pearson Education.	
3.	Y.C. Kanetkar, "Let us C".	
Reference Books		
1.	Gottfried, "Programming in C", Shattern Series	
2.	Herbert Schildt, "Complete 'C' Reference".	

Year, Program, Semester	F.Y. Part I (All Programs) Semester I and II						
Course Code	ESC113/ ESC123						
Course Category	Engineering Science Course						
Course title	**Computer Programming for Engineers (Practical)**						
Teaching Scheme and Credits	L	T	P	Total Contact Hours		Credits	
	-	-	02	02		01	
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total
	-	-	-	50	-	-	50
Pre-requisites (if any)	Physics, Mathematics						
Course Rationale	This laboratory course in Computer Programming for Engineers equips students with hands-on experience in essential programming techniques and concepts crucial for engineering applications. Through practical exercises in creation, editing, compilation, and debugging of programs, students will master control statements, functions, pointers, and file handling, thereby building a solid foundation for problem-solving and computational thinking in engineering contexts.						
Course Objectives	The course is aimed at- 1. Understand the basic terminology used in computer programming 2. Compile and debug programs in C and Implement data structures and algorithms in C						
Course Outcomes	Upon completion of this course, student should be able to - 1. Illustrate the flowchart and design of an algorithm for a given problem and to develop C programs using operators Develop conditional and iterative statements to write C programs 2. Design C programs with the use of Pointers to access arrays, strings , functions and Exercise user defined data types including structures and unions to solve problems 3. Design C programs using pointers and to allocate memory using dynamic memory management and Demonstrate files concept to show input and output of files in C						

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1.	Creation editing, compilation, extension, debugging demonstration with some small program	02
2.	Constants, variables and data types declaration with the use of storage classes.	02
3.	Use of operators and expressions	02
4.	Control statements: if, if-else nested if.	02
5.	Control statement: for statement, while statement, do while statement, Use of break, continue, goto statements.	02
6.	Use of functions: Prototyping, - Concept of local/ global variables	02
7.	Use of pointers: Simple pointers, Operations on pointers, Pointer to arrays, Pointer to Functions	02
8.	I/O functions and files handling	02
Text Books		
1.	E Balguruswamy, “Programming with ANSI C”, (TMH)	
2.	Kernighan and Richie, “The C Programming Language” (PHI)/Pearson Education	
3.	Y.C. Kanetkar, “Let us C”	
Reference Books		
1.	Gottfried, “Programming in C”, Shattern Series	
2.	Herbert Schildt, “Complete ‘C’ Reference”.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">F.Y. Part I (All Programs), Semester I</td></tr>
<tr><td>Course Code</td><td colspan="5">IKS 111</td></tr>
<tr><td>Course Category</td><td colspan="5">Indian Knowledge System</td></tr>
<tr><td>Course title</td><td colspan="5">Yoga and Meditation</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="5">IE at the course in charge end: (Preferred to have 4 assignments and conduct of an MCQ Test based on the course work. However, the course teacher will declare whether the students have passed it or not. Passing is mandatory to earn the credit.</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Basic physical fitness and flexibility for yoga postures (asanas) and meditation practices. Open-mindedness, willingness to learn, and a commitment to regular practice and self-reflection are essential.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course on yoga and meditation is designed to provide you with a deep understanding and practical experience of these ancient practices. Throughout the course, you will explore various aspects of yoga and meditation, including their history, philosophy, techniques, benefits, and practical applications in everyday life. Each lecture will cover a specific topic, building upon the previous ones to create a comprehensive and well-rounded learning experience.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course is aimed at-
1. Gain a comprehensive understanding of yoga and meditation principles and practices for holistic well-being.
2. Develop practical skills to incorporate yoga and meditation into daily life for stress reduction and emotional balance.
3. Explore the scientific basis and applications of yoga and meditation in diverse contexts.
4. Foster personal growth and self-awareness through regular practice, integrating yoga and meditation as a lifelong journey.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to -
1. Develop a strong foundation in yoga and meditation techniques and principles.
2. Cultivate mindfulness and self-awareness through regular practice.
3. Enhance physical flexibility, strength, and overall well-being.
4. Apply yoga and meditation practices to reduce stress and promote mental and emotional balance.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	2	-	3	-	-	-	-	-	-
CO2	-	-	2	2	-	-	-	-	2	-	-	3
CO3	-	-	-	-	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I.	Introduction to Yoga and Meditation: a) Overview of yoga and its origins b) Introduction to meditation techniques and benefits	02
II.	Foundations of Yoga Practice: a) Understanding yoga asanas (poses) and their alignment b) Pranayama techniques for breath control and energy regulation	02
III.	Exploring Meditation Techniques: a) Mindfulness meditation and its practice b) Guided visualization and relaxation techniques	02
IV.	Yoga for Physical Health and Well-being: a) Yoga for flexibility and strength b) Yoga for stress reduction and relaxation	02
V.	Yoga Philosophy and Lifestyle: a) Introduction to the philosophy of yoga b) Applying yoga principles to daily life and relationships	02
VI.	Advanced Practices and Integration: a) Advanced yoga asanas and sequences b) Integrating yoga and meditation into a holistic lifestyle	02
Reference Books		
1.	Iyengar, B.K.S. Light on Yoga: The Bible of Modern Yoga. HarperCollins, 2001.	
2.	Khalsa, Gurucharan Singh. Kundalini Yoga: The Flow of Eternal Power. TarcherPerigee, 1999.	

3.	Lasater, Judith Hanson. Relax and Renew: Restful Yoga for Stressful Times. Rodmell Press, 2011.
4.	Saraswati, Swami Satyananda. Asana, Pranayama, Mudra, Bandha. Bihar School of Yoga, 2008.
5.	Satchidananda, Swami. The Yoga Sutras of Patanjali. Integral Yoga Publications, 2012.
6.	Zinn, Jon Kabat. Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life. Hyperion, 2005.
Important web links	
1.	Yoga Journal: www.yogajournal.com
2.	Headspace: www.headspace.com
3.	The International Sivananda Yoga Vedanta Centers: www.sivananda.org
4.	Insight Timer: www.insighttimer.com

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester I</td></tr>
<tr><td>Course Code</td><td colspan="7">HSMEC 111</td></tr>
<tr><td>Course Category</td><td colspan="7">Humanities and Social Sciences , Management, Environment Courses</td></tr>
<tr><td>Course title</td><td colspan="7">Professional Communication (English)- I</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td colspan="2">02</td><td colspan="2">00</td></tr>
<tr><td rowspan="3">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td colspan="7">IE at the course in charge end: (Preferred to have 3-5 assignments and conduct of an MCQ Test/Viva Voce based on the course work. Passing is mandatory.</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Students must have the knowledge of basic English grammar, writing and reading skill.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">Professional Communication (English)-I is designed to enhance engineering students' proficiency in technical and professional communication. The course covers essential topics such as the communication process, phonetics, grammar, and vocabulary building, while also addressing common errors in English usage. Through practical exercises in oral and written communication, students will develop the skills necessary for effective interpersonal, organizational, and mass communication in professional settings.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. To help the students to understand the fundamental concepts of Technical communication.
2. To acquire the skill of effective use of grammar and vocabulary rules to enhance communication skill.
3. To learn fluency in speech and correct pronunciation.
4. To learn various techniques of technical writing.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course,
1. The students will understand Basic concepts of communication and Technical communication.
2. The students will understand the nuance of phonetics, accent, intonation for improving pronunciation.
3. The students will Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar and to identify the common errors in writing and speaking.
4. The students will adopt various techniques of oral communication.
5. The students will acquires better technical writing techniques.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	3	-	2
CO2	-	-	-	-	-	-	-	-	-	3	-	2
CO3	-	-	-	-	-	-	-	-	-	3	-	2
CO4	-	-	-	-	-	-	-	-	-	3	-	2
CO5	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Technical Communication**: communication basics, communication process, verbal and non-verbal Communication, Technical Communication: Features, element of style, distinction between general and technical Communication, Level of communication: Interpersonal, organisation, Mass communication.	04
II	**Introduction to phonetics**: Introduction, phonetic transcription, English pronunciation, guideline to consonant and vowel, word accent, silent and non-silent letter, Common errors in pronunciation, spelling rules words often misspelled.	04
III	**Communicative Grammar and Vocabulary building**: parts of speech, sentence structure, tense, change the voice, Direct and Indirect speech, framing questions Vocabulary: word formation, synonyms and antonyms, Idioms and abbreviation. **Identifying Common Error in writing and speaking English**: Common Errors: Subject–verb agreement, Noun –pronoun agreement, misplaced modifier, Article, prepositions, sequence of tense and identification of tense, word confused, misused.	06
IV	**Oral communication**: Importance of effective oral communication, introducing oneself and others, oral expressions in various professional contexts, role play, Just A Minute (JAM) activity, speech.	06
V	**Nature and style of Sensible writing**: Importance of effective writing, paragraph writing techniques, document writing, writing introduction and conclusion, proper punctuation, summarization, precise writing, common errors due to Indianism in English communication.	06
Text Books		
1.	Meenakshi Raman and Sangita Sharma, “Technical Communication: Principles and Practice”, 2nd by Oxford University Press, 2011	
2.	J.D.O Connor, “Better English Pronunciation”, 2nd by Cambridge University Press, 1980	
3.	Wren and Martin, “High School English Grammar and Composition”, S Chand and Company Ltd – 2015.	
4.	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press	

5.	Meenakshi Raman and Sangita Sharma, "Technical Communication: Principles and Practice", 2nd by Oxford University Press, 2011.
Reference Books	
1.	Gajendra Singh Chauhan and Et al, "Technical Communication", Cengage learning India Pvt Limited, 2019.
2.	M Ashraf Rizvi, "Effective Technical Communication", Second Edition by McGraw Hill Education (India) Private
3.	Randolph Quirk and S Greenbaum ,"A University Grammar of English Latest", Pearson 2007
4.	Sanjay Kumar and Pushplata Communication Skills" , Oxford University Press India Pvt Ltd - 2019
5.	Practical English Usage by Michael Swan, Oxford University Press – 2016
6.	D Praveen Sam, KN Shoba, "A Course in Technical English", Cambridge University Press – 2020.
Useful web links	
1.	**https://learnenglish.britishcouncil.org**
2.	**https://www.fluentu.com**

