Regulations and Curriculum
I year

Bachelor of Technology (B.Tech.)

Draft Version 2025-01

NITTE
(Deemed to be University)

(Established under Section 3 of UGC Act, 1956)
Placed under Category ‘A’ by MHRD, GoI | Accredited with ‘A+’ Grade by NAAC

Regulations and Curriculum for

I year

Bachelor of Technology (B. Tech.)

Choice Based Credit System (CBCS)
Effective for the batch admitted in
AY 2025-26

(Deemed to be University under Section 3 of UGC Act, 1956)
(Placed under Category 'A' by MHRD, Govt. of India, Accredited with 'A+' Grade by NAAC)
University Enclave, Medical Sciences Complex, Deralakatte,
Mangaluru – 575 018, Karnataka INDIA
Tel: +91-824-2204300/01/02/03, Fax: 91-824-2204305
Website: www.nitte.edu.in E-mail: info@nitte.edu.in

VISION

To build a humane society through excellence in education and healthcare

MISSION

To develop
Nitte (Deemed to be University)
As a center of excellence imparting quality education,
Generating competent, skilled manpower to face the scientific and social challenges with a high degree of credibility, integrity,
ethical standards and social concern

Regulations and Curriculum
B.Tech. Degree Programs
Choice based Credit System
(CBCS)

Effective for the batch admitted during

Academic Year

2025 – 26

and onwards

Curriculum for Acquiring Professional Skills (CAPS)

With Scheme of Teaching & Examination

REGULATIONS: 2025

COMMON TO ALL

B.Tech. DEGREE PROGRAMS

CHOICE BASED CREDIT SYSTEM

(CBCS)

Draft Version 2025.01

Choice Based Credit System (CBCS)

1. Choice for the selection of courses during each semester.
2. Choice in planning the academic activities by selecting desired number of courses per semester.
3. Balanced curriculum with engineering, science, humanities, and management courses.
4. Project based learning (PBL), which focuses on experiential learning.
5. Opportunities to study inter-disciplinary courses.
6. Enabling slow learners by offering important courses in all semesters.
7. Optional Summer semester
8. Opportunity to get associated in research projects to acquire research experience.
9. Value addition with Honors / Minor credentials.

Curriculum for Acquiring Professional Skills (CAPS)

1. Practicing outcome-based education (OBE) where Courses made student-centric rather than teacher-centric.
2. Provisions for courses integrated with Lab/ PBL component.
3. Focus on experiential learning.
4. Ability enhancement and skill development courses as per National Education Policy (NEP) 2020.
5. Focus on Industry Internship and Research Internship.
6. Students to work on real world/interdisciplinary problems in major project.
7. Importance is given to creativity, innovation, and development of entrepreneurship skills.

Key Information

Program Title	Bachelor of Technology Abbreviated as B.Tech. xyz Engineering
Short description	Four-year, eight semester Choice Based Credit System (CBCS) type of Undergraduate Engineering Degree Program with English as medium of instruction.
Program Code	NMAMIT, Nitte:14ENGR__D2
	NMIT, Bangalore:14ENGR__D3
Revision version	**2025.01** These regulations may be modified from time to time as mandated by the policies of the University. Revisions are to be recommended by the Board of Studies for • xyz Engineering • Humanities • Mathematics • Science • Management and further approved by the Academic Council.
Effective from	01-08-2025
Approvals	Approved in the 61st Academic Council meeting of NITTE (Deemed to be University), held on 13.06.2025 and vide Notification of Registrar, N(DU) Ref: N(DU)/REG/AC-NMAMIT/2025-26/---- dated dd.mm.2025
Program offered at	1. NMAM Institute of Technology, N(DU) Off -Campus Centre, Nitte, 574110, Karkala Taluk 2. Nitte Meenakshi Institute of Technology N(DU) Off -Campus Centre, Bangalore P.B.No.6429, Yelahanka, Bangalore - 560064
Grievance and dispute resolution	All disputes arising from this set of regulations shall be addressed to the Executive Council. The decision of the Executive Council is final and binding on all parties concerned. Further, any legal disputes arising out of this set of regulations shall be limited to jurisdiction of Courts of Mangalore only.

CONTENTS

PREAMBLE

Nitte Mahalinga Adyantaya Memorial Institute of Technology (NMAMIT), Nitte, established in 1986 and recognized by the All-India Council for Technical Education, New Delhi, is now a constituent college of Nitte (Deemed to be University), Mangaluru, since June 2022. Rank band 151-200 in the National Institutional Ranking Framework (NIRF) 2024 by Ministry of Education, Government of India, the College has been placed under 'Platinum' category for having high industry linkages by the AICTE-CII Survey of Industry-Linked Technical Institutes 2020. NMAMIT, the off-campus centre of Nitte DU located at Nitte in Karkala Taluk, has active collaborations with several international universities and organizations for faculty and student exchanges, research, internships and placements.

Nitte Meenakshi Institute of Technology (NMIT), Bangalore, established in 2001 and recognized by the All-India Council for Technical Education, New Delhi, is now a constituent college of Nitte (Deemed to be University), Mangaluru, since October 2024. NMIT is Ranked within the rank band 101-150, in the National Institutional Ranking Framework (NIRF)- 2024 by Ministry of Education, Government of India. Also, NMIT is accredited with 'A+' Grade by NAAC and Platinum Grade by AICTE-CII Survey of Industry-Linked Technical Institutes 2020. NMIT, the off-campus centre of Nitte Deemed to be University is located at Yelahanka, Bangalore.

NMAMIT:

The Institute offers UG engineering program in fourteen disciplines; Artificial Intelligence & Machine Learning (AIM), Artificial Intelligence & Data Science (AID), Biotechnology (BTY), Civil Engineering(CIV), Computer & Communication Engineering (CCE), Computer Science & Engineering(CSE),Computer Science (Cyber Security)(CYB), Electrical & Electronics Engineering (EEE), Electronics & Communication Engineering (ECE), Electronics (VLSI Design & Technology) (VDT), Electronics & Communication Engineering (ACT), Information Science & Engineering (ISE) , Mechanical Engineering(MEC) and Robotics & Artificial Intelligence (RAI). Out of these programs, seven UG programs i.e., BTY, CIV, CSE, EEE, ECE, ISE and MEC are accredited by NBA, New Delhi under Tier - I category. The institute also offers PG program M.Tech. in seven disciplines namely Construction Technology, Computer Science & Engineering, Cyber Security, Electric Vehicle Technology, Mechatronics, Structural Engineering and VLSI Design & Embedded Systems as well as MCA program. All the departments have qualified research guides for students interested in taking up research work leading to Ph.D.

NMIT:

The Institute offers UG engineering program in twleve disciplines; Artificial Intelligence & Data Science, Artificial Intelligence & Machine Learning, Aeronautical Engineering(AER), Civil Engineering, Computer Science & Business Systems(CBS), Computer Science & Engineering, Electrical & Electronics Engineering, Electronics & Communication Engineering, Electronics Engineering (VLSI Design & Technology), Information Science & Engineering, Mechanical Engineering and Robotics and Artificial Intelligence. Out of these programs, seven UG programs i.e., AER, CIV, CSE, EEE, ECE, ISE and MEC are accredited by NBA, New Delhi under Tier - I category. The institute also offers PG program M.Tech. in four disciplines namely Electric Vehicle Technology, Structural Engineering, Defence Technology and Robotics & AI as well as MCA and MBA program. All the departments have qualified research guides for students interested in taking up research work leading to Ph.D.

Curriculum: Engineering Programs

The curriculum is jointly approved by members of the Board of Studies (BoS) and Academic Council drawn from academia, Industry, Alumni, and working professionals from Industry, and has been designed to integrate hands-on practical training with the concepts of theory courses to enhance the learning experience.

The Curriculum focuses on students Acquiring Professional Skills (CAPS) through rigorous theoretical training using innovations in pedagogy, experiential learning, active learning, collaborative learning, critical thinking, project planning, Project Based Learning (PBL), Ability enhancement courses for skill-building, effective communication, professional practice, creativity & innovation and developing entrepreneurial skills.

The focus of the Institution is to impart Quality Education to generate competent, Skilled, and Humane Manpower to face emerging Scientific, Technological, Managerial and Social Challenges with Credibility, Integrity, Ethics, and Social Concern.

In the present scenario, students wish to make plans for a bright future. However, student aspirations and industry demands are highly diverse. Employers expect the graduates possess multi-disciplinary competency, Information and Communication Technology (ICT), and leadership skills. In this context, Nitte Deemed to be University offers the opportunity to the students to select the courses of their choice and helps them in grooming to have well-rounded personalities and become industry ready.

Efforts have been made to make the syllabus compliant with international professional societies. As part of providing quality engineering education, Nitte Deemed to be University, has initiated the Choice Based Credit System (CBCS) into its academic curriculum. By this, the students can register for courses of their choice and alter the pace of learning within the broad framework of academic courses and credit requirements. CBCS allows students to plan for their academic load

and alter it as they progress in learning. Students also have the option of choosing courses from a pool of courses within each classification. Ample options are given to choose interdisciplinary courses from other programs which will help the student to develop additional skills. Slow learners will also be benefitted since important courses are offered in all semesters. This arrangement helps the students to re-register and clear the backlog courses in the subsequent semester. Suitable provisions are made for fast learners to associate them with research activities of faculty members and contribute to research beyond the working hours.

A mentor helps the student in identifying the courses to be studied in each semester based on program requirements, course prerequisites, student's interest in various disciplines, past academic performance, and courses offered by the departments.

Learning becomes more 'experiential' by carrying out labs associated with theory, mini-projects, and Project Based Learning (PBL) as a part of many courses which enhances the capability of students in understanding and apply Engineering /Technology concepts to solve real life-problems. Hence students will develop the ability to apply the gained knowledge in multi-disciplinary projects and be able to take up major projects based on real-world problems and come up with better solutions while addressing social concerns.

REGULATIONS

COMMON TO ALL B.Tech. (CBCS) DEGREE PROGRAMS OF NITTE (Deemed to be University)

1. INTRODUCTION

1.1. The general regulations are common to all B.Tech.(CBCS) Degree Programs offered by NITTE (Deemed to be University) at Nitte and Bangalore Off campuses and shall be called "B.Tech. Regulations".

1.2. The provisions contained in this set of regulations govern the policies and procedures on the Registration of students, imparting instructions of courses, the conduct of the examination & evaluation, certification of student performance, and all amendments related to the said Degree program(s).

1.3. This set of Regulations, on approval by the Academic Council and Excecutive council, shall supersede all the corresponding earlier sets of regulations of the B. Tech Degree program of NITTE (Deemed to be University) along with all the amendments thereto, and shall be binding on all students undergoing the Graduate Degree Program(s) (Choice Based Credit System) conducted at Nitte and Bangalore Off campuses with effect from its date of approval. This set of Regulations may evolve and get modified or changed through appropriate approvals from the Academic Council / Excecutive commitee from time to time and shall be binding on all stakeholders. The decisions of the Academic Council (AC) and Excecutive Council (EC) shall be final and binding.

1.4. To guarantee fairness and justice to the parties concerned given the periodic evolutionary refinements, any specific issues or matters of concern shall be addressed separately, by the appropriate authorities, as and when found necessary.

1.5. The Academic Council may consider any issues or matters of Concern relating to any or all the academic activities of Engineering courses for appropriate action, irrespective of whether a reference is made here in this set of Regulations or otherwise.

1.6. The program shall be called **Bachelor of Technology,** abbreviated as B.Tech. (Program Title).

2. ELIGIBILITY FOR ADMISSION

Sl. No	Program	Duration	Eligibility
1	B. Tech.	4 years	Passed 10+2 examination with Physics/ Mathematics / Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject as per Table-1. Obtained not less than 50% marks (40% marks in case of candidates belonging to reserved category) in the above subjects taken together. The specific eligibility requirements will be published in admission brochure from time to time.
2	B.Tech. (Lateral Entry to Second year)	3 years	Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in relevant branch of Engineering and Technology. (The University will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to prepare Level playing field and desired learning outcomes of the program).

Table-1
Academic Level and Credit Framework for admission to Bachelor of Technology (B.Tech.) degree program

Sl. No.	Academic Level	Desired Entry Qualifications at different levels.	NHEQF/ NCrF Level at Exit
1	12th Std.	-	4
2	First Year B.Tech.	12th Completed (NHEQF level 4 completed)	4.5
3	Second Year B.Tech. Degree	A candidate with a UG Certificate in Engineering or Diploma in the appropriate branch of Engineering/ Equivalent Vocational or Technical Program with NHEQF level 4.5	5

2.1. Qualifications from foreign countries

Candidates with qualifications from educational institutions outside of India may be admitted to the program(s) subject to the establishment of equivalence by the university. The Program Committee will evaluate and establish the eligibility of such candidates.

3. PROGRAM PATHS, EXIT OPTIONS, AND DURATION OF THE B. TECH. PROGRAM

3.1 Program paths, exit options.

Sl. No	Academic Level	Entry Level Qualifications	Qualifications at Exit	NCrF Level
1	1st yr. of UG Degree	A candidate completing 10+2 years with Diploma of Vocation or passed 12th std. or equivalent vocational training with NCrF level 4	**UG Certificate***	4.5
2	2nd yr. of UG Degree	A candidate with Diploma in appropriate branch of Engineering/ UG Certificate/ Equivalent Vocational or Technical Program NCrF level 4.5	**UG Diploma (Engg.) ***	5.0
3	3rd yr. of UG Degree	A candidate with 10+3+1/12+2/ UG Diploma (Engg.) in appropriate domain with NCrF level 5	**B. Sc (Engg.) ***	5.5
4	Final yr. of UG Degree	A candidate with 3 yrears' bachelor degree B.Sc. (Engg.) with NCrF level 5.5	**B. Tech (On completion of 165 credits with a minimum CGPA of 5)**	6
	Final yr. of UG Degree with Honours	A candidate with 3 yrs. Bachelor degree B.Sc. (Engg.) with NCrF level 5.5	**B. Tech (Honors)** 183 credits (Additional 18 credits over and above 165 credits in the same discipline)	6
	Final yr. of UG Degree with a minor in (Other Discipline).	A candidate with 3 yrs. Bachelor degree B.Sc. (Engg.) with NCrF level 5.5	**B. Tech with Minor** 183 credits. Additional 18 credits over and above 165 credits in other disciplines	6

*** It is mandatory to earn 4 credits through Discipline specific Internship/ Training/ Specialised courses before the award of Qualifications at Exit.**

3.2 Duration of the B. Tech. program

3.2.1 The B. Tech Program shall extend over a period of a total duration of 4 years for students admitted during the first year of the program.

3.2.2 The total duration shall be 3 years for students admitted to the second year under the lateral entry scheme.

3.2.3 The maximum period which a student can take to complete a full-time academic program is eight years / Six years for Lateral entry diploma students for B.Tech.

3.2.4 Each year shall have the following schedule with 5 ½ days a week. Suggested break down of Academic Year into Semesters.

i)	No. of Semesters / Year	There are three semesters in an academic year. • Two Main semesters (Odd, Even) followed by a summer semester. • Normally the Odd Semester will be from August to December and Even Semester from January to May during a calendar year. • The optional summer semester is offered during the vacation period of the even semester. • The summer semester is offered considering the demand for such courses of needy students, subject to the availability of time, faculty, and other resources under a fast-track mode as the available instructional days during even semester vacation periods are less. However, the number of instructional hours needed to cover the syllabi shall be maintained (equivalent to that in the regular semester) with a greater number of instructional hours per week. **Note:** The summer semester is primarily to assist slow learners and/or failed students in the main semesters. The summer semester may be used to arrange Add-On courses for other students and/or for deputing them for practical training elsewhere.
ii)	Semester Duration	Main semester (Odd, Even) each 20 Weeks; Summer Semester 8 Weeks
iii)	Academic Activities (Weeks)	**ODD / EVEN Semester** Registration of Courses & Course Work (16) Examination Preparation and Examination (04) Total (20) **Summer Semester** Registration of Courses & Course Work (05) Examination Preparation and Examination (03) Total (08) **Declaration of results:** 02 weeks from the date of the last examination **Inter-Semester Recess:** After each Main Semester (02) **Total Vacation:** 10 weeks (for those who do not register for the summer semester) and 4 weeks (for those who register for the summer semester)

Note:

- In each semester, there will be provision for students to register for courses at the beginning, dropping of courses in the middle, and withdraw from courses towards the end, under the advice of a faculty member. These facilities are expected to enhance the learning capabilities of students, minimizing their chances of failure in courses registered and ensuring their better monitoring by Faculty Advisors).
- A regular candidate shall be allowed a maximum duration of eight years from the day of admission to Ist semester to become eligible for the award of a Bachelor's degree.
- The calendar of events in respect of the program shall be fixed by the Institution from time to time, but preferably in line with the suggested academic calendar of the NITTE (Deemed to be University).

4. DEGREE PROGRAMS

4.1 Undergraduate B. Tech. Degree Programs are offered in the following disciplines by the respective program hosting departments listed below:

i)	Biotechnology	(BTY)
ii)	Computer Science & Engineering	(CSE)
iii)	Computer Science & Engineering (Cyber Security)	(CYB)
iv)	Civil Engineering	(CIV)
v)	Electronics & Communication Engineering	(ECE)
vi)	Electronics Engineering (VLSI Design and Technology)	(VDT)
vii)	Electronics & Communication (Advanced Communication Technology)	(ACT)
viii)	Electrical & Electronics Engineering	(EEE)
ix)	Information Science & Engineering	(ISE)
x)	Mechanical Engineering	(MEC)
xi)	Artificial Intelligence and Machine Learning	(AIM)
xii)	Computer and Communication Engineering	(CCE)
xiii)	Robotics and Artificial Intelligence	(RAI)
xiv)	Artificial Intelligence and Data Science	(AID)
xv)	Computer Science and Business Systems	(CBS)
xvi)	Aeronautical Engineering	(AER)
Other teaching departments are –		
i)	Chemistry	(CHY)
ii)	Humanities and Social Sciences	(HSS)
iii)	Mathematics	(MAT)
iv)	Management	(MGM)
v)	Physics	(PHY)

4.2 The provisions of these regulations shall apply to any new discipline that may be introduced from time to time and appended to the above list.

5. CREDIT SYSTEM

In the Credit System, the course work of students is unitized, and each unit is assigned one credit after a student completes the teaching-learning process as prescribed for that unit and is successful in its assessment.

5.1 **Credit Definition:** The following widely accepted definition for credit can provide good flexibility to the students and strengthens CBCS under the University. Here, one unit of course work and its corresponding one credit (while referring to the main semester) shall be equal to:

- Four-credit theory courses (4-0-0) shall be designed for 60 hours of the Teaching-Learning process.
- Four-credit theory + tutorial courses (3-1-0) shall be designed for 45 Lecture hours and 15 turoriual hours of the Teaching-Learning process.
- Three-credit theory courses (3-0-0) shall be designed for 45 hours of the Teaching-Learning process.
- Three-credit theory + tutorial courses (2-1-0) shall be designed for 30 Lecture hours

and 15 turoriual hours of the Teaching-Learning process

- Two-credit theory courses shall be designed for 30 hours of the Teaching-Learning process.
- Two-credit theory + Practical courses (1-0-2) shall be designed for 15 Lecture hours and 30 hours of Practical classes of the Teaching-Learning process
- One credit theory course shall be designed for 15 hours of the Teaching-Learning process.

The above figures shall also be applicable in the case of the summer semester. Other student activities which are not demanding intellectually, or which do not lend to effective assessment, like practical training, study tours, and attending guest lectures shall not carry any credit.

5.2 Credit Assignment and Lower & Upper Limits for Course Credits Registration in a Semester

All courses comprise of specific Lecture/Tutorial/Practical/Project (L-T-P-J) schedule. The course credits are fixed based on the following norms.

Lecture / Tutorials / Practical:

- 1-hour Lecture per week is assigned 1.0 Credit.
- 1-hour Tutorial session per week is assigned 1.0 Credit.
- 2-hour Lab. Session/project work per week is assigned 1.0 credit.
  For example,
- A theory course with L-T-P schedule of 3-1-0 hours will be assigned 4.0 credits.
- A laboratory practical course with L-T-P schedule of 0-0-2 hours will be assigned 1.0 credit.
- Calculation of Contact Hours / Week – A Typical Example
  Example:
  An L-T-P-C of 2-1-2-4 means 2 instructional units based on classroom lecture (L), one instructional unit of the tutorial (T), and one laboratory (P) based instructional unit all delivered during a calendar week and repeated for the entire duration of the semester to earn 4 credits (C) after passing the course.
- As advised by the faculty advisor, a student may register, between a minimum of **16 credits and up to a maximum of 28 credits** during regular semesters**.**
  The maximum number of credits a student can register during a summer semester shall be 16. However, in special cases, the student may be permitted to register additional credits with the approval of the Department Undergraduate Committee (DUGC). There is no minimum number of credits fixed for course registration during the summer semester.

6. REGISTRATION

6.1. Every student after consulting his/ her Faculty Advisor in the parent department shall register for the approved courses (core and elective) to earn credits for meeting the requirements of a degree program at the commencement of each Semester on the days fixed for such registration and notified in the academic calendar. Students who fail to register on or before the specified date will be allowed to register within one week of the last date by paying a late fee. Such courses together with their grade and credits earned will be included in the grade card issued by the University at the end of each semester, like ODD, EVEN, and summer and it forms the basis for determining the student's performance in that semester.

- Each course will be identified by a unique Course Code of six alpha-numerals (Three alphabets followed by 3 digits). The alphabets reflect the discipline to which the course belongs. The first numeral (after the alphabet) indicates the learning level (based on prerequisites) of the course, and the rest of the two numerals indicate a running serial number. Example: EEE101 represents the course offered by EEE Dept., Academic Level-1, course serial number is 01

6.2. Mandatory Pre-Registration for higher semester

To facilitate proper planning of the academic activities of the Semester, the students must declare their intention to register for courses of every semester (2^{nd} Semester and above) at least two weeks before the end of the current semester choosing the courses offered by each department in the next higher semester which is displayed on the Department Notice Board at least 4 weeks before the last working day of the semester.

Registration to a higher semester is allowed only if the student fulfills the following conditions.

- Satisfied all the academic requirements to continue with the program of studies.
- Cleared all Institute, hostel, and library dues and fines, if any, of the previous semester.
- Paid all required fees of the Institute and the hostel for the current semester.
- Has not been debarred from registering on any specific grounds by the Institute.

6.3. Registering for Backlog Courses

6.3.1. Students who have not cleared a course (Theory/ Lab/ project) are shown with "F" grade. A course having an 'F' grade will be considered as a backlog and it has to be re-registered in the subsequent semesters. F-graded courses are eligible to register for the next level course (pre-requisite is met).

6.3.2. Re-registration fee will be as per the university norms existing at the time of re-registration. When a course is re-registered, the evaluation marks of that course shall be treated as canceled/ reset.

6.3.3. To provide an early opportunity for students to clear their backlog of courses, efforts will be made to offer as many courses as possible during Odd, Even and summer semesters.

7. ADD/DROP/AUDIT OPTIONS

7.1 Registration of courses

Each student shall have to register for course work at the beginning of a semester within 2 to 3 days of commencement after discussing with the course teacher and under faculty advice. The permissible course load is to be either average credits (20) or to be within the credit limits of minimum (16) and maximum (28).

7.2 DROP-option

During a specified period in the middle of a semester student's performance in CIE is reviewed by the faculty advisor. Following a poor performance by a student, he/she can be facilitated to drop identified course(s) (up to the minimum credits specified for the semester). Such course(s) will not be mentioned in the Grade card. Such courses are to be re-registered by these students and taken up for study in a subsequent odd / even/ summer semester.

7.3 Withdrawal from courses (Letter Grade "W")

During a specific period specified towards the end of the semester, a student's performance in CIE is reviewed by the faculty advisors. Following a poor performance by a student in the identified course (s) he/she is advised to withdraw from such course(s) (up to the minimum credits specified for the semester) with a mention in the Grade card (Grade "W"). Such courses to be re-registered by these students and taken up for study at a later point in time.