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs), Semester I</td></tr>
<tr><td>Course Code</td><td colspan="7">VSEC111</td></tr>
<tr><td>Course Category</td><td colspan="7">Vocational and Skill Enhancement Courses</td></tr>
<tr><td>Course title</td><td colspan="7">Design Thinking and Innovation-I</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>01</td><td>01</td><td>-</td><td colspan="2">02</td><td colspan="2">00</td></tr>
<tr><td rowspan="3">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td colspan="7">IE at the course in charge end: (Preferred to have 3-5 assignments and conduct of an MCQ Test based on the course work. Passing is mandatory.</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7">Prerequisites for this course include a basic knowledge of design thinking principles to engage with the course content effectively. Familiarity with social issues and community engagement is beneficial, as the course focuses on applying design thinking to address social challenges. Strong communication and collaboration skills are essential for successful interdisciplinary teamwork and engaging with diverse stakeholders</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The purpose of engineering education has to be to transform these graduates who can design. The concept of design or design thinking though complex, it is the robust and it must be developed among the budding graduates so as to make them not alone job seekers but the providers too. Therefore, the particular course is towards preparing engineering graduates as intended to be versatile of all other professionals.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at
1. Develop a solid foundation in design thinking for user-centered problem-solving and engineering innovation.
2. Enhance ideation, prototyping, and iteration skills to generate creative solutions that effectively address user needs and preferences.
3. Analyze and optimize design alternatives based on user feedback, ensuring continuous improvement and alignment with engineering requirements.
4. Incorporate systems thinking, human factors, sustainability, and ethics into engineering design for socially responsible and user-centric solutions.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to-
1. Apply design thinking principles to identify user needs, analyze engineering challenges, and generate innovative solutions.</td></tr>
</table>

	2. Demonstrate proficiency in ideation, prototyping, and iterative design techniques to develop user-centered engineering solutions. 3. Evaluate and enhance design alternatives based on user feedback, ensuring alignment with engineering requirements. 4. Integrate systems thinking, human factors, sustainability, and ethics into engineering design for responsible and user-centric solutions.

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	-	-	1	2	-	3	-	-	-	-	-	-
CO 2	-	-	2	2	-	-	-	-	2	-	-	3
CO 3	-	3	2	-	-	-	-	-	2	-	-	-
CO 4	-	-	-	-	-	3	3	2	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours L+T
I.	**Introduction to Design Thinking:** a) Principles and process of design thinking, user-centered design, and ideation techniques. b) User research skills, rapid prototyping, and testing for iterative design. c) Cultivating a culture of innovation, applying design thinking to engineering problems, and teamwork.	06+06
II.	**Design Thinking in Engineering Practice:** a) Applying design thinking to engineering challenges, empathy-driven design, and systems thinking. b) Analyzing and evaluating design alternatives, iterative design, and continuous improvement. c) Human factors and ergonomics, sustainability and ethics in design, and effective communication.	06+06
	During the tutorial session itself for first 6 sessions, the course facilitator will complete these three sub units interactively while remaining 6 sessions will be free for the students to have the activities for which the following general guidelines to be followed: **General Instructions for course facilitators:** **The facilitators may use different student centric teaching learning methods to make the course content more and interesting and meaningful.** Some of the following activities may be planned	

a) Brain teasers (aka Puzzle Busters, to be solved individually)
b) Cartoon captions (small teams)
c) TRIZ, a systematic ideation method, reading (individual)
d) Book readings and discussions (small teams)
e) Small teams' presentations on innovation:(1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
f) Large groups hands-on projects
g) Eight-dimensional (8D) ideation method examples
h) Large teams' videos.
i) Students also will be taken to the **workshop** to experience some kind of hands on training to make carpentry, metal or smithy job.

Reference Books	
1.	Lockwood, T., & Papke, E. (2010). Design Thinking: Integrating Innovation, Customer Experience, and Brand Value. Allworth Press.
2.	Lewrick, M., Link, P., & Leifer, L. (2018). The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems. Wiley.
3.	Plattner, H., Meinel, C., & Leifer, L. (Eds.). (2014). Design Thinking Research: Building Innovation Eco-Systems (Understanding Innovation). Springer.
4.	Brown, T. (2009). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. Harper Business.
Important web links	
1.	Stanford d.school - https://dschool.stanford.edu/
2.	IDEO U - https://www.ideou.com/

Social Internship: After the First Semester of FY B. Tech the students will undergo social rural internship of 10 days, the evaluation of which will be in the Second Semester

The class teacher jointly with the Program Head and First Year Coordinator will plan for this activity. The following tasks to be thought of before the students proceed for the said social internship and accordingly the students will be guided to complete this internship preferably in a rural part of the state.

a) Introduction to social internship projects and objectives.
b) Assignment of social internship teams and project topics.
c) Guidance on project planning and community engagement strategies.

<table>
<tr><td>Year, Program, Semester</td><td colspan="8">F.Y. Part I (All Programs), Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="8">BSC111/ BSC121</td></tr>
<tr><td>Course Category</td><td colspan="8">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="8">Engineering Chemistry (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="3">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="3">03</td><td colspan="2">03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="8">Knowledge about basic chemistry related to periodic table, properties of elements, physical and chemical properties, etc.</td></tr>
<tr><td>Course Rationale</td><td colspan="8">Engineering Chemistry imparts essential chemical principles for engineering applications, covering water technology, corrosion control, materials, green chemistry, nanomaterials, analytical techniques, and energy sources. This course equips students with the knowledge to tackle practical engineering challenges and fosters a foundation for innovative solutions.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The course is aimed at-
1. To enable the students to understand and apply detailed concepts of water source, water impurities, hardness of water and boiler troubles.
2. To enable the students to analyze engineering problems related to metal corrosion and achieving practical solutions for corrosion control.
3. To enrich students with the concepts related to engineering materials like cement, polymers and composites, and meet out the fuel crises in the present scenario for sustainable development.
4. To enable the students to apply principles of green chemistry in chemical synthesis and understand the concepts of synthesis of nanomaterials.
5. To impart the knowledge of basic principles and applications of spectroscopic and other techniques to analyse the compounds.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">Upon completion of this course, student should be able to-
1. Develop understanding of water quality parameters and incorporate methods to produce soft water for industrial and domestic use.
2. Analyze engineering problems associated with corrosion and develop suitable preventive measures.
3. Select the appropriate materials for engineering applications.
4. Recognize the current developments in the fields of energy, green chemistry and nanotechnology for sustainable development.
5. Apply and demonstrate the instrumental techniques for analysis of the materials.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	2	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Water Technology** Introduction, Impurities in water, Water Quality Parameters (Definition, Causes and Estimation) like Hardness, Chlorides, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), Specifications for drinking water, Boiler feed water, Problems associated with use of hard water in boiler, Treatment of water: Ion Exchange Process and Reverse Osmosis.	06
II	**Corrosion and Corrosion Control** Introduction, Types of corrosion, Atmospheric corrosion, Corrosion due to oxygen and other gases, Electrochemical corrosion, Mechanism of electrochemical corrosion (Hydrogen Evolution and Oxygen Absorption), Galvanic Series, Factors influencing rate of corrosion, Corrosion control methods- Proper selection of material, Cathodic protection (sacrificial anode and impressed current methods), Metallic coating like Hot dipping (Galvanizing and Tinning), Metal cladding, Spraying and Electroplating.	06
III	**Engineering Materials** **Cement:** Introduction, Types, Composition of Portland Cement, Setting and Hardening of Cement **Polymers:** Introduction, Classification, Commercially important polymers with synthesis and applications: PE, PVC, Teflon, Nylon, Bakelite and Silicon Polymers, Biodegradable polymers. **Conducting polymers:** Introduction, Mechanism of conduction in poly acetylene and its applications. **Composites:** Introduction, Constitution, Types: Fiber reinforced composites and Particulate composites, applications.	06
IV	**Green Chemistry** Introduction, 12 principles of green chemistry, Various green chemical approaches Microwave synthesis, Phase transfer catalysis, Synthesis of Adipic acid by conventional and Green route. **Nanomaterials** Introduction, Synthesis of nanomaterials: Top down and bottom up approaches, characteristics of nanomaterials and applications of nanomaterials, Carbon Nano tubes	08