7.4 AUDIT-option (Letter Grade "U")

A student can register for courses for audit only, to supplement his/her knowledge and/or skills. The audit courses shall not be considered in determining the student's academic performance (SGPA and CGPA) in the semester. "U" grade is awarded to such courses and will be reflected in the grade card on satisfying the attendance requirements and CIE requirements. The candidate need not appear for SEE in such courses. However, CORE courses shall not be made available for audit.

8. COURSE STRUCTURE

8.1 Types of courses

A "Course" is defined as a unit of learning that typically lasts one semester, led by one or more teachers, for a fixed roster of students. A course has identified course outcomes, modules/units of study, specified teaching-learning methods, and assessment schemes. A course may be designed to include lectures, tutorials, practical, laboratory work, field work, project work, internship experiences, seminars, self-study components, online learning modules, etc. in any combination.

The following types of courses are included in the B. Tech. program:

(a) **Humanities, Social Sciences, and Management Courses (HSMC):** These are common courses for all disciplines.

(b) **Basic Science Courses (BSC):** Physics, Chemistry, and Mathematics: These are mandatory for all disciplines.

(c) **Engineering Science Courses (ESC):** Basics of Electrical/ Electronics/ Civil/ Mechanical/ Computer Engineering, etc. These are mandatory for all disciplines.

(d) **Professional Core Courses (PCC):** These are the professional Core Courses, relevant to the chosen specialization/ branch. The core courses shall be compulsorily studied by students, and it is mandatory to complete them to fulfill the requirements of a Program.

(e) **Professional Elective Courses (PEC):** These are professional Electives, relevant to the chosen specialization/branch and can be chosen from the pool of courses. It shall be supportive to the discipline providing extended scope/enabling exposure to some other discipline /domain and nurturing student proficiency skills.

(f) **Open Elective Courses (OEC):** These are the Elective Courses from other technical areas and/ or emerging fields. Students of other departments shall opt for these courses for fulfilling the eligibility and prerequisites mentioned in the syllabus.

(g) **Integrated Professional Core Courses (IPCC):** It refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC shall be 04 considering L: T: P as 3:0:1 or L: T: P as 2:1:1, (where L, T, and P represent credits not hours per week)

(h) Emerging Technology Courses (ETC): These courses are designed to teach students about developing technologies that will be available within the next five to ten years and are expected to create significant social or economic effects.

(i) **Programming Language Courses (PLC):** These courses are designed to teach students languages that can be used to communicate with computers for developing and working on different applications.

(j) **Project Work (PRJ):** Provide experiential learning opportunities for students. Students are required individually, or in a small group, to select and complete a project that may include review, design, development, curation, analysis, etc. with the application of skills and knowledge relevant to the area of study. Project work to be carried out at the parent Institution, or any university / Government recognized organization without affecting the regular class work.

(k) **Internship (INT):** The internship (a form of experimental learning) program is a workplace-based professional learning experience that offers supervised exposure to real-life work experience in an area related to the field of study or career interest. An internship may be undertaken at a workplace such as an industry/R&D organization/Government organization, or any other reputed organization/ institution recognized for the purpose by the University. The internship program not only helps fresh pass-outs in gaining professional know-how but also benefits corporate sectors. The internship also enhances the employability skills of the student passing out from Technical Institutions.

(l) **Community Engagement (CEN):** enable students to learn about challenges faced by vulnerable households and develop an understanding of local wisdom and lifestyle in a respectful manner. It enables the students to

- Gain an understanding of rural life, Indian culture and ethos and social realities.
- Develop a sense of empathy and bonds of mutuality with the local community.
- Appreciate significant contributions of local communities to Indian society and economy.

- Learn to value the local knowledge and wisdom of the community
- Identify opportunities for contributing to community's socio-economic improvements.

(m) **Mandatory Non-Credit Courses (MNC):** These courses are mandatory, without the benefit of a grade or credit, passing each mandatory course is required to qualify for the award of a degree.

- Assessment of these courses is conducted in the college and will include Continuous Internal Evaluation (CIE). University Semester End Evaluation (SEE) may not be necessary for these courses.
- A minimum of 40% of the prescribed marks of CIE are required to secure a passing grade in these courses.
- The 'PP' grade is awarded for a Pass in the course and the 'NP' grade is awarded for a Fail in the course. In case an 'NP' grade is awarded, the student has to re-register for the same course wherein he has no alternative options.
- The "PP" and "NP" grades do not carry grade points and are hence not included in the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) computations. However, such non-credit mandatory courses are required to be included in the students' performance records (transcript) with Pass or Fail (PP or NP).
- Courses that come under this category are Employability Skill Development, Kannada etc.

(n) **Ability Enhancement Courses (AEC):** These courses are designed to help students to enhance their skills in language, communication, personality development, etc. They also promote a deeper understanding of courses like social sciences, ethics, culture, human behavior human rights, and the law. Ability Enhancement Courses are based upon the content that leads to knowledge enhancement.

8.2 Typical Breakdown for the B.Tech. Degree Curriculum:

Sl. No.	Course Category	Credit Range		Suggested Credits
1.	Basic Science Courses (BSC)	30-32		31
2.	Engineering Science Courses (ESC)	12-15	18-21	14
3.	Emerging Technology Courses (ETC)	02		02
4.	Programming Language Courses (PLC)	04		04
5.	Professional Core Courses (PCC)*	52 - 55		55
6.	Professional Elective Courses (PEC)	12-15		12
7.	Open Elective Courses (OEC)	6		06
8.	Humanities, Social Sciences and Management courses (HSMC)	12-15		14
9.	Ability Enhancement Courses (AEC)/Skill Enhancement Courses (SEC)	8-12		11
10.	Mandatory Non-credit Courses (MNC)	Non-Credit		00
13.	Project Work (PRJ)	10		10
14.	Internship (INT)	04		04
15	Community Engagement (CEN)	02		02
15.	Note: **Student can register between 16 to 28 credits per semester**			**165**
	Total minimum Credits to be earned: 165			

* Including One discipline specific vocational Skill enhancement course

8.2.1 The Department Undergraduate Committee (DUGC) will discuss and recommend the exact credits offered for the program for the above components, the semester-wise distribution among them, as well as the syllabi of all undergraduate courses offered by the department from time to time before sending the same to the Board of Studies (BOS). The BOS will consider the proposals from the departments and make recommendations to the Academic Council for consideration and approval.

8.3 The earned Credit Requirements for the B.Tech. Degree is 165.

Degree is awarded by prescribing the total number of credits to be earned, rather than by using the program duration, giving flexibility to a student to plan their career.

8.4 Suggested Program structure

8.4.1 Suggested distribution of credits for the Common B. Tech Curriculum N(DU) for Nitte and Bangalore off campuses effective from the AY 2025-26

Type of Course		Credits range		Suggested Semester Wise Credit Distribution								Total Credits	
				I	II	III	IV	V	VI	VII	VIII		
Basic Science Courses (BSC)		31		11	8	4	8					31	
Engineering Science Courses (ESC)		14		8	6							14	
Emerging Technology Courses (ETC)		2							2			2	
Programming Language Courses (PLC)		4			3+1							4	
Professional Core Courses (PCC)		52-55				15	12	12	8	8		55	
Professional Elective Courses (PEC)		12-15						3	6	3		12	
Open Elective Courses (OEC)		6						3	3			6	
Humanities, Social Sciences and Management Courses (HSMC)		14		2	1	2	1	3	2	3		14	
Ability & Skill Enhancement Courses (AEC)	Option-1	8		0	2	2	2	1	1			8	
	Option-2			1	2+1	1	1						
Foreign Language Course/Research Methodology (AEC)		3							-	3		3	
Community Engagement (CEN)		2									2	2	
Professional Practice (PRP)		14	-								14 -	14	14
Capstone Project/ Research Project (PRJ)		-	10								- 10	14	
Internship (INT)		-	4								- 4		
Mandatory Non-credit Courses (MNC)						0		0				0	
Option-1		165		21	21	23	23	22	22	17	16	165	
Option-2				22	22	22	22						

There are two options in choosing Ability Enhancement Courses (AEC)

- NMAMIT Nitte, has chosen Option-1
- NMIT Bangalore, has chosen **Option-2**

8.4.2 Suggested Course Offerings

8.4.2.1 NMAMIT (Option-1):

For Computer Science and allied branches (AIM, AID, CBS, CCE, CSE, CYB, ISE and RAI)

NMAMIT: (AIM, AID, CBS, CCE, CSE, CYB, ISE and RAI) Option-1: 21 Credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT103	Calculus and Differential Equations	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	PHY102	Quantum Computing and Modern Physics	PHY	3	-	2	-	2	3	50	50	100	4
3	ESC	CSE103	Problem Solving Through Programming	CSE (Allied)	3	-	2	-	2	3	50	50	100	4
4	ESC	ECE111	Basic Electronics	ECE	3	-	-	-	1	3	50	50	100	3
5	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
6	HS MC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	1	50	50	100	1
8	ESC	MEC122	Engineering Visualization	MEC	-	-	2	-	1	-	50	-	50	1
Total Option-1					17	1	6	-	9	**19**	**400**	**350**	**750**	**21**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	6	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40x16=640									

NMAMIT (Option-1):
For Computer Science and allied branches (AIM, AID, CBS, CCE, CSE, CYB, ISE and RAI)

NMAMIT: (AIM, AID, CBS, CCE, CSE, CYB, ISE and RAI) Optipon-1, 21 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT106	Linear Algebra and Transform Techniques	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	CHY104	Materials Chemistry for Devices and E-Waste Management	CHY	3	0	2	-	2	3	50	50	100	4
3	ESC	ECE101	Applied Digital Logic Design	ECE	2	0	2	-	1	3	50	50	100	3
4	ESC	EEE102	Elements of Electrical Engineering	EEE	3	0	0		1	3	50	50	100	3
5	PLC	CSE102	Introduction to Python Programming	CSE (Allied) /MEC	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	1	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	2	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
Total					**15**	**1**	**10**	**-**	**7**	**18**	**400**	**300**	**700**	**21**
Additional Academic activities beyond class hours								-	7					
Learning hours per week					15	1	10	-	14					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40x16=640									

Mandatory community Engagement							
9	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.4.2.2 NMIT: Option-2

For Computer Science and allied branches (AIM, AID, CBS, CCE, CSE, CYB, ISE and RAI)

NMIT: (AIM, AID, CBS, CCE, CSE, CYB, ISE and RAI) Option-2, 22 credits															
I/II SEMESTER															
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT103	Calculus and Differential Equations	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	PHY102	Quantum Computing and Modern Physics	PHY	3	-	2	-	2	3	50	50	100	4
3	ESC	CSE103	Problem Solving Through Programming	CSE (Allied)	3	-	2	-	2	3	50	50	100	4
4	ESC	ECE111	Basic Electronics	ECE	3	-	-	-	1	3	50	50	100	3
5	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
6	HSMC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	1	50	50	100	1
8	ESC	MEC122	Engineering Visualization	MEC	-	-	2	-	1	-	50	-	50	1
9	AEC	HSS132	Knowing Yourself	HSS	-	-	2	-	-		50	-	50	1
Total Option-1					17	1	8	-	9	**19**	**450**	**350**	**800**	**22**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	8	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		42									
			Per semester		42x16=672									

NMIT: Option-2
For Computer Science and allied branches (AIM, AID, CBS, CCE, CSE, CYB, ISE and RAI)

NMIT: (AIM, AID, CBS, CCE, CSE, CYB, ISE and RAI) Option-2, 22 credits														
I/II SEMESTER														
Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours/Week				SL	Examination				Credits
					L	T	P	J		Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	BSC	MAT106	Linear Algebra and Transform Techniques	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	CHY104	Materials Chemistry for Devices and E-Waste Management	CHY	3	0	2	-	2	3	50	50	100	4
3	ESC	ECE101	Applied Digital Logic Design	ECE	2	0	2	-	1	3	50	50	100	3
4	ESC	EEE102	Elements of Electrical Engineering	EEE	3	0	0		1	3	50	50	100	3
5	PLC	CSE102	Introduction to Python Programming	CSE (Allied) /MEC	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	1	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	2	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
9	AEC	HSS133	Pathways to Success	HSS	-	-	2		-	0	50	0	50	1
				Total	**15**	**1**	**12**	**-**	**7**	**18**	**450**	**300**	**750**	**22**
Additional Academic activities beyond class hours								-	7					
Learning hours per week					15	1	12	-	14					
Total notional learning hours (L+T+P+J+SL)			Per week		42									
			Per semester		42x16=672									

Mandatory community Engagement							
10	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.4.2.3 NMAMIT: Option-1 (MEC)

NMAMIT: Mechanical Engineering Option-1: 21 Credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT101	Multivariate Calculus and curve fitting	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	CHY103	Materials chemistry and Energy Applications	CHY	3	-	2	-	2	3	50	50	100	4
3	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
4	ESC	MEC112	Elements of Mechanical Engineering	MEC	3	-	-	-	1	3	50	50	100	3
5	ESC	EEE103	Basic Electrical and Electronics Engineering	EEE	3	-	-	-	1	3	50	50	100	3
6	HSMC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	-	50	50	100	1
8	ESC	CSE121	IT Skills	CSE/ any	-	-	2	-	1	-	50	50	100	1
9	ESC	MEC121	Engineering Skill Development Practice	MEC	-	-	2	-	1	-	50	50	100	1
Total Option-1					17	1	6	-	9	**18**	**450**	**450**	**900**	**21**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	6	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40×16=640									

NMAMIT: Option-1 (MEC)

NMAMIT: Mechanical Engineering Optipon-1, 21 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT104	Matrix Algebra and Differential Equations	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	PHY105	Physics of materials	PHY	3	0	2	-	2	3	50	50	100	4
3	ESC	MEC101	Computer Aided Engineering Graphics	MEC	2	0	2	-	2	3	50	50	100	3
4	ESC	CIV111	Engineering Mechanics	CIV	3	0	0	-	1	3	50	50	100	3
5	PLC	CSE102	Introduction to Python Programming	CSE (Allied) /MEC	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	**1**	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	1	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
				Total	**15**	**1**	**9**	**-**	**8**	**18**	**400**	**300**	**700**	**21**
Additional Academic activities beyond class hours								-	7					
Learning hours per week					15	1	9	-	15					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40×16=640									

Mandatory community Engagement							
9	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.4.2.4 NMIT: Option-2 (MEC and AER)

NMIT: (Mechanical Engineering & Aeronautical Engineering) Option-2, 22 credits														
I/II SEMESTER														
Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours/Week				SL	Examination				Credits
					L	T	P	J		Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	BSC	MAT101	Multivariate Calculus and curve fitting	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	CHY103	Materials chemistry and Energy Applications	CHY	3	-	2	-	2	3	50	50	100	4
3	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
4	ESC	MEC112	Elements of Mechanical Engineering	MEC	3	-	-	-	1	3	50	50	100	3
5	ESC	BEE103	Basic Electrical and Electronics Engineering	EEE	3	-	-	-	1	3	50	50	100	3
6	HSMC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	-	50	50	100	1
8	ESC	CSE121	IT Skills	CSE/ any	-	-	2	-	1	-	50	50	100	1
9	ESC	MEC121	Engineering Skill Development Practice	MEC	-	-	2	-	1	-	50	50	100	1
10	AEC	HSS132	Knowing Yourself	HSS	-	-	2	-	-		50	-	50	1
Total Option-1					17	1	8	-	9	**18**	**500**	**450**	**950**	**22**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	8	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		42									
			Per semester		42×16=672									

NMIT: (Mechanical Engineering & Aeronautical Engineering) Option-2, 22 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT104	Matrix Algebra and Differential Equations	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	PHY105	Physics of materials	PHY	3	0	2	-	2	3	50	50	100	4
3	ESC	MEC101	Computer Aided Engineering Graphics	MEC	2	0	2	-	2	3	50	50	100	3
4	ESC	CIV111	Engineering Mechanics	CIV	3	0	0	-	1	3	50	50	100	3
5	PLC	CSE102	Introduction to Python Programming	CSE (Allied) /MEC	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	**1**	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	1	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
9	AEC	HSS133	Pathways to Success	HSS	-	-	2		-	0	50	0	50	1
				Total	**15**	**1**	**11**	**-**	**8**	**18**	**450**	**300**	**750**	**22**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					15	1	11	-	15					
Total notional learning hours (L+T+P+J+SL)			Per week		42									
			Per semester		42×16=672									

Mandatory community Engagement							
10	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.4.2.5 NMAMIT: Option-1 (ECE, ACT, VDT and EEE)

NMAMIT: ECE, ACT and VDT Option-1: 21 Credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT102	Matrix Algebra and Calculus	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	CHY104	Materials Chemistry for Devices and E-Waste Management	CHY	3	-	2	-	2	3	50	50	100	4
3	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
4	ESC	MEC112	Elements of Mechanical Engineering	MEC	3	-	-	-	1	3	50	50	100	3
5	ESC	EEE101	Electrical Circuit Analysis I	EEE	3	-	-	-	1	3	50	50	100	3
6	HSMC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	1	50	50	100	1
8	ESC	CSE121	IT Skills	CSE/ any	-	-	2	-	1	3	50	50	100	1
9	ESC	MEC122	Engineering Visualization	MEC	-	-	2	-	1	-	50	-	50	1
Total Option-1					17	1	6	-	9	**22**	**450**	**400**	**850**	**21**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	6	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40x16=640									

NMAMIT: Option-1 (ECE, ACT, VDT and EEE)

NMAMIT: ECE, ACT and VDT Optipon-1, 21 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT105	Differential equations and Laplace Transforms	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	PHY104	Wave Mechanics and Optoelectronics	PHY	3	0	2	-	2	3	50	50	100	4
3	ESC	ECE111	Basic Electronics	ECE	3	0	0	-	1	3	50	50	100	3
4	ESC	ECE101	Applied Digital Logic Design	ECE (Allied) / EEE	2	0	2	-	1	3	50	50	100	3
5	PLC	CSE101	Introduction to C Programming	CSE (Allied)	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	**1**	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	2	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
				Total	**15**	**1**	**10**	**-**	**7**	**18**	**400**	**300**	**700**	**21**
Additional Academic activities beyond class hours								-	7					
Learning hours per week					15	0	10	-	14					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40x16=640									

Mandatory community Engagement							
9	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.4.2.6 NMIT: Option-2 (ECE, ACT and EEE)

NMIT: ECE, VDT and EEE Option-2, 22 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT102	Matrix Algebra and Calculus	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	CHY104	Materials Chemistry for Devices and E-Waste Management	CHY	3	-	2	-	2	3	50	50	100	4
3	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
4	ESC	MEC112	Elements of Mechanical Engineering	MEC	3	-	-	-	1	3	50	50	100	3
5	ESC	EEE101	Electrical Circuit Analysis I	EEE	3	-	-	-	1	3	50	50	100	3
6	HSMC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	1	50	50	100	1
8	ESC	CSE121	IT Skills	CSE/ any	-	-	2	-	1	3	50	50	100	1
9	ESC	MEC122	Engineering Visualization	MEC	-	-	2	-	1	-	50	-	50	1
10	AEC	HSS132	Knowing Yourself	HSS	-	-	2	-	-		50	-	50	1
Total Option-1					17	1	8	-	9	**22**	**500**	**400**	**900**	**22**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	8	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		42									
			Per semester		42x16=672									

NMIT: Option-2 (ECE, VDT and EEE)

NMIT: ECE, ACT and EEE Option-2, 22 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT105	Differential equations and Laplace Transforms	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	PHY104	Wave Mechanics and Optoelectronics	PHY	3	0	2	-	2	3	50	50	100	4
3	ESC	ECE111	Basic Electronics	ECE	3	0	0	-	1	3	50	50	100	3
4	ESC	ECE101	Applied Digital Logic Design	ECE (Allied) / EEE	2	0	2	-	1	3	50	50	100	3
5	PLC	CSE101	Introduction to C Programming	CSE (Allied)	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	**1**	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	2	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
9	AEC	HSS133	Pathways to Success	HSS	-	-	2		-	0	50	0	50	1
				Total	**15**	**1**	**12**	**-**	**7**	**18**	**450**	**300**	**750**	**22**
Additional Academic activities beyond class hours								-	7					
Learning hours per week					15	1	12	-	14					
Total notional learning hours (L+T+P+J+SL)			Per week		42									
			Per semester		42x16=672									

Mandatory community Engagement							
10	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.4.2.7 NMAMIT: Option-1 (CIVIL Engineering)

NMAMIT: CIV Option-1: 21 Credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT101	Multivariate Calculus and curve fitting	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	CHY102	Chemistry for Civil Engineering	CHY	3	-	2	-	2	3	50	50	100	4
3	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
4	ESC	MEC112	Elements of Mechanical Engineering	MEC	3	-	-	-	1	3	50	50	100	3
5	ESC	EEE103	Basic Electrical and Electronics Engineering	EEE	3	-	-	-	1	3	50	50	100	3
6	HSMC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	1	50	50	100	1
8	ESC	CSE121	IT Skills	CSE/ any	-	-	2	-	1	3	50	50	100	1
9	ESC	MEC121	Engineering Skill Development Practice	MEC	-	-	2	-	1	3	50	50	100	1
Total Option-1					17	1	6	-	9	**25**	**450**	**450**	**900**	**21**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	6	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40x16=640									

NMAMIT: Option-1 (CIVIL Engineering)

NMAMIT: CIV Optipon-1, 21 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT104	Matrix Algebra and Differential Equations	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	PHY103	Applied Physics for Building Structures	PHY	3	0	2	-	2	3	50	50	100	4
3	ESC	MEC101	Computer Aided Engineering Graphics	MEC	2	0	2	-	2	3	50	50	100	3
4	ESC	CIV111	Engineering Mechanics	CIV	3	0	0	-	1	3	50	50	100	3
5	PLC	CSE102	Introduction to Python Programming	CSE (allied)/ CIV	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	**1**	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	1	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
				Total	**15**	**1**	**9**	**-**	**8**	**18**	**400**	**300**	**700**	**21**
Additional Academic activities beyond class hours								-	7					
Learning hours per week					15	1	9	-	15					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40x16=640									

Mandatory community Engagement							
9	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.4.2.8 NMIT: Option-2 (CIVIL Engineering)

NMIT: CIV Option-2, 22 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT101	Multivariate Calculus and curve fitting	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	CHY102	Chemistry for Civil Engineering	CHY	3	-	2	-	2	3	50	50	100	4
3	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
4	ESC	MEC112	Elements of Mechanical Engineering	MEC	3	-	-	-	1	3	50	50	100	3
5	ESC	EEE103	Basic Electrical and Electronics Engineering	EEE	3	-	-	-	1	3	50	50	100	3
6	HSMC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	1	50	50	100	1
8	ESC	CSE121	IT Skills	CSE/ any	-	-	2	-	1	3	50	50	100	1
9	ESC	MEC121	Engineering Skill Development Practice	MEC	-	-	2	-	1	3	50	50	100	1
10	AEC	HSS132	Knowing Yourself	HSS	-	-	2	-	-		50	-	50	1
Total Option-1					17	1	8	-	9	**25**	**500**	**450**	**950**	**22**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	8	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		42									
			Per semester		42x16=672									

NMIT: CIV Option-2, 22 credits														
I/II SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT104	Matrix Algebra and Differential Equations	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	PHy103	Applied Physics for Building Structures	PHY	3	0	2	-	2	3	50	50	100	4
3	ESC	MEC101	Computer Aided Engineering Graphics	MEC	2	0	2	-	2	3	50	50	100	3
4	ESC	CIV111	Engineering Mechanics	CIV	3	0	0	-	1	3	50	50	100	3
5	PLC	CSE102	Introduction to Python Programming	CSE (Allied)/ CIV	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	**1**	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	1	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
9	AEC	HSS133	Pathways to Success	HSS	-	-	2		-	0	50	0	50	1
				Total	**15**	**1**	**11**	**-**	**8**	**18**	**450**	**300**	**750**	**22**
Additional Academic activities beyond class hours								-	7					
Learning hours per week					15	1	11	-	15					
Total notional learning hours (L+T+P+J+SL)			Per week		42									
			Per semester		42x16=672									

Mandatory community Engagement							
10	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.4.2.9 NMAMIT: Biotechnology

First Semester: 21credits

21 Credits														
I SEMESTER														
Sl. No	**Course Type and Course Code**		**Course Title**	**Teaching Department**	**Contact Hours/Week**				**SL**	**Examination**				**Credits**
					L	**T**	**P**	**J**		**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	MAT101	Multivariate Calculus and curve fitting	MAT	3	1	-	-	1	3	50	50	100	4
2	BSC	CHY101	Chemistry for Biotechnology	CHY	3	-	2	-	2	3	50	50	100	4
3	BSC	CIV104	Environmental Science & Sustainability	CIV	2	-	-	-	1	3	50	50	100	2
4	ESC	MEC112	Elements of Mechanical Engineering	MEC	3	-	-	-	1	3	50	50	100	3
5	ESC	EEE102	Elements of Electrical Engineering	EEE	3	-	-	-	1	3	50	50	100	3
6	HSMC	HSS102	Universal Human Values & Professional Ethics	Any	2	-	-	-	1	3	50	50	100	2
7	BSC	BTY111	Biology for Engineers	BTY	1	-	-	-	-	-	50	50	100	1
8	ESC	CSE1	IT Skills	CSE/ Any	-	-	2	-	1	-	50	50	100	1
9	ESC	MEC122	Engineering Visualization	MEC	-	-	2	-	1	-	50	--	50	1
Total Option-1					17	1	6	-	9	**18**	**450**	**400**	**850**	**21**
Additional Academic activities beyond class hours					-	-	-	-	7					
Learning hours per week					17	1	6	-	16					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40x16=640									

NMAMIT: Biotechnology

Second Semester: 21credits

Option-1, 21 credits														
II SEMESTER														
Sl. No	Course Type and Course Code		Course Title	Teaching Department	Contact Hours/Week				SL	Examination				Credits
					L	T	P	J		Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	BSC	MAT104	Matrix Algebra and Differential Equations	MAT	3	1	0	-	1	3	50	50	100	4
2	BSC	PHY101	Physics of fluids and semiconductors	PHY	3	0	2	-	2	3	50	50	100	4
3	ESC	BTY112	Cell and Molecular Biology	BTY	2	0	2	-	2	3	50	50	100	3
4	ESC	CIV111	Engineering Mechanics	CIV	3	0	0	-	1	3	50	50	100	3
5	PLC	CSE102	Introduction to Python Programming	CSE (Allied)	2	0	2	-	1	3	50	50	100	3
6	AEC	HSS131	Communicative English	HSS	1	0	2	-	**1**	3	50	50	100	2
7	PLC	MAT107	Mathematics with MATLAB	MAT	0	0	1	-	-	0	50	0	50	1
8	HSMC	HSS101	Constitution of India & Global Citizenship	HSS	1	0	0	-	-	0	50	0	50	1
				Total	**15**	**1**	**9**	**-**	**8**	**18**	**400**	**300**	**700**	**21**
Additional Academic activities beyond class hours								-	7					
Learning hours per week					15	0	9	-	15					
Total notional learning hours (L+T+P+J+SL)			Per week		40									
			Per semester		40x16=640									

Mandatory community Engagement							
9	INT	Community Engagement (Activity-based Internship)	1) **Social connect & Responsibility** (15 hours lecture to be engaged during second semester)	50	0	100	2*
			2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations of II, IV, V & VI Semesters.)	50	0		

*The grades will be included in the VIII semester grade card

8.5 Eligibility for submission of Capstone Project Work/Professional Practice Report

8.5.1 Capstone project work during the 8th semester shall be taken up batch-wise and report can be submitted for evaluation only on completion of a minimum of 126 credits and for Diploma lateral entry students (those who have joined the second year B.Tech.) the same is 92 credits.