	(properties and applications).	
V	**Modern Analytical Techniques** Chemical Analysis, Qualitative and quantitative analysis, Conventional methods of analysis, An overview of modern analytical techniques: Chromatography, Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), Spectroscopy: Principle, Basic Instrumentation and Applications of Ultraviolet-Visible Spectroscopy and IR spectroscopy.	07
VI	**Fuels and Batteries** **Chemical Fuels:** Introduction, Calorific value, Determination of calorific value by Bomb and Boy's Calorimeters, Combustion. **Batteries:** Introduction, Classification, characteristics, construction, working and applications of Li-ion battery. **Fuel Cells:** Components of fuel cell, Types of Fuel cells-alkaline fuel cells, Methanol-oxygen fuel cell and Hydrogen-oxygen fuel cell. **Bioenergy:** Introduction, Classification of biofuel, Biodiesel- production of biodiesel by alkali catalyzed trans-esterification method, Advantages and disadvantages of biodiesel.	06
Text Books		
1.	Satyaprakash & Manisha Agrawal, "Engineering Chemistry", Khanna Book Publishing, Delhi	
2.	Shashi Chawla, "A Text Book of Engineering Chemistry", Dhanpat Rai and Co. (P) Ltd.	
3.	Bahl and Tuli, "Essentials of Physical Chemistry", S. Chand Publishing	
4.	Baskar, "Engineering Chemistry", Wiley	
5.	Jain and Jain, "A textbook of Engineering Chemistry", Dhanpatrai Publication.	
6.	S. S. Dara, S. "A textbook of Engineering", Chemistry: Chand Publication	
Reference Books		
1.	V.R. Gowariker, "Polymer Science", New Age International Publication	
2.	K. J. Sundars, "Organic Polymer Chemistry", Springer Publication.	
3.	Willard Dean, Merrittee, "Instrumental Methods of Chemical Analysis", Tata MacGrow Hill Limited.	
4.	Chatwal and Anand, "Instrumental Methods of Chemical Analysis", Himalaya Publishing House, New Delhi.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="7">BSC111/ BSC121</td></tr>
<tr><td>Course Category</td><td colspan="7">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="7">Engineering Chemistry (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td colspan="2">02</td><td colspan="2">01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7">Knowledge about basic chemistry related to periodic table, properties of elements and handling of glass wares and chemicals, etc.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The Engineering Chemistry Laboratory course offers hands-on experience in essential chemical analysis and synthesis techniques, fostering practical skills in water quality testing, material preparation, and analytical methods. This practical knowledge is crucial for solving real-world engineering problems and enhancing students' proficiency in laboratory practices.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. To impart the knowledge of independent experimental skills and to develop analytical skills for applications in engineering.
2. To provide hands on practice of titrimetric analysis.
3. To analyze various samples by using instrumental methods.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to-
1. Apply basic concepts of chemistry and select the appropriate method for chemical analysis.
2. Analyze the quality of water by determining its quality parameters.
3. Acquire the skill for the preparation of engineering materials like polymers, nanomaterials.
4. Select instrumental techniques for chemical analysis.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	2	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1.	Preparation of standard solution and standardization of a given solution.	02
2.	Determination of total hardness of a water sample using disodium salt.	02
3.	Determination of chloride content of water sample.	02
4.	Determination of alkalinity of water sample by duel indicator method.	02
5.	Determination of viscosity of a given liquid by Ostwald's viscometer	02
6.	Preparation of Polymers (phenol formaldehyde resin/ urea formaldehyde resin)	02
7.	Preparation of chemical compounds using green route.	02
8.	Preparation of nanomaterials.	02
9.	Estimation of rate of corrosion of aluminium in acidic and alkaline medium.	02
10.	Estimation of copper in the given brass solution.	02
11.	Spectrometric/colorimetric determination of concentration of given inorganic sample.	02
12.	Calibration of pH meter and determination of pH of a solution.	02
13.	Demonstration of TLC/paper chromatography.	02
* Instructor may choose any 8-10 experiments from above.		
Text Books		
1.	Vogel's Text Book of Quantitative Chemical Analysis revised by G. H. Jeffery, J. Bassett, J. Mendham and R.C. Denny, 4th Edition.	
2.	Willard, Merit, Dean and Settle, A text book of Instrumental analysis, 10th edition 2020.	
Reference Books		
1.	A. I. Vogel, Quantitative Chemical Analysis, Longman Publication	
2.	B. K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publication, Meerut.	
3.	Renu Bapna and Renu Gupta, Engineering Chemistry, MacMillan Publishers (India) Ltd, Delhi	
4.	D. A. Skoog, D. M. West, Fundamentals of Analytical Chemistry, Cengage Learning.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="7">ESC111/ ESC121</td></tr>
<tr><td>Course Category</td><td colspan="7">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="7">Elements of Civil and Electrical Engineering (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>04</td><td>-</td><td>-</td><td colspan="2">04</td><td colspan="2">04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7">-</td></tr>
<tr><td>Course Rationale</td><td colspan="7">This course is to provide students with a strong foundation in the fundamental principles and concepts of civil and electrical engineering. This foundational knowledge is essential for understanding and applying advanced concepts in specialized areas of engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. To inculcate essentials of civil engineering field to the students of all branches of Engineering.
2. To provide the students an illustration of the significance of Civil Engineering profession in satisfying societal need.
3. To introduce fundamental laws, various concepts and theorems related with electrical Engineering.
4. To provide fundamental knowledge about AC, DC and magnetic circuits.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to-
1. Understand fundamental aspects of civil engineering.
2. Determine the plan and set out a building.
3. Apply types of traversing for calculations of the included angle.
4. Apply methods of levelling for calculation of reduce levels of different points on the surface of the earth.
5. Understand use of various building materials and explain the method of construction of different components of building and building services.
6. Understand the basic concepts of Electrical and Magnetic circuits.
7. Apply and analyze the resistive circuits using star-delta conversion, KVL and KCL under DC supply.
8. Understand the basics of single phase and three phase circuit.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-

CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-
CO7	3	3	-	-	-	-	-	-	-	-	-	-
CO8	2	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introduction to Civil engineering and Modern surveying** Introduction to civil engineering, various disciplines of civil engineering, relevance of civil engineering in overall infrastructural development of the country, Introduction to types of buildings as per National Building Code, Components of residential building and their functions **Surveying:** Principle and objectives of surveying. Linear measurement: Instrument used, tapes, types of tapes. Angular measurement: Instrument used, meridian, bearing. Problems based on open and closed traversing. **Levelling:** Instrument used, Terminology, Types of leveling, and Methods of leveling, Introduction to contour. **Modern surveying:** Introduction to total station and electronic distance meter.	10
II	**Building planning and services** Introduction to planning of residential building, site plan, orientation of building, open space requirement, FSI, position of doors and windows, size of room, building bye laws. Introduction to various building area terms: Computation of plinth area/built up area, floor area/carpet area for a single storey building. Basic infrastructure and services - Elevators, escalators, ramps, air conditioning, towers, chimney and water tank, concept of intelligent buildings.	05
III	**Building construction materials** Brick and cement block – properties and specifications. Cement – OPC properties, grades and others types of cement and its uses. Cement mortar – constituents and preparations. Concrete – PCC and RCC. Steel – Uses of steel in building construction, types and market forms.	05
IV	**DC Networks** Concepts of linear, nonlinear, active, passive, unilateral and bilateral elements; Ideal and practical voltage & current sources, conversion from one from the other; Kirchhoff's laws, statements; Mesh Analysis; Nodal Analysis; Delta-Star & Star-Delta conversion; and its application. **Magnetic circuits:** Magnetic effect of an electric current, Concept of mmf, flux, flux	07

	density, reluctance, permeability and field strength, their units and relationships. Simple series magnetic circuit , comparison of electric and magnetic circuit, force on current carrying conductor placed in magnetic field, Fleming's left hand rule. Faradays laws of electromagnetic induction.	
V	**AC Fundamentals** Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, Period, frequency, instantaneous, peak(maximum), average and r.m.s. values, peak factor and form factor. Phase difference, lagging, leading and in phase quantities.	06
VI	**Single Phase AC Circuits** Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance, series R-L, R-C and R-L-C circuits, phasor diagrams, voltage, current and power waveforms, concept of impedance, concept of active, reactive, apparent power and power factor.	07
Text Books		
1.	S. S. Bhavikattis, "Basic Civil Engineering", New Age International Pvt. Ltd	
2.	G.K.Hiraskar, "Basic Civil Engineering", Dhanapat Rai Publications	
3.	V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill,(Revised Edition)	
4.	B.L. Theraja ,"Electrical Engineering " Vol-I and II	
5.	V.K.Mehta, " Fundamentals of Electrical Technology",S.Chand Publications	
Reference Books		
1.	Gopi. S., Basic civil engineering Person publishers	
2.	Kandya A. A., Elements of civil engineering, Charotar publishing house	
3.	McKay, W. B. and McKay J. K. Building construction Volume I to IV, Person India education services	
4.	Rangwala S. C., Essentials of civil engineering, Charotar publishing house	
	Rangwala S. C. and Dalal K. B. Building construction, Charotar publishing house	
5.	L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.	
6.	D. C. Kulshreshtha, Basic Electrical Engineering, McGraw Hill, 2009.	
Useful web links		
1.	**https://www.youtube.com/watch?v=SvE3NGfIrJ4&list=PLEtCpM3x4BD8iVQLMyXNCTcXP6dl-SDBz&index=1**	

2.	**https://www.youtube.com/watch?v=2eKR8b7q8K4&list=PLkEhIYDhJ6xN7lsr6rc7d5awH5WTmpxG**
3.	**http://nptel.ac.in/courses/105107122/**
4.	**https://nptel.ac.in/courses/105104100**
5.	**https://www.digimat.in/nptel/courses/video/108105112/L01.html**
6.	**https://nptel.ac.in/courses/108105053**

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="7">ESC111/ ESC121</td></tr>
<tr><td>Course Category</td><td colspan="7">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="7">Elements of Civil and Electrical Engineering (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td colspan="2">02</td><td colspan="2">01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7">-</td></tr>
<tr><td>Course Rationale</td><td colspan="7">This course is to provide students with a strong foundation in the fundamental principles and concepts of civil and Electrical engineering. This foundational knowledge is essential for understanding and applying advanced concepts in specialized areas of engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. To learn methods of surveying for the preparation of plan.
2. To identify components of buildings, materials used in the construction.
3. To expose the students for practical training through experiments to understand about fundamental parameters such as resistance, inductance, capacitance and magnetic, AC and DC circuits.
4. To make them understand electrical safety precautions.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to-
1. Experiment to plot the outline of building.
2. Establish surveying and levelling instruments for finding included angles and reduce levels.
3. Explain the components of different types of construction.
4. To conduct experiments on D.C. circuits and AC circuits.
5. To understand the basics laws of magnetic circuit.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1.	Plotting the outline of building by measuring tape.	02
2.	Plotting of closed traverse by Prismatic compass and Surveyor Compass.	02
3.	Determination of Reduced Levels by using dumpy level (Use of Collimation Plane and Rise and Fall method).	02
4.	Use of Total Station to measure angle, R.L., elevation.(Demonstration)	02
5.	Field visit showing various types of construction and prepare field visit report.	02
6.	Study the verification of Kirchhoff's law and Ohm's Law.	02
7.	Transient analysis of series RL and RC circuit.	02
8.	Study of BH curve for magnetic material.	02
9.	Study of series RLC circuit.	02
10.	Study of various power factor improving methods.	02
Text Books		
1.	S. S. Bhavikattis, "Basic Civil Engineering", New Age International Pvt. Ltd	
2.	G.K.Hiraskar, "Basic Civil Engineering", Dhanapat Rai Publications	
3.	Fundamentals of Electrical Engineering by Ashfaq Husain, Dhanpat Rai Company	
Reference Books		
1.	B.C. Punmia, "Surveying", Vol.- I, Vol.-II, Vol.-III, Laxmi Publication	
2.	K.R.Arora, " Surveying Vol.I", Standard Book House	
3.	L. S. Bobrow, —Fundamentals of Electrical Engineering, Oxford University Press, 2011	

Year, Program, Semester	F.Y. Part I (All Programs) Semester I and II						
Course Code	ESC112/ ESC122						
Course Category	Engineering Science Course						
Course title	**Engineering Graphics (Theory)**						
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits		
	03	-	-	03	03		
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total
	30	70	-	-	-	-	100
Pre-requisites(if any)	Knowledge of plane geometry and solid geometry						
Course Rationale	Engineering Graphics introduces students to the essential principles and practices of technical drawing, including orthographic and isometric projections, and computer-aided design (CAD). This course equips students with the skills to create precise graphical representations of engineering objects, which are crucial for effective communication and design in engineering.						
Course Objectives	The course is aimed at- 1. The course is aimed at developing Basic Graphic skills. 2. To learn the engineering graphics standards. 3. To develop Skills in Reading and Interpretation of Engineering Drawings. 4. To introduce Computer-Aided Drafting tools.						
Course Outcomes	Upon completion of this course, student should be able to- 1. Identify basic concepts of BIS conventions and their application. 2. Interpret first angle and third angle projection system. 3. Construct orthographic projections of points, lines and planes. 4. Apply principles of projection and construct orthographic and isometric views of an object. 5. Develop a skill of visualization to understand and read the drawing.						