8.5.2 Project work can be carried out as domain-specific /interdisciplinary under the guidance of faculty/ faculty members or the students can also opt for Professional Practice in an Industry / Research Institution/Center of excellence.

8.5.3 Viva-voce examination shall be conducted individually.

8.6 ELECTIVES

8.6.1 A candidate shall take electives in each semester from groups of electives, commencing from the 5th semester.

8.6.2 The minimum number of students to be registered for any Elective offered shall not be less than fifteen (15) and should not exceed forty (40).

8.6.3 A candidate shall opt for his/her choice of electives and register for the same at the beginning of each of the 5th to 7th semesters if pre-registration is not done. The candidate is permitted to opt for a change of elective within 15 days from the date of commencement of the semester as per the academic calendar of the college.

9. ATTENDANCE REQUIREMENT

9.1 Each semester is considered as a unit and the candidate has to put in a minimum attendance of 85% in each subject with a provision of condoning 10% of the attendance by the principal for reasons such as medical grounds, participation in University level sports, cultural activities, seminars, workshops, and paper presentation.

9.2 The basis for the calculation of the attendance shall be the term prescribed by the institution by its calendar of events. For the first semester students, the same is reckoned from the date of admission to the course.

9.3 The students shall be informed about their attendance position in the first week of every month by the College so that the students shall be cautioned to make up for the shortage.

9.4 A candidate having a shortage of attendance (<75%) in any course(s) registered shall not be allowed to appear for SEE of such course(s). Such students will be awarded an 'N' grade in these courses.

9.5 He/she shall have to repeat those course(s) with an 'N' grade and shall re-register for the same course(s) core or elective, as the case may be when the particular course is offered next either in a main (odd/even) or summer semester.

9.6 Attendance in CIE and SEE: Attendance in all examinations both CIE and SEE of each course registered shall be compulsory and there shall not be any provision for re-examinations. Any student against whom any disciplinary action is pending shall not be permitted to attend any SEE in that semester.

10. WITHDRAWAL FROM THE PROGRAM

10.1 Temporary Withdrawal

A student who has been admitted to a degree program of the college may be permitted once during the program to withdraw temporarily, for one semester, on the grounds of prolonged illness or grave calamity in the family, etc., provided –

i. The student applies to the College within 6 weeks of the commencement of the college stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent/guardian.
ii. The College is satisfied with the genuineness of the case and that even by considering the expected period of withdrawal, the student can complete the program requirements (165 credits) within the time limits specified by the university.
iii. The student does not have any dues or demands at the College / University including tuition and other fees as well as library material.
iv. A student availing of temporary withdrawal shall be required to pay such fees and/or charges as may be fixed by the college until his/her name appears on the student's roll list. The fees/charges once paid shall not be refunded.
v. A student will be entitled to avail of the temporary withdrawal facility only once during his/her studentship. However, any other concession for the concerned student shall have to be approved by the academic council.

10.2 Permanent Withdrawal

Any student who withdraws the admission before the closing date of admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account.

Once the admission for the year is closed, the following conditions govern withdrawal of admissions.

i) A student who wants to leave the College for good will be permitted to do so (and take a Transfer Certificate from the College, if needed), only after clearing all other dues if any.
ii) Those students who have received any scholarship, stipend, or other forms of assistance from the College shall repay all such amounts.
iii) The decision of the Principal of the College regarding the withdrawal of a student is final and binding.

11. EVALUATION SYSTEM

11.1 The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.

11.2 The Letter grades O, A+, A, B+, B, C, P, and F indicate the level of academic achievement, assessed on a decimal (0-10) scale.

11.3 The Letter grade awarded to a student in a course, for which he has registered shall be based on his performance in quizzes, tutorials, assignments, etc., as applicable, in addition to two mid-semester examinations and one semester-end examination. The distribution of weightage among these components may be as follows.

Semester End Examination (SEE)		:	50% (50 marks)
Continuous Internal Evaluation (CIE)		:	50% (50 marks)
CIE for Non-PBL Courses			
i)	Learning activities (LA): Quizzes (MCQs), Tutorials, Assignments, Seminars, Participative learning etc.	:	20 marks
ii)	Sum of two Mid-semester Examinations	:	30 marks
CIE for IPCC Courses or courses with PBL component			
Theory Part: (Assesment =50 marks)			
i)	Learning activities (LA): Quizzes (MCQs), Tutorials, Assignments, Seminars, Participative learning etc.		20 marks
ii)	Sum of two Mid-semester Examinations	:	30 marks
Practical part /PBL component: (Assesment =50 marks)			
i)	Practical part /Project Based Learning (PBL)	:	50 marks
Final; CIE marks for IPCC Courses or courses with PBL component is sum of the marks of Theory Part and Practical part with weightages as given below.			
60% weightage for theory part (0.6x50=30 marks) + 40% weightage forPractical part / PBL component (0.4x50=20 marks)			

Any variation, other than the above distribution, requires the approval of the pertinent DUGC and Academic Council.

11.4 The letter grade awarded to a student in a 0-0-P (Practical) course, is based on an appropriate continuous evaluation scheme that the course instructor shall evolve, with the approval of the pertinent DUGC and the performance in SEE held on the specified period in a semester.

11.5 **Evaluation Scheme** *(Refer to Appendix-B for detailed evaluation guidelines)*: The course Instructor shall announce in the class and/or display at the Notice board/faculty door/website the details of the Evaluation Scheme, including the distribution of the weightage for each of the components and method of conversion from the raw scores to the letter-grades within the first week of the semester in which

the course is offered so that there are no ambiguities in communicating the same to all the students concerned.

11.5.1 **Internship:** Mandatory Internship is in two parts. Community Engagement (2 weeks-(2 credits)) and Industry Internship (4 weeks-(4 credits))

11.5.1.1 **Community Engagement**

All the students admitted to the 1st semester of engineering programs shall have to undergo Community Engagement

- Social connect & Responsibility (15 hours lecture to be engaged during second semester)
- Community Engagement to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the vacations, preferably during II Semester or IV semester (only for lateral entry students)
- The internship shall include Inter / Intra Institutional activities. A viva – voce examination (Presentation followed by question-answer session) shall be conducted during the 2nd semester (for lateral entry students, during the 4th semester) and the prescribed credit shall be included in the 8th -semester grade card.
- All the students admitted to the 3rd semester of Engineering programs (Lateral Entry Category) shall have to undergo a mandatory internship of 02 weeks (during the 3rd semester or the intervening period of the 3rd and 4th semesters). The internship shall include Inter/Intra Institutional activities.
- The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up / complete the internship shall be declared to fail and shall have to complete it during subsequent University examinations after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the student's internship progress and interact to guide them for the successful completion of the internship).
- **Procedure for the Evaluation of Community Engagement**
  - Students should submit the reports immediately on completion of the Community Engagement to the respective mentors.
  - The Examination of the Community Engagement will be carried out by the mentor.
  - The Community Engagement shall be slated for 100 marks CIE only and will not have SEE.
  - Community Engagement marks are based on CIE marks (25 marks for the Social Connect and Responsibility, 25 marks for the presentation, and 50 marks for the report and final presentation).
  - A Viva-Voce examination is conducted during II/IV Semesters (Presentation followed by question-answer

session) and the prescribed credit shall be included in the VIII semester grade card.

11.5.1.2 Industry Internship

- All the students admitted to engineering programs shall have to undergo Industrial Internship of 04 weeks during the second and third year of their Engineering studies.
- During the intervening period of the IV & V semesters and VI & VII semesters, students shall be ready for industrial experience. Therefore, they shall choose to undergo 4 weeks Internship involving Innovation / Entrepreneurship or at Industry appropriate to the Decipline with the approval of respective HODs.

11.5.2 **Capstone Project work/Professional practice evaluation:** The evaluation of CIE of the project work shall be based on the progress of the student in the work assigned by the project supervisor, periodically evaluated by him/her together with a department committee constituted for this purpose. Seminar presentation, project report, and final oral examination conducted by the project evaluation committee at the department level shall form the SEE of the project work.

11.5.2.1 In the case of other requirements, such as seminar, field work, or comprehensive viva voce, if any, the assessment shall be made as laid down by the DUGC with the approval of BOS and Academic council.

11.5.2.2 There shall be no re-examination for any course in the credit system.

However, re-registration and examination is permitted for students

- who have abstained from attending CIE or SEE without valid reasons ("N" grade), or
- who have failed (F grade) to meet the minimum passing standards prescribed for CIE and/or SEE or
- who have been detained for shortage of attendance or who have withdrawn (W grade) who have dropped any course shall be required to re-register for such course(s) and go through CIE and SEE again and obtain a grade equal to or better than "P" Grade in each case.
- While such students should re-register for the same course(s) if core, they can re-register for the alternative course(s) from among the elective courses, as the case may be. The re-registration shall be possible when the particular course is offered again either in a main (Odd/Even) or summer semester.

11.6 Qualifying standards

Evaluation Method	Qualifying Standard
Sessional (CIE)	Score: ≥40% (≥20 marks)
Terminal (SEE)	Score: ≥40% (≥20 marks)
For securing a final Pass in a course	Total **40 % of the Course maximum marks (100)** i.e., the sum of the CIE and SEE marks prescribed for the Course is desired.

11.7 Grading System

The letter grade awarded to a student for his/her performance in a course is based on Absolute Grading.

a. Absolute Grading – Letter Grade and its range

The grade point scale for absolute grading

Marks Range (%)	Grade Point	Letter Grade	Descriptor
90 & above	10	O	Outstanding
80-89	9	A+	Excellent
70-79	8	A	Very Good
60-69	7	B+	Good
55-59	6	B	Above Average
50-54	5	C	Average
40-49	4	P	Pass
00-39	0	F	Fails
Absent	0	Ab	Absent

CGPA	Classification
7.00-& above	**First Class with Distinction**
6.00-6.99	**First Class**
5.00-5.99	**Second Class**
CGPA < 5.00*	**Academic Probation / Non-compliance**

***** If a student secures CGPA< 5.0 at any point time during his/her studies, he/she will be on Academic Probation/Noncompliance (refer to sections 14.2 and 17.3 for more details.)

i) **Grade "N":** A candidate having a shortage of attendance **(<75%)** in any course(s) or CIE marks less than **40%** shall not be allowed to appear for SEE of such course(s). Such students will be awarded an 'N' grade in these courses with a grade point of 0.

ii) The grade points are given above help in the evaluation of credit points earned by the student in a course as the credit points are equal to the number of credits assigned to the course multiplied by the grade points awarded to the student in that course. This shall be used in Arriving at the credit index of the student for that semester, as it is the total of all the credit points earned by the student for all the courses registered in that semester.

11.8 Earning of Credits

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range of O-P. The letter grade "F" in any course implies the failure of the student in that course and no credits earned.

a. The Transitional Grades "I", "W" and "X" would be awarded by the teachers in the following cases. These would be converted into one or the other of the letter grades (O-F) after the student completes the course requirements.

b. **Grade "I"**: To a student having attendance ≥85% and CIE ≥70% (35 marks), in a course, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:

   i. Illness or accident, which disabled him/her from attending SEE.

   ii. A calamity in the family at the time of SEE required the student to be away from the College.

   iii. However, the committee chaired by the Principal is authorized to relax the requirement of CIE ≥ 70% if the student is hospitalized or advised long-term rest after discharge from the hospital by the Doctor.

   iv. Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Makeup Examinations within 2 working days of that examination for which he or she is absent, failing which they will not be given permission.

c. **Grade "W":** To a student having satisfactory attendance at classes, but withdrawing from that course before the prescribed date in a semester under Faculty Advice

d. Grade "X": To a student having attendance ≥85% and CIE ≥70%, in a course but SEE performance could result in an F grade in the course. **(No "F" grade will be awarded in this case, but the student's performance record is maintained separately).**

11.9 Summer / Fast Track semester

a. The students who have satisfied CIE and Attendance requirements for the course/s and obtained an F grade in SEE are permitted to appear directly in ensuing examination/s as backlog paper/s. The students need not re-register for such course/s in the summer / fast track semester. In case the student wishes to improve CIE/ he/she has to re-register for the summer / regular semester as and when offered next.

b. The student who obtains required attendance and CIE in the summer semester, but obtains an 'F' grade in SEE; is permitted to appear for SEE subsequently as backlog course/s. The student need not repeat the course for Attendance and CIE.

c. The course/s for which the student does not possess satisfactory attendance and CIE score shall be marked as 'N' on the Grade sheet. Such students are not permitted to SEE for the Courses marked as 'N' on the Grade sheet. The students have to re-register only for course/s marked as 'N' in the summer/ subsequent semester whenever that course is offered and obtain the required CIE and attendance. Subsequently, they are eligible to appear for SEE in such course/s.
d. Courses with Transitional Grades viz "W", "I", and "X" are also eligible to register in the summer semester in case they wish to improve their score in CIE.
e. All courses may not be offered in the summer semester. It is the discretion of the University to offer the courses based on the availability of resources. The Institutes shall notify timetable for the summer semester well in advance.
f. Summer Semester is optional; it is for the student to make the best use of the opportunity.
g. A student is permitted to register for a maximum of 16 credits in the Summer / fast track semester.
h. A student has to choose those courses which are offered by the Institution in a given summer Semester.
i. In the summer semester, each course needs to be offered for the required number of lectures/ tutorial/ laboratory hours as prescribed in the syllabus.

11.10 Grade Card

Each student shall be issued a Grade Card at the end of each semester. This will have a list of all the courses registered by a student in the semester, together with their credits, the letter grades with grade points awarded. Only those courses registered for credit and having grade points shall be included in the computation of the students' performance like SGPA and CGPA and the courses are taken for audit will not form part of this computation. The results of mandatory courses, which are of the non-credit type shall also be reflected in the Grade card as PP (for Passed) or NP (for not passed). **Each UG student shall have to obtain the grade PP in each mandatory course to qualify for the Degree awarded by the university.**

11.11 Re-evaluation and paper seeing.

Re-evaluation is permitted only for theory papers. The University, on receiving application within the stipulated time and remittance of a prescribed fee for re-evaluation, shall permit re-evaluation for the course/s applied. The marks obtained after re-evaluation shall be the final marks awarded.

11.12 The Make-Up Examination

The Make-Up Examination facility would be available to students who may have missed attending the SEE of one or more course(s) in a semester for valid reasons and given the "I" grade; Also, students having the "X" grade shall be eligible to take advantage of this facility. **The makeup examination would be held as per dates notified in the Academic Calendar during the summer semester.** However, it would be possible to hold a makeup examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of makeup examinations shall be the same as the regular SEE for the

course(s).

a) All the "I" and "X" grades awarded to the students would be converted to appropriate letter grades after the make-up examinations. Any outstanding "I" and "X" grades after the last scheduled make-up examinations shall be automatically converted to "F" grades.

b) All the "W" grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/ Summer semester and fulfill the passing standards for their CIE and (CIE+SEE).

11.13 Rules for grace marks

Grace marks up to 1% of the maximum total marks of the courses for which he/she is eligible and have registered (non-credit courses excluded) in the examination or 10 marks whichever is less shall be awarded to the failed course(s), (with a restriction of a maximum of 5 marks per course) provided on the award of such grace marks the candidate passes in that course(s)

12. EVALUATION OF PERFORMANCE

The overall performance of a student will be indicated by two indices:
SGPA; which is the Semester Grade Point Average, and CGPA which is the Cumulative Grade Point Average.
SGPA for a semester is computed as follows.

$$SGPA = \frac{\sum[(Course\ Credits) \times (Grade\ Point)] \text{ (for all courses in that semester)}}{\sum[Course\ Credits]}$$

CGPA is computed as follows:

$$CGPA = \frac{\sum[(Course\ Credits) \times (Grade\ Point)]}{\text{(for all courses excluding those with F grades until that semester)}}$$

$$\sum[Course\ Credits]$$

(for all courses excluding those with F grades until that semester)

13. COMMUNICATION OF GRADES

The SGPA and CGPA respectively, facilitates the declaration of academic performance of a student at the end of a semester and the end of successive semesters. Both would be normally calculated to the second decimal position.

14. REQUIREMENTS FOR VERTICAL PROGRESSION (PROMOTION / ELIGIBILITY TO HIGHER SEMESTERS)

14.1 All students are promoted to the next semester or year of their program, irrespective of their academic performance.

14.2 However, at any stage of his/her study, if a student reaches a CGPA below 5.00, the student will be on **Academic Probation** and is permitted to register for a maximum of 16 credits during odd semester of an academic year. However, the student has the choice to re-register for the courses/courses in which he/she has obtained an 'F' / 'N' grade.

14.3 **A Student shall be declared fail if he/she**

(i) Has not satisfied the CIE requirements of any Course/s.

(ii) Has not appeared for the SEE even after satisfying the attendance and CIE requirements.

14.4 **Vertical Progression for regular students who have taken admission to the first year:**

Normally a student is expected to complete a minimum of 85% of credits by the end of the 7th semester. Completion of 126 credits is a pre requisite for submission of **B.Tech. Capstone Project/Professional Practice report in 8th semester. However, the students who have not earned 126 credits will not be eligible for the Semester End Examinations of the 8th Semester.**

14.5 **Vertical Progression in case of Diploma students admitted to Second year (lateral entry):**

14.5.1 Lateral entry students should complete at least 85% of credits by the end of the 7th semester. Completion of 92 credits is a pre requisite for submission of B.Tech. Capstone Project/Professional Practice report in 8th semester. However, the students who have not earned 92 credits will not be eligible for the Semester End Examinations of the 8th Semser.

14.5.2 Diploma students should register for mandatory non-credit Mathematics Courses Bridge Courses as prescribed during III and IV semesters respectively. They shall attend these bridge course classes during the respective semesters to satisfy attendance and CIE requirements.

14.5.3 Completion of Mathematics Courses Bridge Courses shall be mandatory for the award of the degree.

14.6 **Termination from the program**

A student shall be required to withdraw (discontinue) from the program and leave the college on the following grounds.

14.6.1 Failure to secure a minimum CGPA of 5.0 at the end of the 8 years (6 years for lateral entry students).

14.6.2 Failure to earn 165 credits (125 for lateral entry students) in 8 years (6 years for lateral entry students) of duration from the year of admission including the duration of temporary withdrawal (leave of absence).

14.6.3 Absence from classes for more than **six weeks at a time** in a semester without leave of absence being granted by competent authorities.

14.6.4 Failure to meet the standards of discipline as prescribed by the college from time to time.

15 AWARD OF CLASS

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or classes awarded as in the conventional system of declaring the results of university examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class. This can be seen in the following Table.

Percentage Equivalence of Grade Points (For a 10-Point Scale)

Grade Point	Percentage of Marks*	Class
≥ 7.00	≥ 70%	First class with Distinction
≥ 6.00	≥ 60%	First Class
5.0 ≥ CGPA <6.00	50≥ Percentage <60%	Second Class

Percentage * = (CGPA) x 10

16 APPEAL FOR REVIEW OF GRADES

16.1 The entire process of evaluation shall be made transparent, and the course instructor shall explain to a student why he/she gets whatever grade he/she is awarded, if and when required. A mechanism for the review of grades is incorporated into the evaluation system. However, before appealing for such review, a student shall first approach the concerned course Instructor and then the concerned DUGC, with the request to do the needful; and only in situations where satisfactory remedial measures have not been taken, the student may then appeal to the Department Academic Appeals Boards (DAAB) before the date specified in Academic Calendar, by paying the prescribed fees.

16.2 The fee for such an appeal will be decided by the Senate from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student.

17 AWARD OF DEGREE

17.1 B.Tech. Degree

a) Students shall be declared to have completed the Program of B.Tech. degree and is eligible for the award of degree provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and have earned the prescribed number of credits (165 credits for regular students registered for 4-year degree programs & 125 for lateral entry students).

b) For the award of a degree, a CGPA≥5.00 at the end of the Program shall be mandatory.

c) Completion of two Bridge courses in Mathematics shall be mandatory for the award of degree to lateral entry diploma students.

d) Earning of Activity Points:

i. Every student entering 4-year degree program should earn 100 activity points & every student entering 4-year degree program through Lateral Entry should earn 75 activity points as per the AICTE Activity Point Program for the award of an Engineering degree.

ii. The activities can be spread over the years (duration of the program) at any time during the semester weekends and holidays, as per the interest & convenience of the students from the year of entry to the program.

iii. The Activity Points earned shall be reflected on the student's eighth-semester Grade Card.

iv. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression.

v. In case students fail to earn the prescribed activity Points before the commencement of 8th-semester examinations, the eighth-semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of a degree only after the release of the Eighth semester Grade Card.