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	-	1	-	3	-	-
CO2	3	3	3	2	2	1	-	-	-	1	-	-
CO3	3	3	3	2	2	1	-	-	-	1	-	-
CO4	3	3	3	2	2	-	-	-	-	2	-	-
CO5	3	3	3	2	2	-	-	-	2	2	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introduction to Engineering Drawing** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections, Cycloid, Involutes.	06
II	**Orthographic Projections of Points, lines & Planes** Principles of Orthographic Projection - Conventions; Projection of Points and lines inclined to both planes (line in first quadrant only). Projection of planes – inclined Planes and auxiliary Planes.	07
III	**Projections of Regular Solids.** Projection of Prisms, Pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes, solids in first quadrant and resting on HP only.	06
IV	**Orthographic Projections** Different types of lines, Selection of views, spacing of views, dimensioning and sections, Conversion of pictorial view into orthographic view including sectional orthographic view.	08
V	**Isometric projections** Principles of Isometric Projection, Isometric scale, Isometric projections and Isometric views / drawings. Circles in isometric view. Isometric views of simple solids and objects.	06
VI	**Introduction to Computer Aided Sketching** Introduction to CAD software, Graphical User interface of CAD software, Selection of Drawing size and scale, Standard Toolbars, Menus, Tabs, navigational tools, Basic Commands to draw 2D objects, Co-ordinate system and planes, Viewing Commands.	06

***Note:** The above syllabus is to be covered according to the first angle method of projection.

Text Books

1.	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2.	Engineering Drawing and Graphics by K. Venugopal, New Age Publication.
3.	P. S. Gill, Engineering Drawing, S. K. Katariya & sons Publication.

Reference Books

1.	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
2.	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, SciTech Publishers
3.	Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4.	Jain, Maheshwari, Gautam (2021), Engineering Graphics & Design, Khanna Book Publishing.

Alternative NPTEL/SWAYAM Course

Sr. No.	NPTEL Course Name	Instructor	Host Institute
1.	Prof. Rajaram Lakkaraju	IIT Kharagpur	Engineering Drawing And Computer Graphics

2.	Prof. Nihar Ranjan Patra	IIT Kanpur	Engineering Graphics

Useful web links	
1.	**https://nptel.ac.in/courses/112103019/** **National Programme on Technology Enhanced Learning (NPTEL) - Phase II** **Course Name : Engineering Drawing**
2.	**https://nptel.ac.in/courses/112/104/112104172/**
3.	**http://moodle.unishivaji.ac.in/course/search.php?search=engineering+graphics** **Moodle Services, Shivaji University, Kolhapur**
4.	**http://web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf**

Year, Program, Semester	F.Y. Part I (All Programs) Semester I and II						
Course Code	ESC112/ ESC122						
Course Category	Engineering Science Course						
Course title	**Engineering Graphics (Practical)**						
Teaching Scheme and Credits	L	T	P	Total Contact Hours		Credits	
	-	-	02	02		01	
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total
	-	-	-	50	-	-	50
Pre-requisites(if any)	Knowledge of plane geometry and solid geometry						
Course Rationale	Engineering Graphics Laboratory provides hands-on experience in technical drawing, covering lettering, projections, surface development, and CAD software. This course enhances students' practical skills in creating accurate engineering drawings, essential for effective design and communication in engineering projects.						
Course Objectives	The course is aimed at- 1. Fundamental Engineering Graphics standards. 2. Dimensioning and preparation of neat drawings. 3. Reading and Interpretation of Engineering Drawings. 4. Exposure to Computer-Aided Drafting tools.						
Course Outcomes	Upon completion of this course, student should be able to- 1. Identify and implement B.I.S. code of practice for Engineering Drawing. 2. Create geometrical constructions with hand tools. 3. Construct orthographic projection and sectional view of a machine part. 4. Create isometric projection from multiview drawings of an object. 5. Sketch projection of solids and development of lateral surfaces of solids.						

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	-	1	-	3	-	-
CO2	3	3	3	2	2	1	-	-	-	1	-	-
CO3	3	3	3	2	2	1	-	-	-	1	-	-
CO4	3	3	3	2	2	-	-	-	-	2	-	-
CO5	3	3	3	2	2	-	-	-	2	2	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1.	Lettering and geometrical constructions	02
2.	Engineering curves	02
3.	Projections of Points and lines	02
4.	Projections of planes	02
5.	Projections of solids	02
6.	Development of lateral surfaces of solids	02
7.	Orthographic projections	02
8.	Isometric projections	02
9.	Demonstration of drafting software with commands	02
All these sheets should be drawn on half imperial (A2 size) drawing sheets only		
Text Books		
1.	Bhatt N. D., Panchal V. M. & Ingle P. R., (2014), Engineering Drawing, Charotar Publishing House	
2.	Engineering Drawing and Graphics by K. Venugopal, New Age Publication	
3.	P. S. Gill, Engineering Drawing, S. K. Katariya & sons Publication.	
Reference Books Or Web links		
1.	Engineering Drawing Practice for Schools and Colleges- BUREAU OF INDIAN STANDARDS	
2.	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education	
3.	CAD Software Theory and User Manuals	
4.	**http://web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf**	
5.	**https://nptel.ac.in/courses/112/104/112104172/**	

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y, Part I (All Programs) Semester I and II</td></tr>
<tr><td>Course Code</td><td colspan="7">ESC113/ ESC123</td></tr>
<tr><td>Course Category</td><td colspan="7">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="7">Electrical-Electronic Components and Devices (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td colspan="2">02</td><td colspan="2">02</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td>30</td><td>70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Knowledge of Basic Physics and Mathematics ,electron theory, electricity, potential and kinetic energy</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The course offers practical knowledge and skills for understanding and applying various instruments, devices, and systems in real-world scenarios. Studying this course enhances technical competence, critical thinking, problem-solving abilities, and adaptability to evolving technologies in electrical engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. Developing the fundamental understanding of DC and AC Machine.
2. Developing the awareness about Green energy & Power system.
3. Developing the fundamental understanding of various electronics components.
4. Developing the fundamental understanding of Number systems and logic gates.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to-
1. Recognise the concept of DC machine and AC machines.
2. Understand the basics of power systems.
3. Understand the basics of electrical safety rules.
4. Recognise the basics of electronic components and their practical use.
5. Understand the basics of logic gates and number systems.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**DC Machine** **DC Generator:** Working principle of DC machine as generator and motor, constructional features, EMF equation of generator, types of DC generators **DC Motor:** Back EMF and its significance, types of DC motors, numerical problems, Applications of DC Motors	04
II	**AC Machines** **Induction motors**: Concept of rotating magnetic field, principle of operation, types and constructional features, Slip and its significance, Illustrative examples **Transformers:** Principle of operation and construction of single phase transformers (core and shell type), EMF equation, power losses, efficiency, illustrative problems on EMF equation.	04
III	**Basics of Power systems** Introduction**,** Single Line Diagram of AC Power Transmission System Safety & Protection**:** Electric **s**hock & Precautions, HRC Fuse, circuit breaker & its types Earthling: necessity.	04
IV	**Resistors** Concept of resistors, classification, specification: - maximum power rating, tolerance. Construction of carbon film, wire wound resistors, potentiometer, LDR. Color coding.	04
V	**Capacitors and Inductors** Classification of capacitors, specification, Fixed capacitor - construction, specification and application of disc, ceramic capacitor, aluminium electrolytic capacitor. Variable capacitor- Trimmer capacitor. **Inductor :** construction and application of air core, iron core, ferrite core inductor	04
VI	**Number Systems:** Binary Number System, Hexadecimal Number System, octal number system , inert conversion of number systems **Logic gates:** NOT Gate, AND Gate, OR Gate, XOR Gate, NAND Gate, NOR Gate, X-NOR Gate	04
Text Books		
1.	V. N. Mittal and Arvind Mittal “Basic Electrical Engineering” Tata McGraw Hill,(Revised Edition)	
2.	D P Kothari and I J Nagrath “Theory and Problems of Basic Electrical Engineering”, PHI 13th edition 2011.	
3.	Robert Boylestad ,Louis Nashelsky, Electronic Devices and Circuits,Pearson,11th edition,2015	
4.	R.P.Jain**,**"Modern Digital Electronics”, Tata McGraw Hill, 4th edition 2009	
Reference Books		
1.	Edward Hughes: Electrical and Electrical Technology, Pearson Education (Tenth edition)	

2.	Electrical Technology By H.Cotton.		
3.	Allen Mottershead. (PHI)"Electronics Devices & Circuits".		
4.	Thomas L. Floyd"Electronics Devices".		
Alternative NPTEL/SWAYAM Course			
Sr. No.	**NPTEL Course Name**	**Instructor**	**Host Institute**
1.	Basic Electrical Technology	Prof. N.K.De, Prof. G.D.Roy	IIT Khargpur
2.	Fundamentals of Electrical Engineering	Prof. Debapriya Das	IIT Khargpur
Useful web links			
1.	**https://archive.nptel.ac.in/courses/108/105/108105112/**		
2.	**https://nptel.ac.in/courses/108105112**		
3.	**https://www.digimat.in/nptel/courses/video/108108076/L01.html**		
4.	**https://www.digimat.in/nptel/courses/video/108108076/L34.html**		

Year, Program, Semester	F.Y, Part I (All Programs) Semester I and II												
Course Code	ESC113/ ESC123												
Course Category	Engineering Science Course												
Course title	**Electrical-Electronic Components and Devices (Practical)**												
Teaching Scheme and Credits	L	T	P	Total Contact Hours				Credits					
	-	-	02	02				01					
Evaluation Scheme	ISE		ESE		IOE		IPE		EOE		EPE		Total
	-		-		-		50		-		-		50
Pre-requisites(if any)	-												
Course Rationale	This course aims to give a practical understanding of electrical engineering applications in day to day life.												
Course Objectives	The course is aimed at- 1. To make the students familiar with suitability of various electronics components and transducers for different application. 2. To Impart Knowledge about basics of Semiconductor Devices and its parameters. 3. To impart knowledge of the concepts of transformer, different energy conversions machines. 4. To make them understand electrical safety precautions.												
Course Outcomes	Upon completion of this course, student should be able to- 1. Understand the basics of Electronics component. 2. Identify and explain the Basic gates. 3. Understand the applications of various rotating machines. 4. Study the speed control methods for DC motor.												