17.2 Honours/ Minors Degree

17.2.1 B.Tech. (Honours) Degree

i. Students must earn a minimum of 18 additional credits in his/her major program discipline entitles a student to get an 'Honours' credential.

ii. Students have to pay additional fees for all the courses registered for 'Honours'

iii. Students with a minimum of 7.5 CGPA and no backlog at the end of the 4th semester will qualify for registering for courses under the 'Honours credential.

iv. Students shall register for 'Honours' courses from the 5th semester onwards.

v. Students should register for additional courses and plan to take courses that are prescribed under that 'Honours' list as per 'pre-requisite' courses to earn the 'Honours' credential.

vi. Students who wish to acquire an 'Honours' credential need to carry out 'Honours' course registration along with their regular semester course registration.

vii. He/she accumulates credits by registering for the required courses, and if the requirements for 'Honours' are met within the prescribed minimum time limit of the program, the 'Honours' will be awarded along with the degree.

viii. Also, the student should meet the following requirements to become eligible for the 'Honours award.

- Minimum CGPA of 7.5 in this major discipline at the end of the 8th semester
- Minimum CGPA of 7.0 in the registered 'Honours' courses

ix. In case a student withdraws from the 'Honours' registration in the middle of the program, the 'Honours' courses completed will be converted to 'Audit' courses and indicated accordingly in subsequent Grade Sheets and Consolidated Grade Sheets.

x. It must be noted that the 'Honours' award will be mentioned in the Degree Certificate as "Bachelor of Technology in (specialization) with Honours".

xi. This fact will also be reflected in the Consolidated Grade Sheet under a separate heading 'Honours' with similar details shown for other credited courses and the CGPA for 'Honours' will be indicated at the end of the list of courses under 'Honours'.

xii. The grades obtained in the courses credited towards the 'Honours' award is not counted and shall not influence the GPA/ CGPA of the 'program' student has registered.

17.2.2 Minor Degree

i. Students have to earn a min of 18 additional credits from the courses focused on discipline other than his/her major program discipline entitles a student to get a 'Minor' credential.
ii. Students have to pay additional fees for all the courses registered for 'Minor'.
iii. Students with a minimum of 5.0 CGPA and no backlog at the end of the 3rd semester will only qualify for registering for the course under the 'Minor' credential.
iv. Students shall register for 'Minor' degree courses from the 4th semester onwards.
v. All Departments will offer 'Minors' in their varied disciplines and will prescribe what set of courses and/or projects is necessary for earning a minor in that discipline.
vi. Students should register for additional courses and plan to take courses that are prescribed under that 'Minors' list as per 'pre-requisite' courses to earn the 'Minor' credential.
vii. If any of the courses listed under the 'minor' option is a course listed under his/her curriculum as PCC then the student cannot opt for that 'Minor', since all minor courses need to be earned as additional courses to his/her program curriculum and depts decision is final and binding.
viii. Students who wish to acquire a 'Minor' can register for 'Minor' courses along with their regular semester course registration.
ix. Also, the student should have a minimum CGPA of 5.0 in the 'Minor' courses registered to become eligible for the Minor credential. This fact will also be reflected in the Consolidated Grade Sheet under a separate heading 'Minor in (specialization)'.
x. If the course requirements for a particular 'Minor' are met within the prescribed minimum time limit of the program, the minor will be awarded along with the degree, and it will be mentioned in the Degree Certificate as "Bachelor of Technology in (Major discipline) with Minor in (specialization)."
xi. In case a student withdraws from the 'Minor', the 'Minor' courses completed, will be converted to 'Audit' courses and indicated accordingly in subsequent Grade Sheets and Consolidated Grade Sheets.
xii. The grades obtained in the courses credited towards the 'Minor' award are not counted and shall not influence the GPA/ CGPA of the program the student has registered for.

17.2.3 Additional norms for Honours/Minors

i. Students shall register for additional courses to earn Honours/Minors in consultation with their Class Advisor from the list of courses suggested by the DUGC.

ii. DUGC may recommend Massive Open Online Courses (MOOCs)/SWAYAM/NPTEL courses to students who wish to register for Honours/Minors after justifying and establishing the equivalence of the curriculum. The decision of DUGC should be communicated to the Dean of Academics and Controller of Examinations for seeking approval.
iii. The credits prescribed for Honors/Minors may be earned through SWAYAM/NPTEL
iv. Students may choose to take up additional course work, from the MOOCs courses list suggested by various departments (which can be from SWAYAM/NPTEL) with proctored examinations as approved by the University and complete the same before the last working day of the VIII semester with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates: Completed the course (40-59)– ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD (≥ 90 %)
v. In case, there is no proctored examination for SWAYAM/NPTEL Courses, the University will conduct a SEE as deemed to be fit for the award of Credits
vi. The Credit equivalence for online courses shall be as follows –
    - 4 weeks of online course duration – 1 credit (approx. 13-14 hours)
    - 8 weeks of online course duration – 2 credits (approx. 26-28 hours) and
    - 12 weeks of online course duration – 3 credits (approx. 39-42 Hours)

17.2.4 Examination for Swayam Courses

a) Students are advised to check well in advance the availability of SWAYAM courses to be enrolled in the SWAYAM portal (**Ref: Notification of Registrar N(DU)/REG/AC/2024-25/1040)**

b) Students must complete the entire SWAYAM course and submit a minimum of 75% of assignments and quizzes to be eligible for the end-term examination
c) End-term proctored examinations for all SWAYAM-based credit courses are conducted by the National Testing Agency (NTA) and National Programme on Technology Enhanced Learning (NPTEL) at their designated centers across the country.
d) Alternatively, for select courses, the university will conduct end-term examinations during the current semester in alignment with the regular academic calendar. These exams will be conducted in accordance with the UGC's framework to facilitate learning on SWAYAM.
e) The end-term examination will carry 70-75% weightage, while continuous assessments consisting of assignments and quizzes completed on the SWAYAM portal will carry 25-30% weightage depending on the evaluation plan announced by SWAYAM course cooedinators.
f) Completion certificate from SWAYAM must be submitted within the first week of commencement of respective semesters.

g) Re-examinations will be conducted in the subsequent two semesters for students who could not pass or appear in the end-term exams.

17.3 Noncompliance

17.3.1 Noncompliance of CGPA ≥ 5.00 at the end of the Program

a) Students, who have completed all the courses of the Program but do not have a CGPA ≥ 5.00 at the end of the Program, shall not be eligible for the award of the degree.

b) In the cases of 17.3 (1), a student shall be permitted to appear again for SEE in course/s (other than Internship, Technical seminar, Project (Mini and Major), and Laboratories) of any Semester/s without the rejection of CIE marks for any number of times, subject to the provision of a maximum duration of the Program to make up the CGPA equal to or greater than 5.00 for the award of the Degree.

c) Students shall obtain written permission from the Controller of Examinations to reappear in SEE to make up the CGPA equal to or greater than 5.00.

d) In case, the students earn improved grade/s in all the reappeared course/s, the CGPA shall be calculated considering the improved grade/s. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 17.3.1 (b).

e) In case, the students earn improved grade/s in some course/s and the same or lesser than the previously earned pass grade/s in the other reappeared course/s, the CGPA shall be calculated considering the improved grade/s and the pass grades earned before the reappearance. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA<5.00, the students shall follow the procedure laid in 17.3.1 (b).

f) In case, the students earn improved grade/s in some courses and fail in the other reappeared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reappeared course/s in which the students have failed. If it is≥5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 17.3.1 (b).

g) In case, the students fail (i.e., earns an F grade) in all the reappeared course/s, pass grade/s of the course/s earned by the students before reappearance shall be retained. In such cases, the students shall follow the procedure laid in 17.3.1 (b).

17.3.2 Noncompliance with Capstone Project/Professional Practice

The Capstone Project/Professional Practice shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the Capstone Project/Professional Practice shall have to complete the same during subsequent University examinations after satisfying the Capstone Project/Professional Practice requirements.

17.3.3 Noncompliance of Internship

All the students of B. Tech shall have to undergo mandatory Internship-for 4weeks to earn 4 credits during the vacations at the end of the 2/3 academic year. The evaluation of Internship shall be during VIII semester. The internship shall be considered mandatory for the award of a degree. Those, who do not take up/complete the internship shall have to complete the same during subsequent University examinations after satisfying the internship requirements.

The maximum duration for a student for complying with the Degree requirements is 16 – semesters from the date of first registration for his/ her first semester (8 years from the date of admission to the first year, (12 semesters / 6 years from the date of admission for lateral entry student)).

18 GRADUATION REQUIREMENTS AND CONVOCATION

18.1 A student shall be declared to be eligible for the award of the degree if he/she has

a) Fulfilled "Award of Degree" Requirements
b) No Dues to the College, Departments, Hostels, Library, Central Computer Centre and any other centers
c) No disciplinary action is pending against him/her.

18.2 The award of the degree must be recommended by the Excecutive council.

18.3 **Convocation:** Degree will be awarded to the students who have graduated during the preceding academic year. Students are required to apply for the Convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements (refer to "Award of Degree") within the specified date to arrange for the award of the degree during convocation.

19 AWARD OF PRIZES, MEDALS, CLASS & RANKS

19.1 For the award of Prizes and Medals, the conditions stipulated by the Donor may be considered as per the statutes framed by the University for such awards. Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of university examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class, and Second Class as described in Section 15.

19.2 An attempt means the appearance/registration of a candidate for an examination in one or more courses either in part or failing a particular examination.

a. A candidate who fails/remains absent (after submitting exam application) in the main examination and passes one or more subjects/courses or all subjects/courses in the summer / Make-up examination shall be considered as taken more than an attempt.

19.3 Merit Certificates and University Medals/ will be awarded based on overall CGPA, governed by the specific selection criteria that may be formulated by the University for such Medals / Awards

a. Only those candidates who have completed the Program and fulfilled all the requirements in the minimum number of years prescribed (i.e., 3 years for Diploma lateral entry students or 4 years for students who joined after the 12th standard) and who have passed each semester in the **first attempt** are eligible for the award of Merit Certificates and /or University Medals.

b. Candidates with W, N, I, X & F grades and who passes the courses in the subsequent **summer** /make up examinations are not eligible for the award of Gold Medal or Merit Certificate.

20 CONDUCT AND DISCIPLINE

20.1 Students shall conduct themselves within and outside the premises of the College in a manner befitting the students of an Institution of National Importance.

20.2 **As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offense and is banned. Any form of ragging will be severely dealt with.**

20.3 The following acts of omission/ or commission shall constitute a gross violation of the Code of Conduct and are liable to invoke disciplinary measures:

i. Ragging.
ii. Lack of courtesy and decorum; indecent behavior anywhere within or outside the campus.
iii. Willful damage or stealthy removal of any property/belongings of the College/Hostel or fellow students/citizens.
iv. Possession, consumption, or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
v. Mutilation or unauthorized possession of Library books.
vi. Noisy and unseemly behavior, disturbing studies of fellow students.
vii. Hacking in computer systems (such as entering into another Person's area without prior permission, manipulation and/or Damage of computer hardware and software, or any other Cybercrime, etc.).
viii. Plagiarism of any nature.
ix. Any other act of gross indiscipline as decided by the Senate from time to time.
x. Use of Mobile in the college Academic area.
xi. Smoking in College Campus and supari chewing.
xii. Unauthorized fundraising and promoting sales.
xiii. Commensurate with the gravity of the offense the punishment may be: reprimand, expulsion from the hostel, debarring from an examination, disallowing the use of certain facilities of the College, rustication for a specified period or even outright expulsion from the College, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

20.4 For an offense committed in (i) a hostel (ii) a department or a classroom and (iii) elsewhere, the Chief Warden, the Head of the Department, and the Dean (Academics), respectively, shall have the authority to reprimand or impose fine.

20.5 All cases involving punishment other than reprimand shall be reported to the

principal.

20.6 Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Controller of Examinations for taking appropriate action.

20.7 **Note:** Students are required to be inside the examination hall 20 minutes before the commencement of the examination. This is applicable for all examinations (Semester end **summer** /makeup) henceforth. Students will not be allowed inside the examination hall after the commencement, under any circumstances.

21 Pursuing two academic Programs

21.1 Nitte (Deemed to be University) permits students to pursue two academic programs simultaneously, in alignment with the National Education Policy (NEP) 2020 and the UGC's guidelines (Ref: Notification of Registrar N(DU)/REG/AC/2024-25/1039)

21.2 Regulations and guidelines from statutory regulatory authorities will take precedence over these regulations, any updates or amendments to the regulatory guidelines will be incorporated into the university's regulations as required.

21.3 The university reserves the right to amend these regulations as required.

21.4 **Eligibility**

- Students are permitted to pursue a second academic program of the same qualification level – i.e., undergraduate students can enrol for a second undergraduate level program and post-graduate students can enrol for another post-graduate level program.
- Students may enrol for the second program at Nitte (Deemed to be University) or any other recognized university.
- PhD students are not permitted to pursue any other academic program along with their PhD.

21.5 **Modes of Learning:**

- The second program may be pursued in-person, online, or through Open and Distance Learning (ODL) mode.
- Students must seek prior written approval from Nitte (Deemed to be University) before enrolling in the second academic program.
- The application for approval must include details of the second program and its alignment with the student's primary program of study.
- A student can pursue two full time academic programmes in physical mode provided that in such cases, class timings for one programme do not overlap with the class timings of the other program.
- Degree or diploma programmes under ODL/Online mode shall be pursued with only such HEIs which are recognized by UGC/Statutory Council/Govt. of India for running such programmes.

****

APPENDIX - A
Definitions, terminology, and abbreviations

1. **Nitte DU / University**
    a. Refers to Nitte (Deemed to be University)
2. **EC**
    a. Refers to Executive Council of Nitte (Deemed to be University)
3. **BoS**
    a. Refers to the Board of Studies in Mechanical Engineering
4. **Institute/Institution**
    a. Refers to NMAM Institute of Technology, Nitte
5. **Program**
    a. A range of learning experiences over a specified period, leading to the award of a degree/diploma/certificate. A program is completed when the courses that make up the program are completed, and other requirements as specified in the program regulations are met.
6. **Course**
    a. A unit of learning that typically lasts one semester, led by one or more teachers, for a fixed roster of students. Often referred to as a "subject". A course has identified course outcomes, modules/units of study, specified teaching-learning methods, and assessment schemes. A course may be designed to include lectures, tutorials, practical, laboratory work, fieldwork, project work, internship experiences, seminars, self-study components, online learning modules, etc. in any combination.
7. **Semester**
    a. An academic session, usually of 16 weeks duration, with a minimum of 90 working days during which coursework and assessments are to be completed. Typically, two semesters make up an academic year, with the first of these referred to as the Odd Semester and the second as the Even Semester.
    b. An additional short semester (usually 8 weeks) may be offered between an even semester and subsequent odd semester (in the interval between two academic years) and is termed a summer semester. The summer semester is offered to enable students to register for:
        i. Fast-tracked courses required for clearing backlog courses.
        ii. Fast-tracked courses for earning additional credit / completing non-credit mandatory requirement.
        iii. Value added courses.
        iv. The courses offered in summer semesters are bound by the same regulations as that of regular semesters, except that they are run at an accelerated pace to provide the required contact hours and conduct assessments within the 8 weeks.

8. Credit

a. A unit by which the course work is measured. It determines the number of hours of formal learning (contact hours) required per week. Credits are calculated based on the concept of "notional learning time". Notional learning time is the number of hours that a learner is expected to spend, on average, to achieve the specified learning outcomes of the course. This may comprise a variable combination of scheduled learning activities, (lectures, seminars, labs, etc.) and supervised learning time (reading required before classes, working on assignments, examination preparation, and completion of assessments).

9. Credit equivalence of notional learning time for different types of activities

a. The credit values assigned to various teaching-learning activities are as follows:

Type of teaching-learning	Nature of activity	No. of contact hours per week equivalent to one credit	The total number of contact hours over a 16-week semester is equivalent to one credit
Lectures / Seminars / synchronous virtual classes / synchronous webinars	Scheduled instruction	1:1	15
Tutorials	Scheduled instruction	2:1	30
Supervised Demonstrations /Laboratory sessions / Studio / Workshops / Workplace simulation / Skill Practice Sessions	Scheduled instruction	2:1	30
Supervised Field visits/community visits/Internships	Scheduled instruction	3:1	45
Scheduled supervised study (individual or group)	Scheduled instruction	2:1	30
Asynchronous E-Learning modules (structured self-directed study	Independent learning	2:1	30
Student Seminar	Independent /small group learning	2:1	30
Project work/dissertation	Independent /small group learning	3:1	45
Internship for credit	Industry placement/ Research Internship	3:1	40-45

10. Choice-based credit system (CBCS)

A program structure for higher education requires students to earn a minimum of credits by completing various types of courses, including electives, which facilitate a student to have some freedom in selecting his/her own choices, within as well as across disciplines.

11. Course Registration

Refers to formal registration of the Courses in the study every semester (Credits and Audit) by every student under the supervision of a faculty advisor. The institution will maintain records of the same and communicate them to the University.

12. Learning outcomes

a. Program Outcomes (PO) - Statements defining the skills, knowledge, and attitude that graduates of a program will be able to demonstrate upon completing the program.
b. Course Outcomes (CO) - Statements defining the skills, knowledge, and attitude that students will be able to demonstrate upon completing the course. COs are mapped to the POs such that attaining the course outcomes leads to the attainment of program outcomes.
c. Attainment of COs are mapped to POs such that attaining the course outcomes leads to the attainment of program outcomes

13. Evaluation

For all courses, the evaluation will be based on both formative assessment (Continuous Internal Evaluation, CIE) and summative assessment (Semester End Evaluation, SEE). Weightage for CIE and SEE will be 50% and 50 % respectively.

13.1 Continuous Internal Evaluation (CIE)

Refers to the periodic and continuous *formative assessment* of students' performance during the semester by the teacher(s) of the course to provide timely feedback to students and for guiding "course corrections" by the teachers. The assessment methods may include tests, quizzes, assignments, project evaluations, portfolio evaluations, seminar assessments, etc. CIE will have a weightage of 50% in the determination of the final grading of the course.

13.2 Semester End Evaluation (SEE)

Refers to a *summative assessment* that covers the entire course syllabus, conducted by the University, at the end of the semester. Appropriate assessment methods aligned with the learning domain and teaching-learning methods are to be used. SEE will have a weightage of 50% in the determination of the final grading of the course.

14. Grading

Course Grade refers to a qualitative measure of performance of a student in each course, based on the percentage of marks secured in Continuous Internal Evaluation (CIE) and Semester End Evaluation (SEE). A Letter grade is awarded for each course.

15. Semester Grade Point Average (SGPA)

Refers to the measure of a student's academic performance in a semester. It is calculated based on the credits and the grades obtained in the courses offered in the semester.

16. Cumulative Grade Point Average (CGPA)

Refers to the measure of the cumulative performance of a student in all the previous semesters and is computed from the 2nd semester onwards. It is calculated based on the credits and the grades obtained in all the courses taken.

17. Academic Bank of Credits (ABC)

The Academic Bank of Credits is a national-level facility for "credit transfer". It is provided by the Ministry of Education, Govt. of India, to promote the flexibility of the curriculum framework and interdisciplinary/multidisciplinary academic mobility of students across the Higher Education Institutions in the country. The banking and redemption of credits through ABC will be governed by the University's guidelines.

APPENDIX-B

Evaluation Guidelines

CIE and SEE details for various types of courses

1. Theory: PCC/IPCC/PEC/OEC

1.1. Scheme of examinations: CIE+SEE =50+50=100 marks

1.2. Continuous internal evaluation (CIE):

1.2.1. CIE (PCC/PEC/OEC)

Type of Questions	Questions to be set (Can have sub-questions a and b)	Questions to Be answered	Marks per question	Total marks
Mid Sem Exam-1				
40-50 % of the total syllabus				
Descriptive Part-1	2	1	7-8	7.5
Descriptive Part-2	2	1	7-8	7.5
Mid Sem Exam-2				
40-50% of the total syllabus				
Descriptive Part-1	2	1	7-8	7.5
Descriptive Part-1	2	1	7-8	7.5
Participative Learning: Learning Activitiy/TASK				
Learning Activities	The Learning Activities/Task comprises class tests/quizzes/assignments conducted for all 5 units/modules each for a max mark of 20. The final task mark is based on the average of all 5 assessments, All tests/quizzes/Assignments are compulsory.			20
Maximum Marks				**50**

1.2.2 CIE (IPCC/PBL)

Type of Questions	Questions to be set (Can have sub-questions a and b)	Questions to be answered	Marks per question	Total marks
Mid Sem Exam-1				
40-50 % of the total syllabus				
Descriptive Part-1	2	1	7-8	7.5
Descriptive Part-2	2	1	7-8	7.5
Mid Sem Exam-2				
40-50 % of the total syllabus				
Descriptive Part-1	2	1	7-8	7.5
Descriptive Part-1	2	1	7-8	7.5
Learning Activities	The learning activity comprises class tests/quizzes/assignments conducted for all 5 units/modules each for a max mark of 20. The final task mark is based on the average of all 5 assessments, All tests/quizzes/Assignments are compulsory.			20
			Maximum Marks (A)	**50**
Minimum Eligibility 40% of Maximum mark (A)=20 marks				
Practical/Project Based Learning (PBL)				
Practical/PBL	Practical/PBL (comprises of implementation of theoretical concepts through projects/problem solving)			**50**
			Maximum Marks (B)	**50**
Minimum Eligibility 40% of Maximum mark (B) =20 marks				
Maximum CIE Marks [60% of Max marks (A) (Theory)+ 40% of Max marks (B) (Practical/PBL)]				**50**

1.2.3 Semester End Evaluation (SEE): 3 Hours Duration

Type of Questions	**Module & Teaching hours**	**Questions to be set**	**Questions to be answered**	**Marks per question**	**Total marks**
MCQ	Entire Syllabus	20 (4 questions from each unit/module)	All Questions	1	20
Type of Questions	**Module & Teaching hours**	**Questions to be set (Can have sub-questions a, b, and c)**	**Questions to be answered**	**Marks per question**	**Total eligible max marks**
Descriptive	• Unit-1 • 7-8 teaching hours	**2**	**1**	16	16
Descriptive	• Unit-2 • 7-8 teaching hours	**2**	**1**	16	16
Descriptive	• Unit-3 • 7-8teaching hours	**2**	**1**	16	16
Descriptive	• Unit-4 • 7-8 teaching hours	**1**	**1**	16	16
Descriptive	• Unit-5 • 7-8 teaching hours	**1**	**1**	16	16
				Maximum Marks	**100**
Minimum SEE Marks to be scored out of 100 marks					**40**
Minimum SEE Marks to be scored with 50% Weightage					**20**

1.2.4 CIE & SEE for various types of courses

Sl. No.	Courses		Evaluation scheme						
			CIE (Minimum eligibility marks 40% of Max CIE marks to appear for SEE)		SEE (Minimum eligibility marks 40 % of Max marks			Total Marks = (CIE+ SEE)	Requirement for securing a final Pass (Letter Grade P)
			Max Marks	Min eligibility marks 50% of max marks	Max Marks 100 or 50	Minimum eligibility marks required			40 % marks (Agrgregate of CIE +SEE)
						40% of max marks	Out of 50 marks		
1	Integrated Professional Core Course (IPCC)	Theory	50	20	100	40	20	100	40
		Practical	50	20					
		Total (60% of theory +40% of Lab)	50	20					
2	PCC with PBL component	Theory	50	20	100	40	20	100	40
		PBL component	50	20					
		Total (60% of theory +40% of PBL)	50	20					
3	PCC/PEC/OEC		50	20	100	40	20	100	40
4	Laboratory		50	20	50	20	20	100	40
5	Community Engagement		100	40	-	-		100	40
6	Internship Industry/Govt./ MSME/Research center =Total of 4 weeks)		50	20	50	20	20	100	40
7	Capstone Project Research Internship/ Advanced Industry Internship/Project work		100	40	100	40	-	200	80
8	Professional Practice		100	40	100	40	-	200	80

All university examinations (SEE) shall be conducted for a maximum of 100 marks. For assigning the letter grade the university examination marks secured by a student, shall be reduced to 50 marks (except for serial no.04,05, 06,07 and 08) and added to CIE marks. The minimum marks for securing a passing grade **'P'** shall be 40% of the agreegate marks (CIE+ SEE). If the total marks result in a fraction during reduction, it shall be rounded off to the nearest higher value.

2 Laboratory/Practical Course

2.1 Split-up of Marks for evaluation of Practical for 50 CIE marks and 50 SEE marks.

2.2 Split-up of Marks for evaluation of Laboratory work:

2.2.1 Laboratory in-charge faculty will follow rubrics given in the Tables below for an evaluation of laboratory courses

2.2.2 In the case of Practical, the IA marks shall be based on laboratory observation, records, viva, and at least one practical test.

2.2.3 Continuous Evaluation in every lab session will be done using the format mentioned in the Table to evaluate PO9 (Individual and teamwork) and PO10 (Communication).

2.2.4 Rubrics used for continuous Evaluation of **laboratory courses involving experiments with hardware**

Lab conduction and Record			**Lab Internal Assessment**		
Split-up: **60% (30 Marks) of Maximum CIE marks (50).** Each experiment is to be evaluated for conduction with an observation book and record write-up (**30 marks per experiment).** The final marks for conduction and record are the average of all the specified experiments in the syllabus.			Split-up: **40% (20 Marks) of Maximum CIE marks (50). One test of 20 Marks** In the test, conduction of the experiment and acceptable result with viva-voce will carry a weightage of 60% per experiment, with the rest 40% for procedural knowledge and regularity of the student.		
Rubrics per experiment	**Marks Distribution**	**Remarks**	**Rubrics**	**Marks Distribution**	**Remarks**
Circuit	02	Evaluation of Record write-up to include weightage for submission on time, neatness, etc.	Write-up	04	
Design	02		Conduction	10	
Procedure	02				
Conduction	06				
Viva	06				
Record write-up	12		Results	06	
Total Marks	30		**Total Marks**	20	

2.2.5 Split-up of Marks used for continuous Evaluation of laboratory involving experiments with software (Sample for PCC)

Rubrics for Split up of Marks	Methodology / Process Steps per Experiment	Marks
#R1	Observation, Write up of Procedure / Algorithm/ Program execution, and Conduction of experiment	12
#R2	Viva – Voce	06
#R3	Record writing	12
	Total Marks for each experiment	30
#R4	Internal Test: Lab Internal Assessment (i) Write-up of Procedure/Program/Algorithm (ii) Conduction/Execution (iii) Viva-Voce	 04 10 06
	Total Marks	20

3. Internship and Evaluation

3.1 Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program not only helps fresh pass–outs in gaining professional know-how but also benefits corporate sectors. The internship also enhances the employability skills of the student passing out from Technical Institutions.

The following list provides a brief illustrative overview of the knowledge, skills, work habits, and character traits commonly associated with 21st-century skills and to be acquired by graduates:

- Critical thinking, problem solving, reasoning, analysis, interpretation, and synthesizing information.
- Scientific literacy and reasoning, the scientific method.
- Research skills and practices, interrogative questioning.
- Creativity, artistry, curiosity, imagination, innovation, and personal expression.
- Information and communication technology (ICT) literacy, media and internet literacy, data interpretation and analysis, and computer programing.
- Oral and written communication, public speaking and presenting, listening.
- Economic and financial literacy, entrepreneurial skills.
- Global awareness, multicultural literacy, humanitarianism.
- Environmental and conservation literacy, ecosystems understanding.

- Civic, ethical, and social-justice literacy.
- Leadership, teamwork, collaboration, cooperation, and facility in using virtual workspaces.
- Perseverance, self-direction, planning, self-discipline, adaptability, initiative.
- Health and wellness literacy, including nutrition, diet, exercise, and public health and safety.

  The internship experience will augment the outcome-based learning process and inculcate various attributes mentioned above in a student in line with the graduate attributes defined by the NBA as well as NEP 2020

Following are the intended objectives of internship training.

(i) Expose Technical students to the industrial environment, which cannot be simulated in the classroom, and hence create competent professionals in the industry.

(ii) Provide possible opportunities to learn, understand and sharpen the real-time technical/managerial skills required at the job.

(iii) Expose to the current technological developments relevant to the subject area of training.

(iv) Use the experience gained from the industrial internship in discussions held in the classrooms.

(v) Create conditions conducive to the quest for knowledge and its applicability on the job.

(vi) Learn to apply technical knowledge in real industrial situations.

(vii) Gain experience in writing reports on technical works/projects.

(viii) Expose students to the engineer's responsibilities and ethics.

(ix) Familiarize with various materials, processes, products, and their applications along with relevant aspects of quality control and safety measures.

(x) Promote academic, career, and/or personal development.

(xi) Expose the students to future employers.

(xii) Make students available to the industry for employment.

(xiii) Understand the psychology of the workers and their habits, attitudes, and approach to problem-solving.

(xiv) Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations.

3.2 Academic credit framework for the internship and project work undergone as part of the B.Tech. program.

- A minimum of 16 credits to be earned through community engagement activities, Internship and Project work/ professional practice may be counted towards B. Tech. degree program
- Here, 1 credit is equivalent to a minimum of 40-45 hours of work. Therefore, a full-time intern is expected to spend 40 - 45 hours per week on Internship/Training/Project work etc. This will result in about 640 to 720 hours of total internship and project duration for the B. Tech program.

- To derive the benefits of an internship, it may be introduced in two stages of the B.Tech. program.
- Internships may be full-time or part-time; they are full-time during the summer vacation and part-time during the academic session. The curriculum is flexible to adjust internship duration. Therefore, opportunities must be provided for experiences that cannot be anticipated when planning the course.
- The departments have the flexibility to schedule internships, Project work, Seminars, etc. according to the availability of the opportunities. However, the suggested minimum requirement regarding Internship duration and credits are as given in Table -B1.

Table-B1 Suggested Credit Framework for Internship and Capstone Project.

Sl. No.	Title	Schedule	Duration	Activities	Credits
1	Community Engagement	Ongoing First-year academic session/ Vacation of 2nd Semester/ vacation during 3rd semester (for lateral entry students)	02 weeks	1) Social connect & Responsibility (15 hours lecture to be engaged during second semester) 2) Activity based Internship to focus on the activities pertaining to Social Connect & Responsibility (1 week duration (40 - 45 hours) to be completed during the Vacation of 2nd Semester/ vacation during 3rd semester (for lateral entry students) 3) Award of credits in 8th semester	02
2	Internship	a) Summer vacation after 4th Semester	02-04 weeks	Industrial/Govt./ NGO/ MSME/ Rural Internship/ Innovation / Entrepreneurship	---
		b) Summer vacation after 6th Semester	02-04 weeks	Industrial/Govt./ NGO/ MSME/ Rural Internship/ Innovation / Entrepreneurship	
		c) Total of a) and b) should be completed before the beginning of the 8th semester	04 weeks	Evaluation in 8th Semester	04
3	Capstone Project work / Professional Practice	7th Semester	3hours/week	Capstone project phase 1	00
		8th Semester	16 weeks	Professional Practice /Research Internship/ Capstone project phase 2	10
				Report preparation and writing	
Total Credits					**16**

Table-B1 states that during the ongoing/ summer vacations after the 2nd Semester, students are required to be involved in Inter/ Intra Institutional community engagement activities as outlined in section 3.3

3.3 Community Engagement

While intra-activities are within the institution, inter-activities shall be between the concerned institution and neighboring institutions. Intra and Inter activities are the activities that are the impetus to learning techniques. It adds to the comprehensive growth of the mind and associated activities.

As the students are on the verge of learning technical aspects and have a limited period of engagement, it is preferable to expose students to polygonal activities instead of one type of activity. Therefore, activities completed by the students shall not be one type of activity but can be few activities. In this regard, Intra and Inter-Institutional activities shall be completed under the supervision of a faculty on a self-learning basis.

The faculty have to kindle the latent abilities of the students, encourage, guide, supervise and shape them to achieve the desired result. Therefore, a learning agenda in the form of specific learning objectives and outcomes shall be prepared before the start of community engagement.

Whatever the activity/activities that are/are done under Intra and Inter-Institutional activities, should ignite the inquisitiveness to learn, enhance the knowledge, thinking ability and imagination, planning, application of mind, execution ability, innovation attitude, listening and understanding, vocabulary, personal expression, public speaking, written communication, oral presentation of the subject matter, acquire leadership qualities and teamwork requirements, responsiveness, ethics, etc.

3.3.1 Societal (Social) related activities

Short-term internships (about 2 weeks) in villages, slums, or urban areas can be under social internship. The internship will be more fruitful if students work in teams. The teams can select one or more fields to do their best in the field of agriculture, watershed management, wastelands development, non-conventional energy, low-cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, blood bank, and government schemes such as

i) (Swachch Bharat: Swachh Bharat Mission, Swachh Bharat Abhiyan, or Clean India Mission is a country-wide campaign to eliminate open defecation and improve solid waste management.
ii) Accessible India: Accessible India Campaign or Sugamya Bharat Abhiyan is a program to serve the differently able community of the country.
iii) Digital India: A campaign to ensure the Government's services are made available to citizens electronically by improved online infrastructure and by increasing Internet connectivity or making the country digitally empowered in the field of technology.
iv) Beti Bachao and Beti Padhao: A campaign of the Government of India that aims to generate awareness and improve the efficiency of welfare services intended for girls in India.
v) Environment and Energy Conservation and Education, legal aid, consumer protection, and allied field including Indian Red Cross Society, National Cadet Corps, Bharat Scouts, and Guides.

Societal activities are one of the NBA graduate attributes that are part of PO6 and PO7, which are reproduced below.

vi) PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

vii) PO-7: Environment and Sustainability: Understand the impact of the professional engineering solution in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. The long-term goal under Societal (social work) related activities, particularly in a rural area, results in a rural internship. In urban areas, the student may adopt slum/ economically weaker section areas for short duration social internship to uplift the living conditions.

Given the above, internship coordinators should encourage students to take up a societal internship as far as possible.

3.3.2 List of proposed activities

a. Activities concerned with the works of Indian scholars like Charaka and Susruta, Aryabhata, Bhaskaracharya, Chanakya, Madhava, Patanjali, Panini, and Thiruvalluvar, among numerous others
b. Community Photography.
c. Short film production: Contemporary aspects, technical aspects, etc.
d. Internship in Disaster Management.
e. Solar energy connected activities that help the common man.
f. Working with Smart City Administration.
g. Hackathon (it is a design sprint-like event in which computer programs and others involved in software development, including graphic designers, interface designers, project managers, and others, often including domain experts collaborate intensively on software projects).
h. Industrial Safety, Fire Safety, Electrical Safety, Chemical Process Safety, Food Safety, etc.
i. Internship and project work in Indian Knowledge System related Areas/Topics.

3.3.3 Documents to be submitted by Students for Community Engagement Evaluation

3.3.3.1 Student's Diary

The main purpose of writing a daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the student's thought process and reasoning abilities. The students shall record in the daily training diary the day-to-day account of the observations, impressions, information gathered, suggestions given, if any, and activities carried out. It should contain sketches and drawings related to the observations made by the students. The daily training diary should be signed after every day or at least twice a week by the faculty/ in charge of the section (external expert) where the student has been working.

Student's Diary should be submitted by the students along with attendance records. It shall be evaluated based on the following criteria:

i) Regularity in the maintenance of the diary.

ii) Adequacy and quality of information recorded.

iii) Drawings, sketches, and data were recorded.
iv) Thought processes and recording techniques were used.
v) Organization of the information

3.3.3.2 Report: Community Engagement (CEN)

After completion of the CEN, the student shall prepare, with a daily diary as a reference, a comprehensive report in consultation with the mentor/s to indicate what he/she has observed and learned in the training period along with the internship outcomes. The CEN report should be signed by the mentor. The Internship report shall be evaluated based on the following criteria and/or other relevant criteria about the activity completed.

i) Originality.
ii) Adequacy and purposeful write-up.
iii) Organization, format, drawings, sketches, style, language, etc.
iv) Practical applications, relationships with basic theory, and concepts taught in the appropriate course.
v) Variety and relevance of learning experience.

3.3.3.3 Procedure for the Evaluation of Community Engagement

a) Students should submit the reports immediately on completion of the Internship to the respective mentors as outlined in **Table B-2**
b) The Examination of the Community Engagement will be carried out by the mentor
c) The Community Engagement shall be slated for 100 marks CIE only and will not have SEE.
d) Community Engagement marks are based on CIE marks (25 marks for the Social Connect and responsibility, 25 marks for the presentation, and 50 marks for the report and final presentation).
e) A Viva-Voce examination to be conducted (Presentation followed by question-answer session) and the prescribed credit shall be included in the VIII semester grade card.

3.3.4 Assessment Rubrics for evaluation of Community engagement (Intra and Inter-Institutional Activities)

Table – B2 Community Engagment Assessment Rubrics Scheduled during the first year (Prescribed Period 02 weeks and Prescribed credits: 02)					
Sl No	**Sub Activity Head**	**Performance/ Appraisal**	**Assessment Rubrics (Allotted Percentage marks decide the letter grade) Percentage Marks**	**Proposed Document as Evidence**	**Evaluated by**
1	Community Engagement: Inter/ Intra Institutional activitiues.	Excellent	80 to 100	**(i)** Student's Diary and **(ii)** Community Engagement Report along with the certificate issued from the relevant	Institute Faculty (mentor) together with External Expert, if any.
		Good	60 to 79		
		Satisfactory	40 to 59		
		Unsatisfactory and fail	< 40		
Note: The total CIE marks are 100 (25 marks for the Social Connect and responsibility, 25 marks for the presentation, and 50 marks for the report and final presentation). shall be the sum of marks allotted to completed activities by the student.					

3.4 Industry Internship (04 weeks) [Scheduled during the intervening period of IV & V semesters and VI & VII semesters]

3.4.1 Industrial Internships

The gap between the theoretical knowledge obtained in the classrooms and the practical skills required in the actual workplace scenarios is fast growing. This has put forth varied challenges to graduating students when it comes to job placements. As institutes cannot have a relevant facility to expose students to a real-time industrial environment, an industrial internship is an appropriate solution.

The main objective of the industry internship is to ensure that the intern is exposed to a real job world environment and gains practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

3.4.1.1 Industry Internship Benefits

i) Have ample opportunities to attend seminars, symposiums, workshops, etc. This in turn provides an opportunity to establish rapports with professionals and pioneers in their respective fields for further growth.
ii) Have wide scope to publish paper/s in journals.
iii) Good recommendation letter/s that increase the prospectus for further internships, higher studies, and placements.
iv) Helps to acquire team spirit, motivated acts, techniques to resolve conflicts, etc.
v) Helps to develop a lot of leadership skills.
vi) Increases the prospect of placement in the same concern, provided the intern has exhibited a clear understanding of basics and completed the internship.
vii) Fosters to substantiate the issues with facts and figures.

For AICTE Internship opportunities refer to https://internship.aicte-india.org/

3.4.2 Industry Internship Supervision

During the intervening period of the IV & V semesters and VI & VII semesters, students shall be ready for industrial experience. Therefore, they shall choose to undergo an Internship involving Innovation / Entrepreneurship/short-term (about 4 weeks) societal-related activities. Students may choose to work on innovation or entrepreneurial activities, or both resulting in start-up or undergo internship with industry/NGO/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

- The internship shall be carried out under the supervision of a faculty mentor. The faculty mentor/guide should,
- Serve as a teacher, mentor, trainer, critic, leader, and boss.
- Provide sufficient time to guide the interns. (Interns are students or a trainee who does a job to gain work experience)
- Play a vital role, along with the Training and Placement Officer, in providing internship opportunities for the students.
- Exhibit qualities such as leadership, strong communication skills, and patience.
- Provide a letter of recommendation in due consultation with students and the industrial organization (if possible) where the internship is intended to be carried out, endorsed by the authority (Principal/Institution Internship Coordinator).
- Each faculty mentor shall supervise the students/Student batches allotted to them. Often, the supervision may be by an external expert also. In such cases, the faculty mentor shall jointly guide the student/s without causing miscommunications/embarrassment to either side.
- Depending on the activity taken up by the students, the internship shall be carried out individually or in batches having not more than three students.
- Faculty Mentor, along with the external expert, shall scrupulously evaluate the work of an individual student or students of a batch and maintain the relevant documents.
- For allotment of CIE marks, the institutions shall prepare the rubrics for each activity offered by the institution as given in Table - B2. The marks shall be allotted by the Internship committee designated by HOD in consultation with the mentors.

- For all activities conducted by the institution, the attendance of the students shall be maintained by the faculty and maintained in their respective departments.

3.4.3 Innovation

Innovation refers to a new or improved product or process or a combination thereof that differs marginally or significantly from the unit's previous product. An innovation center is a place where students are encouraged to implement the innovative ideas formed through imagination, brainstorming sessions, design thinking, and associated activities to bring them to reality. It is a place, where creative minds are shaped.

3.4.4 Entrepreneurship

Entrepreneurship refers to setting up a new business or business and taking on financial risks in the hope of profit. It involves investment to undertake production along with arranging inputs like land, labour, material, and capital, introducing new techniques and products, identifying new sources for the enterprise, etc.

3.4.5 Incubation Center

An organized unit designed for innovation as well as to accelerate the growth and success of new entrepreneurial companies through mentorship and an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections.

3.4.6 Startup

An entity that develops a business model based on either product innovation or service innovation and makes it scalable, replicable, and self-reliant.

An entity shall be considered a Startup

i) Up to ten years from the date of incorporation/ registration, if it is incorporated as a private limited company (as defined in the Companies Act, 2013) or registered as a partnership firm (registered under section 59 of the Partnership Act, 1932) or a limited liability partnership (under the Limited Liability Partnership Act, 2008) in India.

ii) Turnover of the entity for any of the financial years since incorporation/ registration has not exceeded one hundred crore rupees.

iii) The entity is working towards innovation, development, or improvement of products or processes, or services, or if it is a scalable business model with a high potential for employment generation or wealth creation.

iv) Provided that an entity formed by splitting up or reconstruction of an existing business shall not be considered a Startup.

3.4.7 Places for Innovation/Entrepreneurial Activities

Students shall carry out Innovation or Entrepreneurial activities or both at the Incubation Center and Entrepreneurship Cell of the parent institution or elsewhere such as ATAL Incubation Centers [A flagship of Atal Innovation Mission (AIM), NITI Aayog for promoting the culture of innovation and entrepreneurship in India], institutes of national importance, public sector units, IT companies, government organizations, and non-governmental organizations, industries including MSME, etc.

- **Institutes should deter students to opt for internships at places established for commercial benefits.**

3.4.8 Assessment Rubrics for Innovation / entrepreneurship/ Industry Internship Activities (refer Table B3)

Once the internship begins, the students are required to maintain a diary/journal and submit a report regularly to the guide. These reports should summarize the activities in which the student was involved during the previous week's period. At the end of the internship, each student is required to submit a hard copy of the consolidated diary/journal and report for evaluation. The report should indicate the learning and achievements of the internship.

Table – B3 Innovation/entrepreneurship/ Industry Internship Activities and Assessment Rubrics
Scheduled during the intervening period of IV & V semester and VI & VII Sem
(Prescribed Period 04 weeks: Credits 04)

Sub Activity Head	Performance/ Appraisal	Assessment Rubrics	Proposed Document as Evidence	Evaluated by
(1) Development of new product/ Business Plan/ registration of start-up	Excellent	80 to 100	(i) Student's Diary and (ii) Internship Report or the activity report along with Certificate or Declaration from relevant Authorized Authority. Wherever only Certificate is issued, Assessment shall be at the institute as per (i) and (ii) to decide the letter grade.	(i)Institute Faculty (mentor) together with External Expert if any.
	Good	60 to 79		
	Satisfactory	40 to 59		
	Unsatisfactory and fail	< 40		
(2) Internship with Industry/ Govt. / NGO/ PSU/ Any Micro/ Small/Medium Enterprise.	Excellent	80 to 100		
	Good	60 to 79		
	Satisfactory	40 to 59		
	Unsatisfactory and fail	< 40		
Note: **(i)** The total CIE marks shall be the sum of marks allotted to successfully completed activities by the student.				

4. Capstone Project/Professional Practice / Research Internships

4.1 Capstone project/Research Internship/Professional practice of sufficient duration encourages students early on in their careers. Its main goal is to allow improving their analytical and technical skills in an international environment. An internship can be in an industry or at an appropriate workplace.

- Research internships/industrial projects have different purposes and come with a set of benefits. A prior experience in any field is always preferred over a fresh start. Therefore, one of them can be selected depending on the interest the students have. Internships pose unexpected challenges and make students think appropriately, tackle difficulties with ease, and act in a scholarly way to get past the hurdles and practical constraints. An internship is always beneficial however good or bad it is.
- Professional practice not only enhance one's learning but also identifies him/her as someone who commits to approaching a project and completing it with or without guidance. Internship learning is an impetus for professional development.
- While a research internship is a stepping stone to higher studies, an industry internship is a pathway to a placement. Those who are self-motivated and interested in searching for new things that are original and unique can choose a research internship. Those who are

interested in real industry- experience and aspire to get a job soon after graduation can choose an industry internship.

- Research Internships (Also known as dissertation internships) are focused research projects that push students' intellectual abilities beyond those driven by the classroom. Often, a research internship typically helps solve problems that are usually part of major research projects. It involves a short theoretical or experimental research project supervised by a researcher.
- The research internships, under the advice of a faculty supervisor, can be one's own selected project or a project on which a Researcher is researching, or a new project/real-world project offered by an organization. The research area may be about single or multidisciplinary fields such as science, technology, engineering, mathematics, management, and business studies. Research internships can be carried out either individually or in teams (not exceeding 3 or 4 students).
- Research internship opportunities, before graduation, maybe in a laboratory of college, a research institute, or a company's R & D department. Apart from fixed working hours of the day of an organization, the researcher can devote sufficient time to other research-related activities for early and successful completion of the Research Internship.

4.2 Necessary Skills for Research Internship and Industrial Internship

For the internships to progress without hurdles and for successful completion, the Researchers should maintain a harmonious relationship with the guide/s, administrators, co-workers, and others, and strictly adhere to the rules and regulations of the workplace.

The other skills required or acquirable during the Internship are,

- Good Communication skills.
- Attention to detail.
- Planning and scheduling.
- Documentation.
- Critical thinking.
- Data collection.
- Data analysis.
- Ability to maintain quality, safety, and/or infection control standards.
- Appreciating and practicing ethical issues.

4.3 Responsibilities of an Intern

Interns,

a) If working with a researcher, shall assist the researcher in an ongoing research project or work collaboratively in designing a new project of mutual interest.
b) Shall engage in literature survey and get an insight of the research work at the initial stages.
c) Shall compile data, sort, file, implement ideas with minimal guidance and assist write papers.
d) Shall become familiar with several tools [meters (Electrical and Electronics, mechanical, computer, etc.)] used in data collection, software, graphic software, Statistical Package for the Social Sciences (SPSS) software [IBM's statistical software platform], etc.
e) Shall attain skills with Microsoft Word Office, Excel, PowerPoint, Outlook, etc.
f) Shall give a mid-term oral presentation to a committee for review and feedback.

g) Shall attend discussions, meetings, symposiums, classroom lectures, etc., to learn new scientific techniques, design experiments, analyze results, and formulate different hypotheses.
h) Shall learn to write reports and be able to correspond independently.
i) Shall manage time effectively.
j) Shall keep a track of the progress of the project.
k) Shall develop integrative thinking.

4.4 Research internship Outcomes

a) Generating technical paper/s and publishing in refereed journal/s.
b) Possibility of acquiring intellectual ownership and patent.
c) Build a prototype for an idea on which the research was carried out.
d) File patent/s.
e) Add academic knowledge to the field.
f) Enhanced ability in arranging meetings, presentations, seminars, training, etc.
g) Improved conscientiousness and ethics.

4.5 Research internships Benefits

a) Are a great way to pursue an academic career in teaching and research, as a Research Scientist at a Research Organization, Company, Industry sector, etc.
b) Establish professional networks for a future career.
c) Pave the way to join a research team and work alongside leading experts in the field.
d) Introduced to new ideas through interaction with like-minded students and others.
e) Develop research skills and knowledge in a specific area of interest.
f) Provide opportunities for growth, achievement, and personal development.
g) Offer an opportunity to publish a research paper that will boost the resume while applying for Post Graduate Studies

5. Evaluation Procedure of Rresearch Internship /professional practice /and Capstone Project (16 weeks)

5.1 The students pursuing the course Research **Internship /professional practice /and Capstone Project** shall submit the diary recordings of day-to-day activities to the concerned guide, reporting progress achieved in the course and seeking guidance to proceed with the internship. The interns should provide all the details to the guide so that he/she can discuss with the employer to make the internship successful.