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1.	To study of speed control methods of DC Shunt motors	02
2.	To study of speed control methods of DC Series motors	02
3.	To study of DC and AC motor Starters	02
4.	Study of various wiring systems and switchgear	02
5.	To demonstrate different types of electrical protection equipment such as fuses, MCB, MCCB, ELCB.	02
6.	Testing of electronics components- Resister, capacitor, inductor diode ,Transistor ,LED and switch using multi-meter and CRO	02
7.	Logic gates and truth table verification.	02
8.	To study safety precautions while working on electrical systems, handling of various equipment's such as multimeter, ammeters, voltmeters, wattmeter's, real life resistors, inductors and capacitors	02
All these sheets should be drawn on half imperial (A2 size) drawing sheets only		
Text Books		
1.	Ashfaq Husain,"Fundamentals of Electrical Engineering", Dhanpat Rai Company	
Reference Books		
1.	L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011	
2.	D.C. Kulshreshtha, Basic Electrical Engineering, McGraw Hill, 2009	

<table>
<tr><td>Year, Program, Semester</td><td colspan="8">F.Y, Part I (All Programs) Semester II</td></tr>
<tr><td>Course Code</td><td colspan="8">BSC122</td></tr>
<tr><td>Course Category</td><td colspan="8">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="8">Engineering Mathematics-II (Integral Calculus) (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="3">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>03</td><td>01</td><td>-</td><td colspan="3">04</td><td colspan="2">04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>50</td><td>-</td><td>-</td><td>-</td><td>150</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="8">Differential Calculus, Basics of Integration.</td></tr>
<tr><td>Course Rationale</td><td colspan="8">This course equips students with advanced mathematical techniques essential for engineering analysis. Covering special functions, curve tracing, multiple integrals, complex variable integration, and MATLAB programming, this course provides the analytical tools necessary for solving complex engineering problems and conducting sophisticated mathematical modeling.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The course is aimed at-
1. To familiarize the students with integral calculus.
2. To teach Mathematical methodologies and models.
3. To develop mathematical skills and enhance logical thinking power of students.
4. To provide students with skills in special functions, integral calculus, complex integration which would enable them to devise engineering solutions for given situations they may encounter in their profession.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">Upon completion of this course, student should be able to-
1. To understand the concept of special functions and curve tracing related to multiple integral and various branches of engineering.
2. To understand how to solve double and triple integrals
3. Apply the knowledge of evaluation of multiple integral to various engineering problems.
4. Evaluation and analysis of complex integration.
5. Understand the features of the Matlab software and its applications.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-

CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Special Functions** Gamma functions and their properties, Beta functions and their properties, Differentiation under integral sign.	07
II	**Curve Tracing** Tracing of curves in Cartesian coordinate system (Simple curves, Semi cubical parabola, Cissoid of Diocles, Strophoid, Astroid, Witch of Agnesi and Common Catenary), Tracing of curves in Polar coordinate system (Simple curves, Cardioid, Pascal's Limacon, Lemniscate of Bernoulli and Rose curves)	06
III	**Multiple Integrals** Introduction of Double Integrals, Evaluation of Double Integrals, Change of order of Integration, Change of variables using Jacobians, Change into Polar coordinates, Evaluation of Triple Integral with given limits.	07
IV	**Applications of Multiple Integrals** Applications of Multiple Integrals to Area enclosed by plane curves, Mass of a Plane Lamina, Moment of Inertia of a plane lamina and Volume of solid of revolution.	07
V	**Functions of Complex Variables: Integration** Complex line integrals, Cauchy's integral theorem (without proof), Cauchy's integral formula (without proof), Taylor series, Laurent series, zeros of analytic functions, singularities, and Cauchy's Residue theorem (without proof).	07
VI	**Programming with Matlab** Introduction, Installation, Basic functions of Matlab, Plotting of 2D and 3D Curves, Finding Indefinite Integral, Finding Definite Integral, Plotting of Complex function, Complex Line Integrals.	06
	Suggested list of Tutorials and Assignments- 1. Gamma function 2. Beta function 3. Curve tracing 4. Double and Triple Integration 5. Change of order of Integration 6. Change of variables using Jacobians 7. Applications of Multiple integrals 8. Cauchy's Integral theorem and Cauchy's integral formula 9. Taylor series and Laurent series 10. Cauchy's Residue theorem	

	General Instructions: 1. Each Student has to write at least 6 assignments on entire syllabus and at least 4 assignments on Matlab programming (including print out). Students must be encouraged to write mathematical programs in tutorial class only. 2. Batch wise tutorials are to be conducted. The number of students per batch should be as per the practical batches. 3. Matlab assignments will be based on i. Tracing of 2D and 3D Curves ii. Finding Indefinite and Definite Integrals iii. Double and triple integral iv. Plotting of Complex function v. Complex line integrals	

Text Books	
1.	B. S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi.
2.	Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons.
3.	B. V. Ramana, “Higher Engineering Mathematics”, Tata McGraw-Hill, New Delhi.
4.	William J. Palm III, Introduction to MATLAB for Engineers, McGraw-Hill.
Reference Books	
1.	H. K. Dass, “Advanced Engineering Mathematics”, S. Chand Publishing.
2.	Dr. B. S. Grewal, “Numerical Methods”, Khanna Publishers, Delhi.
3.	Merle C. Potter, “Advanced Engineering Mathematics”, OXFORD University Press, 3rd Edition.
4.	C. R. Wylie, “Advanced Engineering Mathematics”, McGraw Hill Publication, New Delhi.
5.	S. S. Sastry, “Engineering Mathematics (Volume-I)”, Prentice Hall Publication, New Delhi.
6.	M. D. Greenberg, “Advanced Engineering Mathematics”, Pearson Education.

Useful web links	
1.	**https://nptel.ac.in/courses/111105121**
2.	**https://nptel.ac.in/courses/111107119**
3.	**https://nptel.ac.in/courses/111105134**
4.	**https://nptel.ac.in/courses/111105167**

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">F.Y. Part I (All Programs) Semester II</td></tr>
<tr><td>Course Code</td><td colspan="5">IKS121</td></tr>
<tr><td>Course Category</td><td colspan="5">Indian Knowledge System</td></tr>
<tr><td>Course title</td><td colspan="5">Human Rights and Constitution</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>01</td></tr>
<tr><td rowspan="3">Evaluation Scheme</td><td>ISE</td><td>ESE</td><td>IE</td><td>IOE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>50</td><td>-</td><td>50</td></tr>
<tr><td colspan="5">IE at the course in charge end: (Preferred to have 3-5 assignments and conduct of an MCQ Test based on the course work. Passing is mandatory to earn the credit.</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisite for first-year engineering students is the interest in social justice issues and the ability to think critically and analytically is important.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course provides engineering students with a multidisciplinary perspective, allowing them to apply their technical knowledge to contribute to human rights promotion and protection in engineering contexts. Ultimately, students gain the knowledge, skills, and values necessary to navigate the complexities of human rights issues and contribute to their promotion and protection in various aspects of life.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course is aimed at-
1. Develop a comprehensive understanding of the fundamental principles of human rights and their relevance to the Indian Constitution.
2. Cultivate critical thinking and analytical skills for analyzing and addressing human rights issues within engineering contexts.
3. Foster awareness of the legal framework and mechanisms for protecting human rights, enabling students to become advocates for social justice.
4. Promote ethical and inclusive citizenship among engineering students, emphasizing the importance of upholding human rights in their professional and personal lives.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to-
1. Understand the fundamental principles of human rights and their application in engineering contexts.
2. Apply critical thinking skills to analyze and address human rights issues within engineering projects.
3. Evaluate the legal framework and mechanisms for protecting human rights and propose strategies for advocacy in engineering practice.
4. Demonstrate ethical and inclusive citizenship by integrating human rights principles into professional conduct in engineering settings.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	2	-	3	-	2	-	-	-	-
CO2	-	-	2	2	-	2	-	-	2	-	-	3
CO3		3	2	-	-	-	2	-	2	-	-	-
CO4	-	-	-	-	-	3	-	3	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I.	**Introduction to Human Rights and Indian Constitution:** a) Overview of human rights principles and concepts b) Introduction to the Indian Constitution and its significance in protecting human rights	02
II.	**Fundamental Rights and Citizenship:** a) Understanding fundamental rights in the Indian Constitution b) Citizenship rights and their implications on human rights	02
III.	**Social Justice and Equality:** Equality before the law and anti-discrimination provisions Rights of marginalized communities and affirmative action policies	02
IV.	**Rights of Women and Children:** a) Gender equality and women's rights under the Indian Constitution b) Child rights, protection, and welfare laws in India	02
V.	**Freedom of Expression and Media Rights:** a) Freedom of speech and expression in the Indian context b) Media rights, press freedom, and challenges in the digital age	02
VI.	**Human Rights Institutions and Enforcement:** a) National and international human rights institutions b) Human rights enforcement mechanisms and legal remedies	02

Sr. No.	Reference Books
1.	Baxi, Upendra. The Future of Human Rights. Oxford University Press, 2008.
2.	Basu, Durga Das. Introduction to the Constitution of India. LexisNexis, 2019.
3.	Bhagwati, P. N., & Desai, S. M. Human Rights: International Challenges. Eastern Book

	Company, 2012.
4.	Mookherjee, Monika, & Shiva Rao, B. R. Perspectives on Human Rights. Oxford University Press, 2018.
5.	Murthy, S. N. Human Rights in India: Historical, Social, and Political Perspectives. Oxford University Press, 2006.
6.	Shah, A. G. The Constitution of India: Select Issues in Historical Perspective. Oxford University Press, 2014.
Sr. No.	**Important web links**
1.	**Human Rights Watch: https://www.hrw.org/**
2.	**National Human Rights Commission (NHRC): https://nhrc.nic.in/**
3.	**Ministry of Law and Justice, Government of India: https://www.molaw.gov.in/**
4.	**United Nations Human Rights: https://www.ohchr.org/**

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester II</td></tr>
<tr><td>Course Code</td><td colspan="7">HSMEC121</td></tr>
<tr><td>Course Category</td><td colspan="7">Humanities and Social Sciences , Management, Environment Courses</td></tr>
<tr><td>Course title</td><td colspan="7">Professional Communication (English)-II</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td colspan="2">02</td><td colspan="2">00</td></tr>
<tr><td rowspan="3">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td colspan="8">IE at the course in charge end: (Preferred to have 3-5 assignments and conduct of an MCQ Test/Viva Voce based on the course work. Passing is mandatory.</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Students must have the knowledge of basic English grammar, writing and reading skill.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">Professional Communication (English) II enhances essential communication skills for professional success, covering business correspondence, job application techniques, and workplace communication. This course focuses on developing listening, reading, and interpersonal skills, as well as corporate communication strategies, equipping students to excel in various professional contexts.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. To acquire the techniques of letter, E-Mail writing.
2. To learn drafting CV, cover letter, report and proposal writing.
3. To learn interview techniques and group discussion skill.
4. To develop reading and listening skill for better communication.
5. To be acquaint workplace communication and etiquettes.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to-
1. Write various types of business letters and official correspondences and to make students familiar with E-communication.
2. Learn the essentials of communication skill for the employment.
3. Get ample practice of listening and reading skill.
4. Acquaint with various soft skills and etiquettes at work place.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	3	-	2
CO2	-	-	-	-	-	-	-	-	-	3	-	2

CO3	-	-	-	-	-	-	-	-	-	3	-	2
CO4	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I.	**Professional Correspondence :** Principles, Features, Types, Format and layout of Business letter. Types of Business Correspondence – letters of Enquiry, Quotation, Order, Instructions, Sales, Credit, Complaint, Collection etc. E-mail writing	06
II.	**Communication skill for Employment:** Job Application letters -- Covering letter, Resume, C.V. Interview skill, Group Discussion skills - Features and Importance, presentation skills - Features, Types, Structure, Aids and Importance, Technical Proposal- Writing technical proposals. Technical Report -- Writing Technical Reports.	06
III.	**Developing listening skill:** difference between Hearing and Listening, listening process, Traits of good listener, Techniques to improve listening skills with audio/ video sample.	04
IV.	**Reading skill:** Importance of effective reading, types of reading, (Skimming; Scanning, Intensive reading, Extensive reading) Overcoming common obstacles, reading comprehension, tips and strategies to improve reading skill.	04
V.	**Professional Communication at workplace:** Soft skills. Kinesics, Para language, Interpersonal communication skills – Role of Personality and its various attributes like EQ, attitude, motivation, stress management and accepting criticism in determining efficacy of interpersonal communication, oral expressions in various professional contexts, Telephonic Etiquette. Corporate communication skills – Role of business etiquette, conducting meetings, managing conflict, negotiation, team spirit, decision-making, time management and problem solving skills.	06
Text Books		
1.	A Textbook of English Language Communication Skills, (ISBN-978-81-955465-2-7), Published by Infinite Learning Solutions, Bengaluru - 2022.	
2.	Technical Communication – Principles and Practice, Third Edition by Meenakshi Raman and Sangeetha Sharma, Oxford University Press 2017.	
3.	David Irwin, “Effective Business Communications” Viva- Thorogood.	
4.	Dhanavel. S P, “English and Soft Skills”, Orient BlackSwan. India 2018.	
Reference Books		
1.	Rajendra Pal and J S Korlaha, “Essentials of Business Communication” HI Sultan Chand and Sons, New Delhi	
2.	Goldsmith, “Soft Skills: Enhancing Employability”, Marshall and M.S. Rao Dreamtech Press. India, 2020	

3.	Technical Communication by Gajendra Singh Chauhan and Et al, (ISBN-978-93- 5350-050-4), Cengage learning India Pvt Limited [Latest Revised Edition] - 2019.
4.	Practical English Usage by Michael Swan, Oxford University Press – 2016.
5.	Functional English (As per AICTE 2018 Model Curriculum) (ISBN-978-93-5350-047-4) Cengage learning India Pvt Limited [Latest Edition 2019].
Useful web links	
1.	**https://learnenglish.britishcouncil.org**
2	**https://www.fluentu.com**

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">F.Y. Part I (All Programs) Semester II</td></tr>
<tr><td>Course Code</td><td colspan="7">VSEC121</td></tr>
<tr><td>Course Category</td><td colspan="7">Vocational and Skill Enhancement Courses</td></tr>
<tr><td>Course title</td><td colspan="7">Design Thinking and Innovation-II</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>01</td><td>01</td><td>-</td><td colspan="2">02</td><td colspan="2">00</td></tr>
<tr><td rowspan="3">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>50</td><td>-</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td colspan="7">IE at the course in charge end: (Preferred to have 3-5 assignments and conduct of an MCQ Test based on the course work. Passing is mandatory.</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="7">Design Thinking & Innovation - I</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The purpose of engineering education has to be to transform these graduates who can design. The concept of design or design thinking though complex, it is the robust and it must be developed among the budding graduates so as to make them not alone job seekers but the providers too. Therefore, the particular course is towards preparing engineering graduates as intended to be versatile of all other professionals.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is aimed at-
1. Foster entrepreneurial mindset and innovative problem-solving.
2. Develop practical entrepreneurial skills for successful implementation.
3. Apply design thinking principles to solve real-world problems through hands-on activities.
4. Foster creativity, collaboration, and iterative problem-solving skills in a practical design thinking session.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to-
1. Identify and evaluate entrepreneurial opportunities, and develop innovative solutions.
2. Apply critical thinking, refine business models, and effectively communicate entrepreneurial ideas.
3. Demonstrate proficiency in utilizing design thinking tools and methods to generate innovative solutions.
4. Collaborate effectively in multidisciplinary teams to prototype and iterate on design concepts.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	2	-	-	-	-	-	3	-	-	2
CO2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	2	2	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Innovation and Entrepreneurship:** a) Introduction to innovation and entrepreneurship, market analysis, and creative confidence. b) Business model development, prototyping, and customer validation. c) Pitching and presentation skills, entrepreneurial skills, and mind-set development	12 (L)
During the tutorial session itself for first 6 sessions, the course facilitator will complete these three sub units interactively while remaining 6 sessions will be free for the students to have the activities for which the following general guidelines to be followed: **General Instructions for course facilitators:** **The facilitators may use different student centric teaching learning methods to make the course content more and interesting and meaningful.** Some of the following activities may be planned a. Brain teasers (aka Puzzle Busters, to be solved individually) b. Cartoon captions (small teams) c. TRIZ, a systematic ideation method, reading (individual) d. Book readings and discussions (small teams) e. Small teams' presentations on innovation:(1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering. f. Large groups hands-on projects g. Eight-dimensional (8D) ideation method examples h. Large teams' videos. i. Students also will be taken to the **workshop** to experience some kind of hands on training to make carpentry, metal or smithy job. (Care to be taken to make the students aware of Design Thinking & Customer Centricity Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of	12 (T)

Customer Expectations with Product Design)	
	Reference Books
1.	Drucker, P. F. (2007). Innovation and Entrepreneurship: Practice and Principles. Harper Business.
2.	Blank, S. G. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch.
3.	Christensen, C. M. (2013). The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business Review Press.
4.	Bagchi, S., (2011).The Professional: Defining the New Standard of Excellence at Work. Portfolio/Penguin, India.
	Important web links
1.	**YourStory (https://yourstory.com/)**
2.	**Inc42 (https://inc42.com/)**

<table>
<tr><td>Year,Program, Semester</td><td colspan="5">F.Y. Part I (All Programs) Semester II</td></tr>
<tr><td>Course Code</td><td colspan="5">PSI 121</td></tr>
<tr><td>Course Category</td><td colspan="5">Project Seminar Internship</td></tr>
<tr><td>Course title</td><td colspan="5">Social Internship</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td colspan="4">10 Days Social Internship</td><td>00</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="3">IE: 50</td><td colspan="2">Total =50</td></tr>
<tr><td colspan="5">IE at the course in charge end: (A brief report on the internship activity is mandatory to be submitted. Report evaluation will be for 30 marks while there will be 20 marks for viva voce based on the activity.Passing is mandatory.)</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">Design Thinking and Innovation-I and orientation by the program before proceeding on to this internship.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course is aimed at-
1. Cultivate rural awareness and empathy among students.
2. Enable students to apply engineering skills effectively in underserved areas.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to-
1. Increased recognition of rural challenges and dynamics.
2. Demonstrated ability to devise and implement relevant solutions.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	2	-	3	3	-	3	-	-	2
CO2	-	-	2	2	-	3	-	-	-	-	-	3

Level of Mapping as: Low 1, Moderate 2, High 3

Social Internship Course Description

After the First Semester of FY B. Tech, the students will undergo social internship of 10 days preferably in rural part of the country.