5.2 The intern should constantly update the guide about the progress of the internship. The guide should know the intern's internship tasks, duties, responsibilities, and potential projects. The evaluation of interns and their internship progress should be honest and constructive.

5.3 The hardcopy or softcopy of the diary maintained by the interns must be signed at regular intervals by the guide.

5.4 Regarding the intern's feedback, the guides should propose changes in internship activities so that they are helpful to the internship.

5.5 Illustrations, drawings, photos, forms, samples, classified materials, etc., are to be included in the report only after obtaining the consent of the concerned authorities and should indicate the source of all such material. The final report should also be submitted

to the place where the internship was carried out. The report should avoid a tone that is predominantly cynical or unduly critical of the employer or of those with whom the student intern has worked. The content of the report must be based on interns' own work.

5.6 Recommendation letter

The guide must state whether the intern,

a) Exceeded the expectations of the internship.
b) Met the expectations of the internship.
c) Did not meet the expectations of the internship.
d) Did work to a satisfactory level.
e) Did an unsatisfactory internship.

In the end, the guide should issue a recommendation letter.

5.7 Continuous Internal Evaluation (CIE)

The guides should evaluate the interns using the following as well as any other appropriate methods.

a) Punctuality of intern.
b) Conduct and character.
c) Tactfulness and politeness with colleagues and the public.
d) Attitude regarding professionalism.
e) Inquisitiveness and eagerness to learn.
f) Research attitude.
g) Problem-solving techniques.
h) Innovation mindset.
i) Time management and meeting deadlines.
j) Receptiveness to feedback and critiques.
k) Ability to work in a team as a member.
l) Ability to work without supervision.
m) Supervisory skills and leadership skills.
n) Judgment and decision-making skills.
o) Writing skills, oral communication skills, technical communication skills, computer skills, analysis skills, and business writing skills.
p) Appropriateness of technical skills.
q) Familiarization with writing technical papers, standards, codes, etc.
r) Reading Behavioural attitude.
s) Outcomes.
t) Successes and failures experienced

5.8 Assessment of CIE marks

5.8.1 **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the internship, shall be based on the evaluation of the diary, presentation skill, and viva-voce in the ratio of 50:25:25.

5.8.2 **Interdisciplinary:** The CIE marks awarded for the internship, shall be group-wise at the institution level with the participation of all guides of the internship. Participation of external guide/s, if any, is desirable.

5.8.3 The CIE marks awarded for the internship, shall be based on the evaluation of the diary, presentation skill, and viva-voce in the ratio of 50:25:25.

5.9 Assessment of SEE marks

5.9.1 Single discipline: Contribution to the internship and the performance of each group member shall be assessed individually in the semester-end examination (SEE) conducted at the department. Marks shall be awarded based on the evaluation of the report, presentation skill, and viva-voce in the ratio of 50:25:25.

5.9.2 Interdisciplinary: Contribution to the internship and the performance of each group member shall be assessed individually in the semester-end examination (SEE) conducted separately at the departments to which the student/s belongs. Marks shall be awarded based on the evaluation of the report, presentation skill, and viva-voce in the ratio of 50:25:25.

5.10 Evaluation Industry Internship/Professional Practice /Project Work:
Split-up of marks for evaluation of Project work for 100 CIE marks and 100 SEE marks.

Split up	Rubrics		% Marks
Report (50 % Marks)	Content Development	Abstract/ Synopsis Write-up	10
		Selection of Topic/ Relevance of the subject to the concerned discipline	05
		Problem Identification	05
		Objectives and Methodology	05
	Problem-Oriented Exposition	Literature Survey (Papers/Sites/Sources Surveyed)	10
		Documentation/ Systematic Approach	10
		Results (with inferences, Conclusions, etc.)	05
Project Presentation Skill (25 % Marks)		Quality of preparation of presentation	05
		Communication Skills	05
		Technical knowledge and awareness	05
		Individual involvement	10
Viva-Voce (25 % Marks)		The clarity in answering questions relating to fundamentals and concepts	10
		The clarity in answering the questions related to the project	05
		The understanding ability of the questions asked	05
		The confidence in answering the questions asked.	05
		Total Marks	100 %

Scheme & Syllabus for
B. Tech.
I – II Semester

B.Tech. ~~(ECE)~~: Scheme of Teaching and Examinations
(Batch 2025-29)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2025 - 26)

Basic Science Courses

MULTIVARIATE CALCULUS AND CURVE FITTING

Course Code:	**MAT101**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T:P)	**3:1:0**	**Credits:**	**04**
Total Teaching Hours:	**45+15+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Mathematics

Course Objectives:

- The course covers basic concepts and applications of single and multivariate calculus
- The course elaborately covers Concepts of vector calculus
- The course also covers techniques to fit curves using Least square methods and regression

UNIT-I

Differential Calculus **9+3 Hours**

Polar curves, angle between tangent and radius vector, angle of intersection, pedal equation, radius of curvature (no derivations). Taylor's and Maclaurin's series (without proof)-problems.

UNIT-II

Partial Differentiations **9+3 Hours**

Partial derivatives, Homogeneous function, Euler's theorem, Total derivative, Partial differentiation of implicit and composite functions, Jacobian, Maxima and Minima for function of two variables. Lagrangian multipliers,

UNIT - III

Multiple Integrals **9+3 Hours**

Multiple integrals –Evaluation of double and triple integrals, Change of variables, area using double and volume using triple integrals. Gamma and Beta functions, Relation between Beta and Gamma functions, Problems.

UNIT-IV

Vector Differentiation **9+3 Hours**

Vector functions, Vector differentiation, Velocity and acceleration, Gradient, Divergence and Curl, Directional Derivatives, Solenoidal and irrotational vectors, Laplacian, Vector identities.

UNIT -V

Application : Curve fitting **9+3 Hours**

Curve fitting using least square method, straight line, parabolic and exponential curves,
Regression lines, correlation, rank correlation, multiple linear regression.

Course Outcomes: At the end of the course student will be able to

1	Apply concepts of calculus and Taylor series to engineering problems
2	Adopt multivariate calculus to different situations arising in engineering field
3	Evaluate integrals using the analytical techniques discussed and use special function
4	Apply concepts of vector calculus to engineering problems
5	Fit least square curves and regression line to the data available

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MAT101.1	3	2										
MAT101.2	2	2										
MAT101.3	3	1										
MAT101.4	3	2										
MAT101.5	3	2										

1: Low 2: Medium 3: High

TEXTBOOKS:

1	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015.
2	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016.
3	N.P. Bali and M.Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.

REFERENCE BOOKS:

1	G.B. Thomas and R.L.Finney, "Calculus and Analytic geometry", Pearson, 2002.
2	Shanthi Narayan, " Differential Calculus, 6th edition, Shyam Lal Charitable Trust, Delhi.
3	G Shanker Rao, " Probabilty and Statistics for Science and Engg", Univ Press, 2011
4	Gupta, S. C. & Kapoor, V. K. ***Fundamentals of Mathematical Statistics***, 11th Ed., S.Chand and Company Pvt. Ltd., 2014.

E Books / MOOCs/ NPTEL

1	**http://nptel.ac.in/courses/11110*7108/***

MATRIX ALGEBRA AND CALCULUS

Course Code:	MAT102	Course Type:	BSC
Teaching Hours/Week (L: T:P)	3:1:0	Credits:	04
Total Teaching Hours:	45+15+0	CIE + SEE Marks:	50+50

Teaching Department: Mathematics

Course Objectives:

1	This course will enable the students to master the basic tools of elementary linear algebra, eigen values and eigenvectors of a square matrix using the characteristic polynomial, differential calculus, partial differentiation, multiple integration and become skilled for solving problems in science and engineering.

UNIT-I

Matrices — **9+3 Hours**

Elementary row transformations of a matrix, Rank of a matrix by echelon form, Consistency of system of equations, Solution of system of linear equations, Gauss-elimination method, solving system of equations by Gauss- Siedel Method, LU decomposition method, Tridiagonal system,

UNIT-II

Eigen Values and Eigen vectors — **9+3 Hours**

Eigen values and Eigenvectors (Direct method), Trace, relation between trace and Eigen values of a matrix, Characteristic equation, Power method of finding dominant Eigen value and corresponding Eigenvector, Eigen values of symmetric matrices using Jacobi Method and Given's method. Diagonalization.

UNIT - III

Differential calculus — **9+3 Hours**

Polar curves, angle between the radius vector and the tangent, angle of intersection of two curves. derivatives of arcs, radius of curvature - Cartesian, parametric and polar forms. Rolle's Theorem (without proof), mean value theorems, Taylor and Maclaurin series.

UNIT-IV

Partial Differentiation — **9+3 Hours**

Partial derivatives of simple functions, total differentiation - differentiation of composite and implicit functions, Jacobians. Taylor's theorem for functions of two variables, maxima and minima for functions of two variables, Lagrange's method of undetermined multipliers.

UNIT -V

Multiple Integrals — **9+3 Hours**

Double integrals and triple integrals, evaluation by change of order of integration, change of variables and applications to area and volume. Beta and Gamma functions and their properties.
Applications: Calculation of mass, centre of gravity

Course Outcomes: At the end of the course student will be able to

1	Solve system of equation numerically to get approximate solution
2	Compute and interpret Eigen values and Eigen vectors
3	Apply mean value theorem, Taylor's series and concepts of polar curves for engineering problems
4	Differentiate multivariate functions and Extremize the same.
5	Evaluate multiple integrals and apply the concept of special fuctions

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MAT102.1	3	2										
MAT102.2	2	2										
MAT102.3	3	1										
MAT102.4	3	2										
MAT102.5	3	2										

1: Low 2: Medium 3: High

TEXTBOOKS:	
1	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015.
2	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016.
3	N.P. Bali and M.Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
REFERENCE BOOKS:	
1	G.B. Thomas and R.L.Finney, "Calculus and Analytic geometry", Pearson, 2002.
2	Shanthi Narayan, " Differential Calculus, 6th edition, Shyam Lal Charitable Trust, Delhi.
3	Seymore Lipschutz, Marc Lipson, "Linear Algebra" 3rd edition, Schaum series,Tata McGraw Hill,2011
4	Gilbert Strang "Linear Algebra for everyone" 2020,PHI
E Books / MOOCs/ NPTEL	
1	**http://nptel.ac.in/courses/11110*7108/***
2	**https://nptel.ac.in/courses/122101003**

CALCULUS AND DIFFERENTIAL EQUATIONS

Course Code:	**MAT103**	**Course Type:**	**BSC**
Teaching Hours/Week (L-T-P)	**3:1:0**	**Credits:**	**04**
Total Teaching Hours:	**45+15+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Mathematics

COMMON FOR CSE/ISE/CCE/AIM/AI&DS/R&AI/CYB/CBS

Course Objectives:

This course will enable the students to master the concepts, methods of solutions and basic tools used under single variable, multivariable differential calculus.
The course also imparts knowledge of modeling and solving Ordinary and partial differential equation.
The course also includes techniques of multiple integration with applications

UNIT-I

Differential calculus — **9+3 Hours**

Polar curves, angle between tangent and radius vector, angle of intersection, pedal equation, radius of curvature (no derivations). Taylor's and Maclaurin's series (without proof)-problems.

UNIT-II

Partial Differentiation — **9+3 Hours**

Partial derivatives, Homogeneous function, Euler's theorem, Total derivative, Partial differentiation of implicit and composite functions, Jacobian, Maxima and Minima for function of two variables. Lagrangian multipliers,

UNIT-III

Ordinary differential equation — **9+3 Hours**

Linear differential equation, Bernoulli differential equation, exact differential equation, second and higher order differential equation with constant coefficients-complimentary function, particular Integral, variation of parameter.

UNIT-IV

Partial differential equations — **9+3 Hours**

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions. Classification of 2nd order PDES. Solution of P.D.E: Direct integration method and method of separation of variables. Solution of heat, wave and Laplace equations.

NIT-V

Multiple Integrals — **9+3 Hours**

Multiple integrals –Evaluation of double and triple integrals, change of variables, area using double and volume using triple integrals. Gamma and Beta functions, Relation between Beta and Gamma functions, properties and Problems

Course Outcomes: At the end of the course student will be able to

1	Apply concepts of polar curves and expand functions into Taylor series.
2	Apply concept of multivariate calculus and Extremize functions arising in engineering field.
3	Model and solve Ordinary differential equations in engineering field
4	Form and solve partial differential equations relevant to engineering.
5	Apply concepts of multiple integration and special functions.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
MAT103.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT103.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT103.3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT103.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT103.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015.
2	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016.
3	N.P. Bali and M.Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
REFERENCE BOOKS:	
1	G.B. Thomas and R.L.Finney, "Calculus and Analytic geometry", Pearson, 2002.
2	W.E. Boyce and R.C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009
3	G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007
4	Shepley L Ross, "Differential equations" 3rd edition, Wiley, 2004
5	Shanthi Narayan, " Differential Calculus, 6th edition, Shyam Lal Charitable Trust, Delhi.
E Books / MOOCs/ NPTEL	
1	http://nptel.ac.in/courses/111106100/
2	https://nptel.ac.in/courses/122101003

MATRIX ALGEBRA AND DIFFERENTIAL EQUATIONS

Course Code:	**MAT104**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P)	**3:1:0**	**Credits:**	**04**
Total Teaching Hours:	**45+15+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Mathematics

Course Objectives:

- The course provides extensive knowledge of methods to solve Differential equations
- The course also provides knowledge of Laplace transforms
- The course imparts numerical techniques to fit and interpolate data

UNIT-I

Matrix Algebra — **9+3 Hours**

Elementary row transformations of a matrix, Rank of a matrix by echelon form, Consistency of system of equations, Solution of system of linear equations, Gauss-elimination method, solving system of equations by Gauss- Siedel Method, LU decomposition method.

UNIT-II

Eigen Values and Eigen vectors — **9+3 Hours**

Eigen values and Eigenvectors (Direct method), Characteristic equation. Power method of finding dominant Eigenvalue and corresponding Eigenvector, Eigenvalues of symmetric matrices using Jacobi and Given's Method

UNIT-III

First order ODE — **9+3 Hours**

Linear and Bernoulli's differential equations, Exact differential equations. Non-linear differential equations (first order and higher degree) equations solvable for p, equations solvable for y, general and singular solutions of Clairaut's equations.
Applications – Growth and decay, Newton's law of cooling, Mixing

UNIT-IV

Higher order ODE — **9+3 Hours**

Second and higher order linear differential equation with constant coefficients, solution by inverse differential operator, method of variation of parameters, linear differential equation with variable coefficients- Cauchy's linear differential equation. Applications to engineering problems.

UNIT-V

Laplace Transforms — **9+3 Hours**

Definitions, transforms of elementary functions, transforms of derivatives and integrals- properties. Periodic functions, unit step functions and unit impulse functions. Inverse Transforms and properties, convolution theorem, Applications to engineering problems.

Course Outcomes: At the end of the course student will be able to

1.	Adopt numerical techniques to solve system of equations.
2.	Evaluate and interpret Eigen values using analytical and numerical techniques
3.	Model and solve first order ordinary differential equation
4.	Solve higher order equations using analytical techniques
5.	Apply Laplace transforms to convert functions and equations arising in engineering fields

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MAT104.1	3	2										
MAT104.2	2	2										
MAT104.3	3	1										

MAT104.4	3	2										
MAT104.5	3	2										

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015
2.	. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016
3	. N.P. Bali and M.Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010
REFERENCE BOOKS:	
1.	G.B. Thomas and R.L.Finney, "Calculus and Analytic geometry", Pearson, 2002.
2.	W.E. Boyce and R.C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.
3.	G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.
4.	Shepley L Ross, "Differential equations" 3rd edition, Wiley, 2004
5	Seymore Lipschutz, Marc Lipson, "Linear Algebra" 3rd edition, Schaum series,Tata McGraw Hill,2011
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/courses/111106100
2.	http://nptel.ac.in/courses/111106139
3	https://nptel.ac.in/courses/111101115

DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

Course Code:	MAT105	Course Type:	BSC
Teaching Hours/Week (L: T:P)	3:1:0	Credits:	04
Total Teaching Hours:	45+15+0	CIE + SEE Marks:	50+50

Teaching Department: Mathematics

Course Objectives:

- The course provides extensive knowledge of methods to solve Differential equations
- The course also provides knowledge of Laplace transforms
- The course imparts numerical techniques to fit and interpolate data

UNIT-I

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS — **9+3 Hours**

Exact equation, Reducible to exact, linear and Bernoulli's differential equations, orthogonal trajectories of cartesian and polar curves. Applications: Rate of growth and decay, Newton' law of cooling, Mixing.

UNIT-II

ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER — **9+3 Hours**

Second and higher order linear differential equation with constant coefficients, solution by inverse differential operator, method of variation of parameters, Cauchy and Legendre equations
Applications: Oscillations of spring, LCR circuits

UNIT - III

LAPLACE TRANSFORMS — **9+3 Hours**

Definitions, transforms of elementary functions, transforms of derivatives and integrals- properties. Periodic functions, unit step functions and unit impulse functions.
Inverse Laplace Transforms and properties, convolution theorem,
Applications: Solution of ODE, LCR circuits

UNIT-IV

NUMERICAL METHOD-1: INTERPOLATION — **9+3 Hours**

Interpolation: Newton's forward and backward formulae, Newton's divided difference formulae and Lagrange's formula for unequal intervals and inverse interpolation by Lagrange's formula, Numerical differentiation with Newton's forward and backward difference interpolation.

UNIT -V

PARTIAL DIFFERENTIAL EQUATIONS — **9+3 Hours**

Formation of partial differential equations by elimination of arbitrary constants/arbitrary functions. Derivation of one-dimensional heat and wave equations, Solution of PDE's by direct integration method, by the method of separation of variables. Solution of heat, wave and Laplace equation.

Course Outcomes: At the end of the course student will be able to

1	Apply concept of analytic functions, expand into series and integration to complex functions
2	Apply concept of Z transform to discrete signals and functions
3	Apply Fourier analysis to periodic and aperiodic functions
4	Apply concepts of vector differential calculus to engineering problems
5	Adopt techniques of vector integration to engineering problems

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MAT105.1	3	2										
MAT105.2	3	2										
MAT105.3	2	2										
MAT105.4	2	2										
MAT105.5	3	2										

1: Low 2: Medium 3: High

TEXTBOOKS:	
1	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015
2	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016.
3	S.S.Sastry, "Introductory methods of Numerical Analysis", 2nd edition, 1990, Prentice Hall.
4	N.P. Bali and M.Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
REFERENCE BOOKS:	
1	W.E. Boyce and R.C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.
2	G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.
3	Shepley L Ross, "Differential equations" 3rd edition, Wiley, 2004
4	M K Jain, S R K Iyengar, R K Jain, Numerical Methods for Scientific and Engg. Computation, New Age, 2012
5	V Krishnamurthy, S K Sen , Numerical Algorithms, East West press, 2007
E Books / MOOCs/ NPTEL	
1	http://nptel.ac.in/courses/111106100
2	http://nptel.ac.in/courses/111106139
3	http://nptel.ac.in/courses/111107111

LINEAR ALGEBRA AND TRANSFORM TECHNIQUES

Course Code:	**MAT106**	**Course Type:**	**BSC**
Teaching Hours/Week (L-T-P)	**3:1:0**	**Credits:**	**04**
Total Teaching Hours:	**45+15+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Mathematics

Course Objectives:

The course will cover the concepts, methods to solve system of equations, evaluate Eigen values and Eigen vectors

The course will impart knowledge of Linear algebra such as vector space, linear transformation, inner product space and matrix decomposition

The course will also cover periodic function and Fourier analysis of periodic and aperiodic function.

UNIT-I

Matrices **9+3 Hours**

Elementary transformation of a matrix, Echelon form and rank of a matrix. Consistency and solution of system of linear equations - Gauss elimination method. LU Decomposition method.

Eigen values and Eigen vectors of a square matrix, Characteristic and minimal polynomial**,** Rayleigh's power method.

UNIT-II

Vector Spaces **9+3 Hours**

Vector spaces, subspaces, linear combination, spanning set**,** linearly dependent and independent vectors, basis and dimension, Change of basis, coordinates, row space, column space and null space.

UNIT-III

Linear Transformations **9+3 Hours**

Linear transformations, algebra of linear transformations, representation of transformations by matrices, isomorphism, Range(image) and Null space(Kernel) of a linear transformation. Rank – nullity theorem. Inner products, orthogonal sets of projections, Gram-Schmidt's orthogonalization process.

UNIT-IV

Matrix Decompositions **9+3 Hours**

Diagonalization, Jordon Canonical form, Quadratic forms, QR-factorization, least-squares problems, and singular value decomposition.

UNIT-V

Fourier series and Integral Transforms **9+3 Hours**

Euler's formulae, Dirichlet's conditions for Fourier series expansion.

Fourier Transforms: Definition, Complex Fourier transforms, Cosine and Sine transforms, Inverse Fourier transforms.

Laplace Transforms: Definition, Laplace Transform of elementary functions, First shifting property, Transforms of periodic function, unit step function, unit impulse function, derivatives, integrals, multiplication by , Division by (only statements of properties and its problems). Inverse Laplace transforms by the method of partial fractions.

Course Outcomes: At the end of the course student will be able to

1	Apply concept of Eigen values to engineering problems and solve system of equation numerically
2	Construct vector spaces and analyse the properties like basis and dimensions
3	Analyse problems adopting concepts of Linear transformation, Orthogonality and inner products
4	Apply concepts of decomposition and canonical forms to engineering problems
5	Apply Fourier analysis to periodic and aperiodic functions

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
MAT106.1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT106.2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT106.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT106.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT106.5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1	Seymore Lipschutz, Marc Lipson, "Linear Algebra" 3rd edition, Schaum series,Tata McGraw Hill,2011
2	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016
3	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015.
REFERENCE BOOKS:	
1	David C. Lay, "Linear Algebra and Its Applications", Pearson Education, Inc., 5th edition, 2016.
2	Gilbert Strang, "Introduction to Linear Algebra", Wellesley-Cambridge Press, 5th edition, 2016
3	J.W. Brown and R.V. Churchill, "Fourier Series and Boundary Value Problems", McGraw-Hill Education, 8th Edition, 2011
4	Gilbert Strang "Linear Algebra for everyone" 2020,PHI
5	J R Hanna, J H Rowland, Fourier Series, Transforms and Boundary Value Problems, Dover, 2018
E Books / MOOCs/ NPTEL	
1	https://nptel.ac.in/courses/111101115
2	https://archive.nptel.ac.in/courses/111/106/111106135/
3	https://onlinecourses.nptel.ac.in/noc24_ma21/preview

PHYSICS OF FLUIDS AND SEMICONDUCTORS

Course Code:	**PHY101**	**Course Type:**	**BSC**
Teaching Hours/Week (L:T:P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Physics

Course Objectives:

1.	To understand and apply the static properties of fluids.
2.	To study the flow behavior of fluids and their measurements.
3.	To study the properties of conductors and their applications.
4.	To identify the fundamental principles of semiconductors for optoelectronic devices.
5.	To gain a foundational understanding of various characterization methods and techniques.

UNIT-I

Fluid Statics — **09 Hours**

Introduction to Fluid Mechanics -Definition and properties of fluids, distinction between fluids and solids, Fluid Statics - Pressure and its measurement, Pressure variation in static fluids, Hydrostatic forces on submerged surfaces, Buoyancy and Archimedes' principle, Manometry and pressure measurement devices, Numericals. Surface tension and measurement of surface tension of a liquid (liquid-drop method).