Here are some of the potential activities that students could engage in during their 10-day social internship:

1. **Community Needs Assessment:**
   - Conduct surveys and interviews to understand the specific needs and challenges of the community.
   - Identify priority areas for potential engineering interventions.
2. **Interactive Workshops:**
   - Organize workshops to share basic engineering concepts with community members, fostering mutual learning.

- Collaborate on simple projects, like building low-cost solar cookers or water purification systems.

3. **Design Thinking Sessions:**
    - Facilitate brainstorming sessions with locals to generate innovative ideas for solving local problems.
    - Prototype and refine potential solutions based on community input.
4. **Infrastructure Evaluation:**
    - Assess existing infrastructure (water supply, sanitation, roads, etc.) for maintenance needs or improvements.
    - Propose feasible upgrades using engineering principles.
5. **Environmental Initiatives:**
    - Participate in tree planting drives or waste management campaigns to promote environmental sustainability.
    - Educate the community about eco-friendly practices.
6. **Skill Enhancement Workshops:**
    - Teach basic technical skills, such as basic repairs, to empower locals to address minor challenges independently.
    - Provide training on digital literacy to bridge the technological gap.
7. **Health and Hygiene Workshops:**
    - Conduct workshops on personal hygiene, sanitation, and health awareness.
    - Collaborate with healthcare professionals to provide basic medical check-ups and guidance.
8. **Documentation and Reporting:**
    - Maintain a daily journal to document experiences, observations, and interactions.
    - Compile a comprehensive report outlining findings, proposed solutions, and lessons learned.
9. **Cultural Exchange Activities:**
    - Engage with the community through cultural activities, such as sharing traditional dances, songs, or cuisine.
    - Foster a sense of unity and understanding between students and locals.
10. **Feedback and Reflection Sessions:**
    - Regularly engage in discussions to reflect on the challenges faced, lessons learned, and potential improvements.
    - Gather feedback from both students and community members to enhance the internship's impact.

The specific activities may vary based on the community's needs and the students' skills. The key is to create meaningful interactions that promote learning, collaboration, and positive impact.

Equivalence for the curriculum revision at First Year B. Tech

We at the B. Tech (All Programs), Department of Technology due for revision in curriculum w.e.f. 2023-2024 have revised the structure and the content as well at the F.Y.B. Tech .The entire structure for Second Year to Final Year B. Tech respective Programs is also designed under this revision. The detailed of course content will be designed and submitted as the First Year batch proceed year to year.

A special mention rather feature of this revision is, ***it is in line with New National Education Policy 2020 guidelines.*** It is our every effort to incorporate most of the key features of NEP2020. Also it has taken due care to match with the National Credit Framework requirements as well as an attempt is made to make it in alignment with AICTE Model curricula.

Following is a semester wise table that depicts equivalences for the previous version of curriculum with the new one particularly for first two semesters under F.Y B.Tech.

SEM – I

Sr. No.	First Year B. Tech Semester I Pre-revised syllabus	First Year B. Tech Semester I Revised syllabus	Remark
1.	Engineering Mathematics–I	Engineering Mathematics–I	Content is revised
2.	Engineering Physics (Theory & Lab)	Engineering Physics (Theory & Lab)	Content is revised
3.	Basics of Mechanical Engineering (Theory & Lab)	-	-
4.	-	Elements of Mechanical and Electronics Engineering (Theory & Lab)	Two courses of the previous version are clubbed.
5.	Engineering Mechanics (Theory & Lab)	Engineering Mechanics (Theory & Lab)	Content is revised
6.	Basic Electronics Engineering (Theory & Lab)	-	Clubbed with other course.
7.	Computer Programming (Lab)	Computer Programming for Engineers (Theory & Lab)	Content is revised
8.	Workshop Practice (Lab)	-	A new course called design thinking & Innovation is introduced in lieu.
9.	-	Professional Communication (English)-I (Theory)	Content is revised, split in I & II, It is as an audit course.
10.	-	Design Thinking and Innovation-I	Newly introduced audit course.
11.	-	Yoga and Meditation	Newly introduced Credit course.

SEM – II

Sr. No.	First Year B. TechSemester II Pre-revised syllabus	First Year B. TechSemester II Revised syllabus	Remark
1.	Engineering Mathematics–II	Engineering Mathematics–II	Content is revised.
2.	Engineering Chemistry (Theory & Lab)	Engineering Chemistry (Theory & Lab)	Content is revised.
3.	Engineering Graphics (Theory & Lab)	Engineering Graphics (Theory & Lab)	Content is revised.
4.	Basic Civil Engineering (Theory & Lab)	-	-
5.	-	Elements of Civil and Electrical Engineering (Theory & Lab)	Two courses are clubbed with content revision
6.	Basic Electrical Engineering (Theory & Lab)	-	-
7.	-	Electrical-Electronic Components and Devices (Theory & Lab)	Two courses are clubbed with content revision
8.	Programming with Scilab and Matlab (Lab)	-	-
9.	ProfessionalCommunication (Lab)	Professional Communication (English)-II (Theory)	Content is revised, split in I & II, It is as an audit course.
10.	-	Design Thinking and Innovation-II	Newly introduced audit course.
11.	-	Social Internship	Newly introduced audit course
12.	-	Human Rights and Constitution	Newly introduced Credit course.

Courses against Certificate in Respective B.Tech Major

(Exit After First Year B.Tech)

Here onwards are the Program Wise course contents for the two courses, two credits each per Program. These need to be completed by the candidates who wish to exit after their First Year of B.Tech with a claim to be the awardees for the Certificate in respective Major Specialisation. The candidates also have to undergo one month industrial internship with 4 credits, thus with total earning of **08 credits** against this certification. Also such candidates have to pay separate fees for such a certification.

Shivaji University, Kolhapur

Department of Technology

B. Tech (Chemical Engineering), Exit After First Year (Certificate Course in Chemical Engineering)

Teaching & Evaluation Scheme

Sr.No.	Category	Course Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs Or In face to face mode (Program Core Courses)	CC- CHE1	Fundamentals of Chemical Engineering	02	-	-	02	02	30:70	00:00
2.		CC- CHE2	Introduction to Distributed Control System	02	-	-	02	02	30:70	00:00
3.	Program Based Internship	CC-PBI	In plant Training	One Month				04	00:00	50:50
				-	-	-	-	**08***	**200****	**100**
			Total Hours	**04**	-	-	**04**	-	-	-

Note: The Workload against the Certificate Course will be finalised at the Program Level considering the strength of the students seeking for the Certificate. *Obtaining these credits will be in addition to 42 regular credits at FY B. Tech

** There is an option for End Semester Examination either on respective MOOC platform if any or through the University System.

Note 1: The students aspiring to exit after first year will undergo the study of courses/MOOC from the list provided by the Program.

Note 2: Program Specific Industry Internship to be completed by such students before commencement of SY B. Tech.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">First Year B. Tech (Chemical Engineering), Part I, Semester I & II</td></tr>
<tr><td>Course Code</td><td colspan="5">CC-CHE 1</td></tr>
<tr><td>Course Category</td><td colspan="5">Certificate in Chemical Engineering</td></tr>
<tr><td>Course title</td><td colspan="5">Fundamentals of Chemical Engineering</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td>02</td><td>02</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisites for this course typically include a solid background in chemistry and mathematics, including topics like stoichiometry, chemical equations, and calculus. Basic understanding of physics principles, such as thermodynamics and fluid mechanics, is also helpful. Familiarity with engineering fundamentals and problem-solving skills is advantageous.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course provides a comprehensive introduction to the core principles and concepts in chemical engineering. It aims to equip students with the foundational knowledge and skills necessary to understand and analyze chemical processes, perform mass and energy balances, and apply engineering principles to solve problems in the field of chemical engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course is aimed at-
1. Apply chemical engineering principles to analyze and solve engineering problems in various process industries.
2. Evaluate and interpret mass and energy balances in chemical systems using quantitative analysis techniques.
3. Demonstrate an understanding of thermodynamics and its application to chemical processes.
4. Assess and analyze the performance and design of chemical reactors and separation processes.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to-
1. Apply chemical engineering principles to solve complex engineering problems in diverse process industries.
2. Analyze and interpret mass and energy balances in chemical systems to ensure efficient and sustainable operations.
3. Explain the application of thermodynamics in predicting and optimizing the behaviour of chemical processes.
4. Evaluate and propose effective reactor designs and separation processes based on performance analysis and optimization techniques.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	-	-
CO2	-	3	2	2	-	-	-	-	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	-
CO4	-	-	2	-	2	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I.	**Introduction to Chemical Engineering:** • Overview of chemical engineering principles, scope, and applications • Fundamentals of chemical processes, unit operations, and process flow diagrams • Introduction to mass and energy balances in chemical systems • Overview of safety considerations and ethical responsibilities in chemical engineering	04
II.	**Thermodynamics and Phase Equilibrium:** • Introduction to thermodynamics and its application in chemical engineering • Laws of thermodynamics and their relevance to chemical processes • Phase equilibrium and its significance in chemical systems • Application of thermodynamics to analyze and predict phase behaviour in chemical processes	04
III.	**Chemical Reaction Engineering**: • Fundamentals of chemical kinetics and reaction rate equations • Analysis of reaction mechanisms and rate-determining steps • Reactor types and their design considerations • Application of reaction engineering principles to optimize chemical reactions	04
IV.	**Heat and Mass Transfer:** • Principles of heat transfer and its application in chemical engineering • Conduction, convection, and radiation heat transfer mechanisms • Mass transfer fundamentals and its relevance in chemical processes • Design and analysis of heat exchangers and mass transfer equipment	04
V.	**Separation Processes:** • Introduction to separation processes in chemical engineering • Distillation, absorption, extraction, and adsorption processes • Membrane separation techniques and their applications • Analysis and optimization of separation processes in chemical systems	04

VI.	**Process Control and Safety:** • Basics of process control and instrumentation in chemical engineering • Control system components, feedback loops, and PID control • Safety considerations and hazard analysis in chemical processes • Overview of regulatory frameworks and best practices for process safety	04

Reference Books	
1.	Felder, R. M., & Rousseau, R. W. (2016). Elementary Principles of Chemical Processes. Hoboken, NJ: Wiley.
2.	Smith, J. M., Van Ness, H. C., & Abbott, M. M. (2017). Introduction to Chemical Engineering Thermodynamics. New York, NY: McGraw-Hill Education.
3.	Levenspiel, O. (2016). Chemical Reaction Engineering. Hoboken, NJ: Wiley.
4.	Coulson, J. M., Richardson, J. F., Sinnott, R. K., & Towler, G. (2017). Chemical Engineering Design: Principles, Practice, and Economics of Plant and Process Design. Oxford, UK: Butterworth-Heinemann.
5.	Seader, J. D., Seader, J. F., & Lewin, D. R. (2016). Separation Process Principles. Hoboken, NJ: Wiley.
Important web links	
1.	AIChE (American Institute of Chemical Engineers): https://www.aiche.org/
2.	Chemical Engineering World: https://www.chemengonline.com/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">First Year B. Tech (Chemical Engineering), Part I, Semester I & II</td></tr>
<tr><td>Course Code</td><td colspan="5">CC-CHE 2</td></tr>
<tr><td>Course Category</td><td colspan="5">Certificate in Chemical Engineering</td></tr>
<tr><td>Course title</td><td colspan="5">Introduction to Distributed Control System</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td>02</td><td>02</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">Prerequisites: Basic understanding of control systems and familiarity with principles of science and engineering.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course offers participants a foundational understanding of DCS technology and its significance in modern industries. By covering key aspects such as architecture, programming, integration, and maintenance, the course prepares participants to contribute effectively to DCS-driven operations. This knowledge serves as a stepping stone for further studies and career opportunities in chemical engineering, automation, and related fields. Ultimately, the course empowers participants to grasp the principles and advantages of DCS and apply them practically in real-world scenarios.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course is aimed at-
1. Understand DCS principles, components, and advantages over traditional control systems.
2. Gain practical skills in configuring and programming DCS systems for industrial control strategies.
3. Develop troubleshooting and maintenance abilities to ensure reliable DCS operation.
4. Explore DCS integration, human-machine interfaces (HMIs), and emerging trends in the field.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to-
1. Understand DCS principles, components, and advantages over traditional control systems.
2. Apply DCS configuration and programming skills to design and implement control strategies in industrial applications.
3. Demonstrate proficiency in troubleshooting and maintenance to ensure reliable DCS operation.
4. Analyze DCS integration, human-machine interfaces (HMIs), and emerging trends to assess their impact on industrial control systems.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	2	2	-	-	-	-	-	-	-
CO2	-	3	2	2	-	-	-	-	-	-	-	-
CO3	-	2	3	2	2	-	-	-	-	-	-	-
CO4	-	-	2	-	2	2	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I.	**Introduction to Control Systems** • Overview of control systems and their importance in various industries • Introduction to basic control principles: feedback, feedforward, and closed-loop control. • Types of control systems: centralized vs. distributed control • Introduction to DCS components: sensors, actuators, controllers	04
II.	**DCS Architecture and Configuration** • Understanding the architecture and structure of a DCS • Introduction to hardware components of a DCS: controllers, input/output (I/O) modules • Introduction to DCS software and configuration tools • Basics of communication protocols used in DCS	04
III..	**DCS Programming and Control Strategies** • Introduction to programming languages used in DCS • Basics of control strategies and their implementation in DCS • Overview of process control loops and tuning parameters • Simple control algorithm design using DCS programming language	04
IV.	**DCS Integration in Industries** • Integration of DCS with various industries: manufacturing, power, chemical, etc. • Introduction to safety instrumented systems (SIS) and programmable logic controllers (PLC) • Overview of field instrumentation in DCS: sensors, transmitters, control valves • Examples of DCS integration in different industrial processes	04

V.	**Human-Machine Interface (HMI) and Operator Interaction** • Understanding the role of HMI in DCS • Basics of HMI design and layout principles • Introduction to real-time monitoring and control through HMIs • Overview of alarms and operator response in DCS environments	04
VI.	**DCS Maintenance and Troubleshooting** • Introduction to preventive maintenance practices for DCS • Troubleshooting techniques for common DCS issues • Importance of software updates, backups, and system security in DCS • Basic safety considerations during maintenance activities	04

Reference Books	
1.	Wilkes, M.J. (1998). Distributed Control Systems: Their Evaluation and Design. Addison-Wesley.
2.	Gopal, M. (2005). Distributed Control Systems: Concepts and Applications. Alpha Science International Ltd.
3.	Bailey, D.H. (2001). Distributed Control Systems: Their Implications for Process Industries. Wiley-Interscience.
4.	IDC Technologies. (2003). Practical Distributed Control Systems (DCS) for Engineers and Technicians. IDC Technologies.
Important web links	
1.	https://www.controlglobal.com/
2.	https://www.isa.org/

The document over the next pages is for one month Industrial Internship necessary as a part of requirement to fulfil the credits 4 in number in addition to the 4 credits against two theory courses. The student aspiring to exit after the first year will have total 8 credits earned over and above the 42 credits from the First Year. The scheme for this Industrial Internship is common to all the UG Programs. It is as follows.

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">Exit after First Year of B. Tech (Respective Specialization), Certificate Claim</td></tr>
<tr><td>Course Code</td><td colspan="7">CC-PBI</td></tr>
<tr><td>Course Category</td><td colspan="7">Course for Certicate in Respective Specialization</td></tr>
<tr><td>Course title</td><td colspan="7">Industrial Internship</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td colspan="5">One Month</td><td colspan="2">04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td>-</td><td>50</td><td>-</td><td>50</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Completion of all the courses of FY B. Tech.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The purpose of the In Plant Training course is to provide students with practical exposure to the industry. This hands-on experience allows students to apply theoretical knowledge gained in the classroom to real-world scenarios. By engaging in industrial training, students develop essential skills, gain industry insights, and enhance their employability in the respective engineering field.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The training will ensure students
1. To gain practical exposure to industrial processes in respective engineering field.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of the In-Plant Training course, students will be able to
1. Understand industrial processes in respective field of engineering.
2. Apply theoretical knowledge to practical situations.
3. Utilize tools and techniques effectively in experiments.
4. Identify and mitigate workplace safety hazards.
5. Collaborate effectively in multidisciplinary teams.
6. Communicate findings professionally.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	2	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	3	-	-	-

CO 6	-	-	-	-	-	-	-	-	-	3	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

The In-Plant Training course encompasses a comprehensive blend of theoretical learning and hands-on experience in an industrial setting. The course content includes the following however all the contents may not be exactly applicable to all the specializations. There may be variation from Specialization to Specialization:

1. Introduction to respective Engineering Industry: Overview of different sectors, processes, and applications within the particular engineering domain.
2. Safety Procedures and Protocols: Training on safety regulations, hazard identification, emergency procedures, and personal protective equipment (PPE) usage.
3. Equipment Familiarization: Hands-on experience with common equipment and instrumentation used in particular engineering processes, including pumps, reactors, distillation columns, and control systems or any other as applicable to the field.
4. Process Simulation and Optimization: Practical exercises on process simulation software and optimization techniques to enhance efficiency and productivity.
5. Troubleshooting and Maintenance: Practical sessions on diagnosing and resolving equipment malfunctions, conducting routine maintenance, and ensuring operational integrity.
6. Industrial Visits and Guest Lectures: Field trips to industrial facilities and guest lectures by industry experts to provide first hand insights into real-world applications and challenges.
7. Project Work: Collaborative projects or case studies addressing specific engineering problems or process improvements relevant to the host industry.
8. Evaluation and Assessment: Continuous evaluation based on performance during training, report submissions with the components of the report has been separately mentioned under Evaluation Method.

Evaluation Method

1. **Attendance and Participation:** Regular attendance and active participation in training sessions, workshops, and industrial visits will be monitored.
2. **Skills Assessment:** Evaluation of practical skills demonstrated during hands-on training activities, including equipment operation, experimentation, troubleshooting, and safety compliance.
3. **Performance Review:** Ongoing assessment of individual and group performance based on assigned tasks, projects, and team collaborations.
4. **Supervisor Feedback:** Feedback from industry supervisors regarding student performance, professionalism, attitude, and adaptability in the workplace.

5. **Training Report:** Submission of a comprehensive training report summarizing the learning outcomes, experiences, observations, and insights gained during the In Plant Training period.

Training Report Format: The training report should follow a structured format to ensure clarity, coherence, and completeness. Here's a suggested outline:

1. **Title Page:**
    - Title of the report: "In Plant Training Report"
    - Student's name
    - Enrolment number
    - Department/Program
    - Name of the institution
    - Duration of the training period
    - Name and address of the host industry
2. **Acknowledgments (Optional):**
    - Acknowledge any individuals, organizations, or institutions that contributed to the training experience.
3. **Table of Contents:**
    - List of sections and subsections with corresponding page numbers.
4. **Introduction:**
    - Brief overview of the training objectives, scope, and significance.
    - Description of the host industry and the specific department or division where the training was conducted.
5. **Training Objectives:**
    - Recapitulation of the objectives outlined at the beginning of the training period.
6. **Training Activities:**
    - Detailed account of the activities undertaken during the training, including:
        - Description of the tasks assigned and responsibilities undertaken.
        - Summary of workshops, seminars, industrial visits, and hands-on training sessions participated in.
        - Highlights of any notable experiences, challenges faced, and lessons learned.
7. **Skills Acquired:**
    - Discussion of the practical skills and knowledge gained throughout the training period.
    - Reflection on the application of theoretical concepts in real-world industrial scenarios.
8. **Observations and Insights:**
    - Analysis of observations made during the training, including:
        - Observations regarding industry practices, processes, and technologies.
        - Insights into workplace dynamics, organizational culture, and professional etiquettes.
        - Suggestions for improvement or areas of further learning identified during the training.
9. **Conclusion:**
    - Summary of key takeaways and learning outcomes from the training experience.

10. **References:**
    - List of sources referenced or consulted during the preparation of the report (if applicable).
11. **Appendices (Optional):**
    - Additional materials such as photographs, diagrams, charts, or supplementary documents supporting the content of the report.
12. **Declaration:**
    - Statement affirming the authenticity and originality of the report, along with the student's signature and date.

The training report should be well-organized, concise, and professionally presented, demonstrating the student's ability to articulate their learning experiences and insights gained during the In-Plant Training period.

Useful web links	
1.	www.internshala.com