UNIT-II

Fluid Dynamics — **09 Hours**

Continuity Equation, Conservation of mass, Continuity equation for incompressible fluids. Applications of continuity equation-Fluid Dynamics: Bernoulli's Equation, Energy conservation in fluid flow, Bernoulli's equation and its derivation Applications of Bernoulli's equation, Pitot tubes and velocity measurement (qualitative), Viscosity and Fluid Flow, Introduction to viscosity, Newton's law of viscosity, Viscosity measurement techniques Stoke's law, falling ball viscometers. Laminar and turbulent flow, Reynolds number and its significance, Importance of Reynolds number for biological systems, Numericals.

UNIT-III

Conductors — **09 Hours**

Conductors: Free-electron concept. Classical free-electron theory - Assumptions. Drift velocity. Mean collision time and mean free path. Relaxation time. Expression for electrical conductivity in metals (Drude-Lorentz theory). Failures of classical free-electron theory. Quantum free-electron theory - Assumptions. Fermi - Dirac Statistics- Fermi energy and Fermi factor for metals. Effect of temperature on electrical resistivity of metals – Matthiessen's rule, Effect of impurities on electrical resistivity of metals- Nordheim's rule.

UNIT-IV

Semiconductors — **09 Hours**

Classification of Solids (Conductor, Semiconductor and Insulators, Semiconductors - intrinsic and extrinsic semiconductors, Carrier generation in intrinsic and extrinsic semiconductors. Fermi factor and Fermi energy in semiconductors – intrinsic and extrinsic semiconductors. Conductivity of intrinsic semiconductor, effect of temperature. Conductivity and effect of temperature on conductivity of extrinsic semiconductor – intrinsic effect, maximum device temperature, Direct and Indirect bandgap semiconductors. Hall effect – theory, derivation of expression for carrier concentration, Hall coefficient and mobility.Applications, p-n Junctions- formation, biased and unbiased junction, LED, photodiode and solar cell.

UNIT-V

Characterization Techniques — **09 Hours**

X-ray diffraction techniques: Properties and production of X-ray, Characteristic X–ray spectrum, Bragg's Law(derivation), Diffraction Methods-Laue method, rotating crystal method, powder method, X- ray diffractometer–determination of crystal structure. Numerical problems.

Electron Microscopy: Introduction, Principle of Electron microscope, electrostatic and magneto

static lenses, Construction and working of electron microscope, types of electron microscope. Basic construction and working of SEM.
Mass spectrometry: Introduction, Principle, Instrumentation, Applications.

List of Experiments

1.	Energy gap of semiconductor by Four Probe Method.
2.	Hall effect.
3.	Fermi Energy of the given conductor.
4.	Determination of coefficient of viscosity.
5.	Determination of surface tension of liquids
6.	I-V characteristics of Zener diode
7.	LED Characteristics and determination of Plank's constant using LEDs.
8.	I-V characteristics of solar cell
9.	Diffraction Halos - Determination of size of the particles.
10.	Fluid Velocity Measurement Using a Pitot Tube (Pitot Static Tube)
11.	Reynolds Experiment (Virtual)
12.	Bernoulli's Experiment (Virtual)

Course Outcomes: At the end of the course students will be able to

1.	Apply fundamental principles of fluid mechanics to analyse and solve problems related to fluid properties.
2.	Understand and analyze the flow behavior of fluids and their measurements.
3.	Analyze the dynamics of free electrons in metals to interpret the mechanism of electrical conduction.
4.	Analyze the role of semiconductors in electronic devices, exploring the properties of semiconductors.
5.	Acquire knowledge of various material characterization techniques.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	PSO↓		
PHY101.1	3	2						2			1			
PHY101.2	3	2						2			1			
PHY101.3	3	2						2			1			
PHY101.4	3	2						2			1			
PHY101.5	3	2						2			1			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Robert Resnick Jearl Walker, David Halliday, "Principles of Physics", 10th Edition, Wiley Publisher, 2015.
2.	J. C. Upadhyaya, "University Physics-I", Himalaya Publishing House, Mumbai.

REFERENCE BOOKS:	
1.	Aurthur Beiser, "Concepts of Modern Physics", McGrawhill, 6th Edition, 2009.
2.	John W. Jewett and Raymond A. Serway, "Physics for Scientists and Engineers", 10thEdition, Thomson Brooks/Cole Publishers, 2018.
3.	Frank White, "Fluid Mechanics", Seventh Edition, Mc-Graw Hill publishers.
4.	A. J. Dekker, "Electrical Engineering Materials", Prentice Hall India Pub., New Delhi, Reprint 2011.
5.	B. G. Streetmann, "Solid State Electronic devices", 6th edition, Prentice Hall India Learning Private Limited.
6.	M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, "A Textbook of Engineering Physics", S. Chand and Company Limited, New Delhi.
7.	S. O. Pillai, "Solid State Physics", New Age International Private Limited, 8th Edition, 2018.
8.	Gupta and Gour, "Engineering Physics", Dhanpat Rai Publications, 2016 (Reprint).
9.	Sam Zhang, Lin Li, Ashok Kumar, "Materials Characterization Techniques", CRC Press, First Edition, 2008.
10.	Mitra P.K., "Characterization of Materials", Prentice Hall India Learning Private Limited.
E Books / MOOCs/ NPTEL/ Web links	
1.	Fluid Mechanics: https://archive.nptel.ac.in/courses/112/105/112105269/
2.	Fluid Mechanics: https://nptel.ac.in/courses/112104118
3.	Conductors and Semiconductors: https://archive.nptel.ac.in/courses/115/105/115105122/
4.	Characterization techniques: https://archive.nptel.ac.in/courses/113/105/113105101/
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1.	https://me.iitp.ac.in/Virtual-Fluid-Laboratory/index.html
2.	http://nptel.ac.in
3.	https://swayam.gov.in
4.	https://virtuallabs.merlot.org/vl_physics.html
5.	https://phet.colorado.edu
6.	https://www.myphysicslab.com

QUANTUM COMPUTING AND MODERN PHYSICS
(For all IT Branches and RAI)

Course Code:	**PHY102**	**Course Type:**	**BSC**
Teaching Hours/Week (L:T:P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Physics

Course Objectives:

1.	To understand the concepts of quantum mechanics.
2.	To study the principles of quantum computing and its applications.
3.	To study the properties of conductors and superconductors and their applications.
4.	To identify the fundamental principles of semiconductors to apply in electronic devices.
5.	To understand the principles, construction, and applications of LASERs and Optical fibres.

UNIT-I

Quantum Mechanics — **09 Hours**

Introduction to quantum mechanics, de Broglie Hypothesis and Matter Waves, de Broglie wavelength, Phase Velocity and Group Velocity, Relation between Phase Velocity and Group Velocity (Derivation), Relation between Particle Velocity and Group Velocity, Heisenberg's Uncertainty Principle - Application of Uncertainty Principle (nonexistence of electron inside the nucleus),

Wave Function, Physical Significance of a wave function, Time independent Schrödinger wave equation (Derivation), Eigen functions and Eigen Values, Particle inside one dimensional infinite potential well, Numerical Problems.

UNIT-II

Quantum Computing — **09 Hours**

Introduction to Quantum Computing, Moore's law and and its end, Differences between Classical & and Quantum computing. Dirac representation and matrix operations: Matrix representation of 0 and 1 States, Identity Operator I, Applying I to $|0\rangle$ and $|1\rangle$ states, Row and Column Matrices and their multiplication (Inner Product), Orthogonality, Orthonormality. Concept of qubit and its properties. Representation of qubit by Bloch sphere. Single and Two qubits. Extension to N qubits. Numerical Problems.

Quantum Gates: Single Qubit Gates: Quantum Not Gate, Pauli – X, Y and Z Gates, Hadamard Gate, Phase Gate (or S Gate).

UNIT-III

Conductors and Superconductors — **09 Hours**

Free-electron concept. Classical free-electron theory – Assumptions, Drift velocity, mean collision time, mean free path and relaxation time, Expression for electrical conductivity in metals (Drude-Lorentz theory), Failures of classical free-electron theory. Quantum free - electron theory – Assumptions, Fermi energy and Fermi factor for metals and its variation with temperature, Numerical problems.

Introduction to superconductors, characteristic properties: Meissner effect, Critical field, Critical Current. Type-I and Type-II superconductors. BCS theory (qualitative). High temperature superconductors, Numerical problems.

UNIT-IV

Semiconductors — **09 Hours**

Introduction to semiconductors, intrinsic and extrinsic semiconductors - carrier generation, Direct and indirect band gap semiconductors. Expression for concentration of electrons in conduction band and and holes concentration in valance band (only mention the expression), Fermi level in Intrinsic and Extrinsic Semiconductors and its behavior with temperature, Electrical conductivity of an intrinsic semiconductor (derivation) and effect of temperature on intrinsic conductivity, Hall effect, Expression for Hall coefficient (derivation) and its application.

p-n junction: Junction formation, Unbiased and biased p-n junction, Devices: LED, Photodiode and

solar cell. Numerical problems.

UNIT-V

LASER and Optical Fibers	**09 Hours**

Introduction to lasers, Characteristics of LASER, Interaction of radiation with matter, Einstein's coefficients (Qualitative), Requisites of a Laser System. Conditions for Laser action. Principle, Construction and Working of Nd:YAG LASER and semiconductor LASER, Application of Lasers in Bar code scanner and Laser Printer. Numerical Problems.

Introduction and Principle of Optical Fibers (TIR), Propagation mechanism in optical fibers - Angle of Acceptance and Numerical Aperture N.A.), Expression for NA, Fractional Index Change, Modes of Propagation, Number of Modes and V Number, Types of Optical Fibers, Attenuation, Factors contributing and Mention of Expression for Attenuation coefficient, Numerical problems.

List of Experiments

1.	Energy gap of a semiconductor (any method).
2.	Hall effect
3.	I-V characteristics of Zener diode
4.	Solar cell characteristics.
5.	Determination of wavelength by Laser diffraction.
6.	Diffraction of White light by optical grating
7.	Determination of acceptance angle and numerical aperture of the given Optical Fiber.
8.	Photo electric effect – Determination of the work function of the material of the emitter of a photocell.
9.	Photo-Diode characteristics
10.	LED characteristics and determination of Planck's Constant using LEDs.
11.	Transistor Characteristics.
12.	Determination of Fermi Energy of Copper.
13.	Resonance in LCR circuits.
14.	Simulation experiment.

Course Outcomes: At the end of the course students will be able to

1.	Apply the knowledge of quantum mechanics to analyse the physical properties exhibited by particles at sub-atomic level.
2.	Apply the basic principles of Quantum Mechanics in Quantum Computing.
3.	Apply knowledge of conductor and superconductor properties to engineering applications.
4.	Analyze the role of semiconductors in electronic devices, exploring the properties of semiconductors.
5.	Analyze the properties of optical waves in the phenomena of lasing action and signal propagation.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	PSO↓		
PHY102.1	3	2						2			1			
PHY102.2	3	2						2			1			
PHY102.3	3	2						2			1			
PHY102.4	3	2						2			1			
PHY102.5	3	2						2			1			

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Parag K Lala, "Quantum Computing – A Beginner's Introduction", Indian Edition, McGraw Hill, Reprint 2020.
2.	B. G. Streetmann, "Solid State Electronic devices", 6th edition, Prentice Hall India Learning Private Limited.
3.	A. Ghatak, "Optics", Tata McGraw Hill Pub., 5th Edition, 2012.
REFERENCE BOOKS:	
1.	Michael A. Nielsen & Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge Universities Press, 2010 Edition.
2.	Vishal Sahani, "Quantum Computing", McGraw Hill Education, 2007 Edition.
3.	Maria Luisa Dalla Chiara, Roberto Giuntini, Roberto Leporini, Giuseppe Sergioli, "Quantum Computation and Logic: How Quantum Computers Have Inspired Logical Investigations", Trendsin Logic, Volume 48, Springer.
4.	Gupta and Kumar, "Solid State Physics", K. Nath & Co., Meerut.
5.	A. J. Dekker, "Electrical Engineering Materials", Prentice Hall India Pub., New Delhi, Reprint 2011.
6.	S. O. Pillai, "Solid State Physics", New Age International Private Limited, 8th Edition, 2018.
7.	M. Ali. Omar, "Elements of Solid State Physics: Principles and Applications", Pearson Publishers.
8.	Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Education Private Limited, Special Indian Edition, 2009.
9.	Kenneth Krane, "Modern Physics", Wiley International, 3rd Edition, 2012.
10.	Michael Tinkham, "Introduction to Superconductivity", II Edition, McGraw Hill, INC
E Books / MOOCs/ NPTEL/ Web links	
1.	LASER: https://www.youtube.com/watch?v=WgzynezPiyc
2.	Superconductivity: https://www.youtube.com/watch?v=MT5Xl5ppn48
3.	Optical Fiber: https://www.youtube.com/watch?v=N_kA8EpCUQo
4.	Quantum Mechanics: https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s
5.	Quantum Computing: https://www.youtube.com/watch?v=jHoEjvuPoB8
6.	Quantum Computing: https://www.youtube.com/watch?v=ZuvCUU2jD30
7.	Physics of Animation: https://www.youtube.com/watch?v=kj1kaA_8Fu4
8.	Statistical Physics Simulation: https://phet.colorado.edu/sims/html/plinko-probability/latest/plinkoprobability_en.html
9.	NPTEL Superconductivity: https://archive.nptel.ac.in/courses/115/103/115103108/
10.	NPTEL Quantum Computing: https://archive.nptel.ac.in/courses/115/101/115101092
11.	Virtual LAB: https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
12.	Virtual LAB: https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1.	http://nptel.ac.in
2.	https://swayam.gov.in
3.	https://virtuallabs.merlot.org/vl_physics.html
4.	https://phet.colorado.edu
5.	https://www.myphysicslab.com

APPLIED PHYSICS FOR BUILDING STRUCTURES
(For CIV Branch)

Course Code:	**PHY103**	**Course Type:**	**BSC**
Teaching Hours/Week (L:T:P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Physics

Course Objectives:

1.	To understand and apply the concepts of oscillations and resonance.
2.	To recognize and implement fundamental concepts in elastic materials.
3.	To identify the fundamental principles and applications of laser technology.
4.	To grasp the principles, construction, and applications of optical fibres.
5.	To study and understand the fundamental principles and concepts of acoustics.

UNIT-I

Oscillations — **09 Hours**

Introduction to Simple Harmonic motion (SHM), derivation of differential equation for SHM, Free, Damped and Forced oscillations, Theory of damped oscillations (Quantitative), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations (Qualitative), resonance, and sharpness of resonance. Springs: Stiffness Factor and its Physical Significance, series and parallel combination of springs (Derivation), Types of spring and their applications. Numerical Problems.

UNIT-II

Elasticity — **09 Hours**

Stress and Strain, Types of stress and strain, Hooke's law, Elastic Moduli, Stress-Strain Curve, Stress hardening and softening. Poisson's ratio and its limiting values. Relation between Y, η and σ (with derivation), Relation between Y, k and σ (with derivation), relation between Y, k and η. Torsional Pendulum. Torsion of a cylinder and determination of couple per unit twist. Introduction to beams. Bending moment and derivation of expression, Cantilever and expression for depression produced and its Applications, Numerical problems.

UNIT-III

LASER — **09 Hours**

Introduction to Laser, Basic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients, Expression for energy density and its significance. Laser Action, Population Inversion, Metastable State, Requisites of a laser system, Nd:YAG LASER, Carbon dioxide LASER, Semiconductor laser, Applications: LIDAR, Road Profiling, Bridge Deflection, Speed Checker., Numerical Problems.

UNIT-IV

Optical Fiber — **09 Hours**

Introduction to optical fibers, Principle and Construction of Optical Fibers, Propagation mechanism in optical fibers - Acceptance angle and Numerical Aperture (NA), Expression for NA, Fractional Index Change, Modes of Propagation and V-Number. Types of optical fibers, Attenuation and Fiber Losses, Point to point Communication, Merits and Demerits of optical Fibers, Applications: Fiber Optic Sensors, Displacement Sensor, Fiber Optic Temperature Sensor, Force sensor, Numerical Problems.

UNIT-V

Acoustics — **09 Hours**

Introduction to Acoustics, Introduction to sound, Velocity, frequency and wavelength of sound, Classification of sound, Characteristics of musical sound, Loudness and Intensity, Weber-Fechner law, Sound intensity level, Sound pressure level, Human audiogram, Units of loudness, Reflection, refraction and diffraction of sound waves, Reverberation and reverberation time, Absorption power and Absorption coefficient, Requisites for acoustics in auditorium, Sabine's formula (derivation), Measurement of absorption coefficient, Factors affecting the acoustics and remedial measures, Sound Insulation and its measurements. Noise and its Measurements, Impact of Noise in Multi-storied

buildings. Numerical problems.

List of Experiments

1.	Spring constant (k) by static and dynamic methods
2.	Effective spring constant of the given springs in series and parallel combinations
3.	Young's modulus of the material of the given bar by single cantilever.
4.	Young's modulus of the material of the given bar by Uniform Bending.
5.	Rigidity modulus of the Material of the wire using Torsional Pendulum.
6.	Diffraction of white light using optical grating.
7.	Determination of wavelength by Laser diffraction.
8.	Numerical Aperture of the given Optical Fiber.
9.	Photo-Diode characteristics
10.	Diffraction Halos - Determination of size of the particles.
11.	Ultrasonic interferometer
12.	LED characteristics and determination of Planck's Constant using LEDs.
13.	Resonance in Sonometer
14.	Simulation experiment

Course Outcomes: At the end of the course students will be able to

1.	Analyze the characteristics of mechanical waves for solving various engineering problems.
2.	Apply the knowledge of elasticity and material failures to explore the applications in various engineering fields.
3.	Apply the knowledge of laser characteristics in civil engineering applications.
4.	Analyze the characteristics of optical fibers in signal propagation and sensing.
5.	Apply the concepts of acoustics in buildings in designing structures.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	PSO↓		
PHY103.1	3	2						2			1			
PHY103.2	3	2						2			1			
PHY103.3	3	2						2			1			
PHY103.4	3	2						2			1			
PHY103.5	3	2						2			1			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	J. C. Upadhyaya, "University Physics-I", Himalaya Publishing House, Mumbai.
2.	A. Ghatak, "Optics", Tata McGraw Hill Pub., 5th edition, 2012.

REFERENCE BOOKS:

1.	A P French, "Vibrations and Waves (MIT introductory Physics Series)", CBS, 2003 Edition.
2.	Timoshenko, S. and Goodier J. N., "Theory of Elasticity", 2nd Edition, McGraw Hill Book Co, 2001.
3.	D. S. Mathur, "Elements of Properties of Matter", S. Chand Publishing.
4.	Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 1997.
5.	Wole Soboyejo, "Mechanical Properties of Engineered Materials", CRC Press, 1st edition, 2002.
6.	Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Education Private Limited, Special Indian Edition, 2009.

7.	M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, "A Textbook of Engineering Physics", S. Chand and Company Limited, New Delhi.
8.	Tor Eric Vigran, "Building Acoustics", Taylor and Francis, 2008 Edition.
9.	B. P. Singh and Devaraj Singh, "Building Science: Lighting and Accoustics", Dhanpat Rai Publications (P) Ltd.,
E Books / MOOCs/ NPTEL/ Web links	
1.	**Simple Harmonic motion:** https://www.youtube.com/watch?v=k2FvSzWeVxQ
2.	**Stress-strain curves:** https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
3.	**Stress curves:** https://www.youtube.com/watch?v=f08Y39UiC-o
4.	**Oscillations and waves:** https://openstax.org › books › college-physics-2e
5.	**Acoustics:** https://www.youtube.com/watch?v=fHBPvMDFyO8
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1.	http://nptel.ac.in
2.	https://swayam.gov.in
3.	https://virtuallabs.merlot.org/vl_physics.html
4.	https://phet.colorado.edu
5.	https://www.myphysicslab.com

WAVE MECHANICS AND OPTOELECTRONICS
(For ECE, EE, ACT and VLSI Branches)

Course Code:	**PHY104**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Physics

Course Objectives:

1.	To understand and apply the concepts of wave mechanics.
2.	To study the properties of conductors and superconductors and their applications.
3.	To identify the fundamental principles of semiconductors for optoelectronic devices.
4.	To understand the concept of dielectric materials and their applications
5.	To understand the principles, construction, and applications of LASERs and Optical fibers.

UNIT-I

Wave Mechanics — **09 Hours**

Introduction to Matter waves and de Broglie Hypothesis, de Broglie wavelength, Phase Velocity and Group Velocity, Relation between the Phase Velocity and Group Velocity, Relation between the Group Velocity and Particle velocity, Physical significance of a wave function, Heisenberg's Uncertainty Principle and application, Schrodinger wave equation (time independent), Eigen functions and Eigen Values, Particle in one dimensional infinite potential well, waveforms and probabilities. Numerical problems.

UNIT-II

Conductors and Superconductors — **09 Hours**

Free-electron concept. Classical free-electron theory – Assumptions, Drift velocity, mean collision time, mean free path and relaxation time, Expression for electrical conductivity in metals (Drude-Lorentz theory), Failures of classical free-electron theory. Quantum free-electron theory – Assumptions, Success of QFET (Specific heat and electrical conductivity), Fermi - Dirac Statistics, Fermi energy and Fermi factor for metals. Numerical problems.

Introduction to superconductors, characteristic properties. Type-I and Type-II superconductors. BCS theory (qualitative). High temperature superconductors, Numerical problems.

UNIT-III

Semiconductors — **09 Hours**

Introduction to semiconductors, intrinsic and extrinsic semiconductors - carrier generation, Direct and indirect band gap semiconductors. Expression for concentration of electrons in conduction band, holes concentration in valance band (only mention the expression), Fermi energy, Fermi level in Intrinsic semiconductor (derivation), Extrinsic Semiconductors and its behaviour with temperature, Electrical conductivity of an intrinsic semiconductor (derivation) and effect of temperature on intrinsic conductivity, Hall effect, Expression for Hall coefficient (derivation) and its application.

p-n junction: Junction formation, Unbiased and biased p-n junction, Devices: LED, Photodiode and solar cell. Numerical problems.

UNIT-IV

Dielectrics — **09 Hours**

Introduction to dielectrics, Dipoles, Polar and non-polar dielectrics, Dielectric constant, Electrical polarization, Polarizability, Electrical Polarization Mechanisms, Electric susceptibility, Internal fields in solids (Qualitative), Clausius-Mossotti equation (Derivation), Dielectric in AC fields - Dielectric loss (Qualitative), Frequency dependence of polarization, Temperature dependence of polarization, Dielectric breakdown, Application of dielectrics. Ferroelectric materials and Piezoelectric materials, properties, and applications, Numerical Problems.

UNIT-V

LASERs and optical fibers — **09 Hours**

Introduction to lasers, Characteristics of LASER, Interaction of radiation with matter, Einstein's coefficients, Requisites of a Laser System. Conditions for LASER action. Principle, Construction and Working of Nd:YAG LASER and semiconductor LASER, Application of Lasers in Bar code scanner

and Laser Printer. Numerical Problems.
Introduction and Principle of Optical Fibers (TIR), Propagation mechanism in optical fibers - Angle of Acceptance and Numerical Aperture N.A.), Expression for NA, Fractional Index Change, Modes of Propagation, Number of Modes and V Number, Types of Optical Fibers, Attenuation, Factors contributing and Mention of Expression for Attenuation coefficient, Point to point communication, Numerical problems.

List of Experiments (Any Ten experiments)

1.	Diffraction of White light using optical Grating.
2.	Wavelength by Laser diffraction.
3.	Numerical aperture of the given Optical Fiber.
4.	Energy gap of semiconductor (any method)
5.	Hall effect
6.	Determination of Fermi Energy of Copper.
7.	Photo electric effect – Determination of the work function of the material of the emitter of a photocell.
8.	Photo-Diode characteristics
9.	Solar cell characteristics
10.	LED characteristics and determination of Planck's Constant using LEDs.
11.	Ferroelectric phase transition in Barium titanate.
12.	Zener diode Characteristics
13.	Transistor Characteristics
14.	Charging and Discharging of a Capacitor.
15.	Simulation experiment

Course Outcomes: At the end of the course students will be able to

1.	Apply the knowledge of quantum mechanics to analyse the physical properties exhibited by particles at sub-atomic level.
2.	Analyze the dynamics of free electrons in metals to interpret the mechanism of electrical conduction.
3.	Analyze the role of semiconductors in electronic devices, exploring the properties of semiconductors.
4.	Apply the knowledge of dielectric materials for engineering applications.
5.	Analyze the properties of optical waves in the phenomena of lasing action and signal propagation.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	PSO↓		
↓ Course Outcomes														
PHY104.1	3	2						2			1			
PHY104.2	3	2						2			1			
PHY104.3	3	2						2			1			
PHY104.4	3	2						2			1			
PHY104.5	3	2						2			1			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Education Private Limited, Special Indian Edition, 2009.
2.	B. G. Streetmann, "Solid State Electronic devices", 6th edition, Prentice Hall India Learning Private Limited.
3.	A. Ghatak, "Optics", Tata McGraw Hill Pub., 5th edition, 2012.

REFERENCE BOOKS:	
1.	A. J. Dekker, "Electrical Engineering Materials", Prentice Hall India Pub., New Delhi, Reprint 2011.
2.	W. A. Wahab, "Solid State Physics, Structure and Properties of Materials", Narosa Publishing House Pvt. Ltd., New Delhi.
3.	Gupta and Kumar, "Solid State Physics", K. Nath & Co., Meerut
4.	M. Ali. Omar, "Elements of Solid-State Physics: Principles and Applications", Pearson Publishers.
5.	S O Kasap, "Principles of electronic materials and device's", 4th edition, McGraw Hill, 2017.
6.	M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, "A Textbook of Engineering Physics", S. Chand and Company Limited, New Delhi.
7.	Kenneth Krane "Modern Physics", Wiley International, 3rd Edition, 2012.
8.	B. P. Pal, "Fundamentals of Fibre Optics in Telecommunication & Sensor Systems", New Age International Publishers
E Books / MOOCs/ NPTEL/ Web links	
1.	Laser: https://www.britannica.com/technology/laser,k
2.	Laser: https://nptel.ac.in/courses/115/102/115102124/
3.	Quantum mechanics: https://nptel.ac.in/courses/115/104/115104096/
4.	Physics: http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
5.	Numerical Aperture of fiber: https://bop-iitk.vlabs.ac.in/exp/numerical-aperture-measurement
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1.	http://nptel.ac.in
2.	https://swayam.gov.in
3.	https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
4.	https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1
5.	https://virtuallabs.merlot.org/vl_physics.html
6.	https://phet.colorado.edu
7.	https://www.myphysicslab.com

PHYSICS OF MATERIALS
(For ME and AE Branches)

Course Code:	**PHY105**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Physics

Course Objectives:

1.	To understand and apply the concepts of oscillations and resonance.
2.	To recognize and implement fundamental concepts in elastic materials.
3.	To understand the principles, construction, and applications of LASERs and Optical fibres.
4.	To study and analyse the concept of thermoelectric materials.
5.	To understand the fundamentals of various characterization techniques.

UNIT-I

Oscillations — **09 Hours**

Introduction to Simple Harmonic motion (SHM), derivation of differential equation for SHM, Free, Damped and Forced oscillations, Theory of damped oscillations (Quantitative), Types of damping (Graphical Approach). Engineering applications of damped oscillations, Theory of forced oscillations (Qualitative), resonance, and sharpness of resonance. Springs: Stiffness Factor and its Physical Significance, series and parallel combination of springs (Derivation), Types of spring and their applications. Numerical Problems.

UNIT-II

Elasticity — **09 Hours**

Stress and Strain, Types of stress and strain, Hooke's law, Elastic Moduli, Stress-Strain Curve, Stress hardening and softening. Poisson's ratio and its limiting values. Relation between Y, η and σ (with derivation), Relation between Y, k and σ (with derivation), relation between Y, k and η. Torsional Pendulum. Torsion of a cylinder and determination of couple per unit twist. Introduction to beams. Bending moment and derivation of expression, Cantilever and expression for depression produced and its Applications, Numerical problems.

UNIT-III

LASERs and Optical fibers — **09 Hours**

Introduction to lasers, Characteristics of LASER, Interaction of radiation with matter, Einstein's coefficients (Qualitative), Requisites of a LASER System. Conditions for Laser action. Principle, Construction and Working of Nd: YAG LASER and Semiconductor LASER, Applications: LASER cutting, welding and drilling. Numerical Problems.

Introduction and Principle of Optical Fibers (TIR), Propagation mechanism in optical fibers - Angle of Acceptance and Numerical Aperture N.A.), Expression for NA, Fractional Index Change, Modes of Propagation and V Number, Types of Optical Fibers, Attenuation, Factors contributing and Mention of Expression for Attenuation coefficient, Numerical problems.

UNIT-IV

Thermoelectric materials — **09 Hours**

Introduction, Seeback effect, Peltier effect, Seeback and Peltier coefficients, Figure of merit (Mention Expression), Thermo emf and thermo current, Expression for thermo emf in terms of temperature, Thermocouple, Thomson effect, EMF in thermocouple, Thermoelectric power, laws of thermoelectricity, Relation between Peltier coefficient and thermoelectric power, Construction and Working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), Applications of thermocouple, Numerical Problems.

UNIT-V

Material Characterization and Instrumentation Techniques — **09 Hours**

X ray diffraction, Bragg's law, Principle, construction and working of X-ray Diffractometer, Crystallite size determination by Scherer equation, Atomic Force Microscopy (AFM): Principle, construction, working and applications, Principle, construction, working and applications of Scanning electron

microscopy (SEM), Transmission electron microscopy (TEM) Difference between SEM and TEM, Numerical Problems.

List of Experiments

1.	Spring constant (k) by static and dynamic methods
2.	Effective spring constant of the given springs in series and parallel combinations
3.	Young's modulus of the material of the given bar by single cantilever.
4.	Young's modulus of the material of the given bar by Uniform Bending
5.	Rigidity modulus of the Material of the wire using Torsional Pendulum.
6.	Study of Peltier effect and See beck effect
7.	Thermo emf - Determination of temperature and sensitivity of thermocouple.
8.	B-H curve – Study of magnetic hysteresis.
9.	LCR series and parallel resonance
10.	Sonometer experiment-To find frequency of AC
11.	Simulation Experiment
12.	Determination of acceptance angle and numerical aperture of the given Optical Fiber.
13.	Determination of wavelength by Laser diffraction.
14.	Diffraction of White light by optical grating

Course Outcomes:

At the end of the course student will be able to

1.	Analyze the characteristics of mechanical waves by solving their equations of motion.
2.	Apply the knowledge of elasticity and material failures to explore the applications in engineering fields.
3.	Analyze the properties of optical waves in the phenomena of lasing action and signal propagation.
4.	Apply the concepts of thermoelectric materials for engineering applications.
5.	Acquire knowledge of various material characterization techniques.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	PSO↓		
PHY105.1	3	2						2			1			
PHY105.2	3	2						2			1			
PHY105.3	3	2						2			1			
PHY105.4	3	2						2			1			
PHY105.5	3	2						2			1			

1: Low 2: Medium 3: High

TEXTBOOKS:

1	J. C. Upadhyaya, "University Physics-I", Himalaya Publishing House, Mumbai.
2	B. G. Streetmann, "Solid State Electronic devices", 6th edition, Prentice Hall India Learning Private Limited.

REFERENCE BOOKS:

1.	A P French, "Vibrations and Waves (MIT introductory Physics Series)", CBS, 2003 Edition.
2.	D. S. Mathur, "Elements of Properties of Matter", S. Chand Publishing.
3.	Timoshenko, S. and Goodier J.N., "Theory of Elasticity", 2nd Edition, McGraw Hill Book Co, 2001.
4.	Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 1997.
5.	Wole Soboyejo, "Mechanical Properties of Engineered Materials", CRC Press, 1st edition, 2002.
6.	Gupta and Kumar, "Solid State Physics", K. Nath & Co., Meerut

7.	W. A. Wahab, "Solid State Physics, Structure and Properties of Materials", Narosa Publishing House Pvt. Ltd., New Delhi.
8.	A. J. Dekker, "Electrical Engineering Materials", Prentice Hall India Pub., New Delhi, Reprint 2011.
9.	M. N. Avadhanulu, P G Kshirsagar and TVS Arun Murthy, "A Textbook of Engineering Physics", S. Chand and Company Limited, New Delhi.
10.	M. Ali. Omar, "Elements of Solid State Physics: Principles and Applications", Pearson Publishers.
11.	Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Education Private Limited, Special Indian Edition, 2009.
12.	V. Raghavan, "Materials Science and Engineering", PHI Pub.,
13.	Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRC Press, First Edition, 2008.
14.	Characterization of Materials- Mitra P K, Prentice Hall India Learning Private Limited.

E Books / MOOCs/ NPTEL/ Web links	
1.	Simple Harmonic motion: https://www.youtube.com/watch?v=k2FvSzWeVxQ
2.	Stress-strain curves: https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
3.	Stress curves: https://www.youtube.com/watch?v=f08Y39UiC-o
4.	Oscillations and waves: https://openstax.org › books › college-physics-2e
5.	Thermoelectricity: https://www.youtube.com/watch?v=2w7NBuu5w9c&list=PLtkeUZItwHK5y6qy1GFxa4Z4RcmzUaaz6
6.	Thermoelectric generator and coolers: https://www.youtube.com/watch?v=NruYdb31xk8
7.	Virtual lab: https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
8.	Material characterization: https://onlinecourses.nptel.ac.in/noc20_mm14/preview https://www.encyclopedia.com/science-and-technology/physics/physics/cryogenics https://www.usna.edu/NAOE/_files/documents/Courses/EN380/Course_Notes/Ch10_Deformation.pdf
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1.	http://nptel.ac.in
2.	https://swayam.gov.in
3.	https://virtuallabs.merlot.org/vl_physics.html
4.	https://phet.colorado.edu
5.	https://www.myphysicslab.com

CHEMISTRY FOR BIOTECHNOLOGY

Course Code:	**CHY101**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T:P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Chemistry

Course Objectives:

1.	To understand the basic components of electrochemical cells and relate their principles to sensors and analytical techniques.
2.	To understand the construction and working mechanism of energy conversion and storage devices such as batteries, fuel cells, and solar PV cells.
3.	To analyze the prime problems faced in boiler feed water and subsequent remedialmeasures undertaken and analyze the quality of water.
4.	To Identify the different types of polymers, their synthetic routes, and applications; identify the methodologies used to analyze as well as improvise on chemical fuels.
5.	To understand the principles of green chemistry and apply them in organic transformations; identify the synthetic approaches undertaken for designing nanomaterials.

UNIT-I

Electrode system and Analytical techniques — **09 Hours**

Electrode System: Introduction, types of electrodes; Reference electrode- introduction, Calomel electrode–construction, working and applications; Concentration cell- definition, construction, working and numerical problems; Ion selective electrode-definition, construction and working of glass electrode, determination of pH using glass electrode; Biosensors- construction, working and applications of biosensors

Analytical techniques: Principle and instrumentation of conductometry, its application in the estimation of strong acid and acid mixture; Principle and instrumentation of potentiometry, its application in the estimation of iron; Colorimetry- Principle, instrumentation and applications in estimation of copper and iron

UNIT-II

Energy Conversion and Storage — **09 Hours**

Batteries: Introduction, classification of batteries, construction, working and applications of Ni-MH and Li-ion battery. **Fuel Cells**: Introduction, construction, working and applications of methanol–oxygen fuel cell. **Flow battery**- Construction, working and applications of Vanadium redox flow battery. **Solar Energy**: Introduction, importance of solar PV cell, construction and working of solar PV cell, advantages and disadvantages

UNIT-III

Water Chemistry — **09 Hours**

Impurities in water; water analysis - determination of hardness, determination of dissolved oxygen by Winkler's method; boiler feed water, and boiler problems – scales and sludges, boiler corrosion; External treatment - hot lime soda process, ion-exchange method; Internal treatment -phosphate conditioning, colloidal conditioning, Calgon conditioning; Desalination of seawater - Electro dialysis and reverse osmosis; BOD and COD – definition and numerical problems; Sewage treatment - Primary, secondary, and tertiary treatments

UNIT-IV

Polymersand Chemical fuels — **09 Hours**

Polymers: Definition,classification based on origin, structure, methods of polymerization, response to heat, and tacticity; free radical mechanism of polymerization of vinyl chloride; Glass transition temperature -definition and factors affecting Gynesis, properties, and applications of PMMA and Polyurethane; Elastomers - Synthesis and applications of butyl rubber and silicone rubber; Adhesives: Synthesis and applications of epoxy resin; Polymer Composites: Introduction, synthesis, properties, and applications of carbon fibre; Conducting polymers-definition, mechanism of conduction in polyacetylene and applications

Chemical Fuels: Introduction, definition, classification of fuels; Calorific value – definition; Gross and Net calorific values; Bomb calorimetric method of determination of calorific value, numerical problems; Diesel knocking and its mechanism, cetane number, synthesis and advantages of biodiesel

UNIT-V

Green chemistry and Nanomaterials | **09 Hours**

Green Chemistry: Introduction, definition,major environmental pollutants;basic principles of green chemistry; various green chemical approaches – microwave synthesis, bio-catalyzed reactions;super critical conditions for solvent free reactions; synthesis of typical organic compounds by conventional and green route i) Adipic acid ii) Paracetamol

Nanomaterials: Introduction, size dependent properties of nanomaterials (surface area, catalytic, conducting); preparation of nanomaterials by sol-gel and co-precipitation method with example;introduction, properties, synthesis, and applications carbon nano tubes

List of Experiments

1.	Determination of strength of an acid in Pb-acid battery.
2.	Determination of Total Hardness of a sample of water using disodium salt of EDTA.
3.	Estimation of iron in TMT bar by diphenylamine/external indicator method.
4.	Conductometric estimation ofacid mixture with standard NaOH solution.
5.	Potentiometric estimation of FAS using standard $K_2Cr_2O_7$solution.
6.	Determination of pKa of vinegar using pH sensor (Glass electrode).
7.	Determination of the viscosity coefficient of a given liquid using Ostwald's viscometer.
8.	Estimation of Copper present in electroplating effluent by optical sensor (colorimetry).
9.	Colorimetric determination of iron.
10.	Estimation of Sodium present in soil/effluent sample using a flame photometer.
11.	Synthesis of biodiesel (Demonstration).
12.	Synthesis of Iron-oxide Nanoparticles (Demonstration).
13.	Synthesis of polyurethane (Demonstration).

Course Outcomes: At the end of the course students will be able to

1.	Identify the terms processes involved in scientific and engineering and applications.
2.	Explain the phenomena of chemistry to describe the methods of engineering processes.
3.	Solve the problems in chemistry that are pertinent in engineering applications.
4.	Apply the basic concepts of chemistry to explain the chemical properties and processes.
5.	Analyze properties and multi processes associated with chemical substances in disciplinary situations.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	PSO↓		
CHY101.1	3	1												
CHY101.2	3	2												
CHY101.3	3	3												
CHY101.4	2	1												
CHY101.5	2	1												

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Engineering Chemistry by P.C. Jain & Monica Jain., Dhan Patrai Publications, New Delhi.2015
2.	A Textbook of Engineering Chemistry, R. V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
3.	A Textbook of Engineering Chemistry, SSDara &Dr. SS Umare, S. Chand & Company Ltd., 12t h Edition, 2011.

REFERENCE BOOKS:

1.	Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013-2nd Edition.
2.	Engineering Chemistry, Satya Prakash &Manisha Agrawal, Khanna Book Publishing, Delhi
3.	Essentials of Physical Chemistry, Bahl & Tuli, S. Chand Publishing

4.	Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
5.	Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing
6.	Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons,4th Edition, 1999.
7.	Nanotechnology A Chemical Approach to Nanomaterials, G.A.Ozin& A.C.Arsenault, RSC Publishing, 2005.
8.	Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, Mc GrawHill,2019.
9.	OLED Display Fundamentals and Applications, TakatoshiTsujimura, Wiley–Blackwell,2012
10.	Super capacitors: Materials, Systems, and Applications, MaxLu, Francois Beguin, ElzbietaFrackowiak, Wiley-VCH;1stedition,2013
11.	Handbook on Electroplating with Manufacture of Electro-chemicals", ASIAPACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda,
12.	Laboratory manual in Engineering Chemistry Sudharani, Dhanpat rai Publishing Company, New Delhi.
13.	Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi:10.17226/4782.
14.	Engineering Chemistry, Edited by Dr.Mahesh B and Dr. Roopa Shree B, SunstarPublisher, Bengaluru, ISBN978-93-85155-70-3, 2022
15.	High Performance Metallic Materials for Cost Sensitive Applications, F.H.Froes,et al. John Wiley & Sons, 2010
16.	Instrumental Methods of Analysis, Dr. K. R. Mahadik and Dr. L. Satyanarayana, Nirali Prakashan, 2020
17.	Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
18.	Polymer Science, VR Gowariker, N V Viswanathan, Jayadev, Sreedhar, NewageInt.Publishers,4th Edition, 2021
19.	Nanostructure materials and nanotechnology, Hari Singh, Nalwa, academicpress,1stEdition,2002.
20.	"EngineeringChemistry",OGPalanna,TataMcGrawHillEducationPvt.Ltd.NewDelhi,FourthReprint, 2015.
E Books / MOOCs/ NPTEL	
1.	http://libgen.rs/ • https://nptel.ac.in/downloads/122101001/
2.	https://nptel.ac.in/courses/104/103/104103019/ • https://ndl.iitkgp.ac.in/.
3.	https://www.youtube.com/watch?v=faESCxAWR9k

CHEMISTRY FOR CIVIL ENGINEERING
(For CV Branch)

Course Code:	**CHY102**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T:P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Chemistry

Course Objectives:

1	To introduce students to various structural materials, including metals, alloys, ceramics, cement, refractories, and glass, and their applications in civil construction
2	To explain the working principles of energy systems such as electrode systems, batteries, and green energy technologies, and their applications in civil engineering
3	To familiarize students with smart materials, polymers, and nanomaterials, emphasizing their properties, synthesis methods, and potential applications in construction and engineering
4	To explore corrosion chemistry and the methods of corrosion control, enabling students to apply corrosion prevention strategies to materials in construction
5	To familiarize students with analytical techniques such as colorimetry, conductometry, and potentiometry, and to enable them to apply these methods in determining material properties

UNIT-I

STRUCTURAL MATERIALS — **09 Hours**

Metals and Alloys: Introduction, properties and application of iron and its alloys; properties and application of aluminum and its alloys **Ceramics:** Introduction; types; properties; application of ceramics in civil construction **Cement:** Introduction; composition; classification; properties; manufacture of Portland cement (wet method); process of setting and hardening of cement; additives for cement (accelerators, retarders, extenders, dispersants); Testing of cement (% of CaO by EDTA method) **Refractories:** Introduction; classification based on chemical composition; properties and application of refractory materials **Glass:** Introduction; composition; types; preparation of soda-lime glass; properties and application of glass in construction

UNIT II

ELECTRODES AND ENERGY SYSTEMS — **09 Hours**

Electrode System: Introduction; types of electrodes; Reference electrode - introduction, Calomel electrode – construction, working, advantages and applications, Ion selective electrode – introduction, Glass electrode - construction, working and advantages of glass electrode, determination of pH using glass electrode, ; Concentration cell – definition, construction, working, and numerical problems; **Batteries:** Introduction; classification of batteries; construction, working and applications of Li-ion battery **Green Energy:** Introduction; construction and working of solar photovoltaic cell, advantages, and disadvantages. Synthesis and properties of biodiesel, hydrogen as green fuel, applications of power alcohol

UNIT-III

CORROSION CHEMISTRY — **09 Hours**

Corrosion Chemistry: Introduction; electrochemical theory of corrosion (taking Fe as example); mechanism of rusting; corrosion types – differential metal corrosion, differential aeration corrosion, pitting corrosion, stress corrosion and caustic embrittlement; boiler corrosion; factors affecting corrosion – primary and secondary factors; corrosion control - selection of metals & design;, cathodic protection - sacrificial anode method and impressed current method; metal coating – galvanization and tinning; organic coating ; anodic protection of metals; role of inhibitors in corrosion control

UNIT IV

POLYMERS — **09 Hours**

Polymers: Introduction; classification based on origin, structure, methods of polymerization, response to heat, tacticity; molecular weight of polymers: number average molecular weight, weight average molecular weight and poly dispersion index (PDI) - numerical problems; Glass transition temperature – definition, significance, factors affecting glass transition temperature **Fibers**: Synthesis, properties and applications of nylon fibers **Adhesives**: Introduction, properties and applications of epoxy resin **Polymer composites**: Introduction, synthesis, properties and applications of Kevlar **Geopolymer concrete**: Introduction,

synthesis, constituents, properties and applications **Biodegradable polymers**: Synthesis of polylactic acid (PLA) and its applications

UNIT V

NANOMATERIALS AND ANALYTICAL TECHNIQUES	**09 Hours**

Nanomaterials: Introduction; classification based on dimension; synthesis of nanomaterials by top-down approach (photolithography) and bottom-up approach (sol-gel method); synthesis (CVD technique), properties and applications of carbon nanotubes **Analytical techniques:** Introduction; types of analytical techniques; Colorimetry – Beer Lambert's law, instrumentation of colorimetry, determination of Cu/Fe by colorimetry; Conductometry - Principle and instrumentation; conductometric titration in the estimation of strong acid and acid mixture; Potentiometry - Principle and instrumentation; estimation of Fe in FAS by potentiometric titration; advantages of analytical techniques

List of Experiments (Any ten)

1	Determination of strength of an acid in Pb-acid battery. (acid base titration)
2	Determination of Total Hardness of a sample of water using disodium salt of EDTA.
3	Estimation of iron in TMT bar by diphenylamine/external indicator method.
4	Estimation of CaO in the cement solution by EDTA method.
5	Determination of COD of waste water.
6	Conductometric estimation of strong acid /weak acid with standard NaOH solution
7	Conductometric estimation of acid mixture with standard NaOH solution.
8	Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution.
9	Determination of pKa of vinegar using pH sensor (Glass electrode).
10	Determination of the viscosity coefficient of a given liquid using Ostwald's viscometer.
11	Estimation of Copper present in electroplating effluent by optical sensor (colorimetry).
12	Colorimetric determination of iron.
13	Estimation of sodium present in soil/effluent sample using a flame photometer.
14	Synthesis of biodiesel (Demonstration).
15	Synthesis of zinc oxide Nanoparticles (Demonstration).
16	Synthesis of polyurethane (Demonstration).

Course Outcomes: At the end of the course students will be able to

1	Differentiate metals, ceramics, cement, and glass based on properties, and relate them to specific civil engineering applications.
2	Apply the principles of batteries, fuel cells, and solar technologies in sustainable civil engineering solutions.
3	Analyze the application of smart materials and corrosion control techniques in enhancing durability of construction materials.
4	Assess mechanical, thermal, and chemical properties of polymers and nanomaterials for their suitability in civil engineering applications.
5	Apply analytical techniques to determine properties like concentration, conductivity, and pH of construction materials.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	PSO↓		
CHY102.1	3	1												
CHY102.2	3	2												
CHY102.3	3	3												
CHY102.4	2	1												
CHY102.5	2	1												

1: Low 2: Medium 3: High

TEXTBOOKS:	
1	Engineering Chemistry by P.C. Jain & Monica Jain., Dhanpat Rai Publications, New Delhi.2015.
2	A Textbook of Engineering Chemistry, R. V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
3	A Textbook of Engineering Chemistry, SS Dara &Dr. SS Umare, S. Chand & Company Ltd., 12th Edition, 2011.
REFERENCE BOOKS:	
1	Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013-2nd Edition.
2	Engineering Chemistry, Satya Prakash &Manisha Agrawal, Khanna Book Publishing, Delhi.
3	Essentials of Physical Chemistry, Bahl & Tuli, S. Chand Publishing.
4	Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley.
5	Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing.
6	Textbook of Polymer Science, F.W. Billmeyer, John Wiley & Sons,4th Edition, 1999.
7	Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
8	Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, Mc GrawHill,2019.
9	OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell,2012
10	Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, Elzbieta Frackowiak, Wiley-VCH;1stedition,2013.
11	Handbook on Electroplating with Manufacture of Electro-chemicals", ASIAPACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda.
12	Laboratory manual in Engineering Chemistry Sudharani, Dhanpat Rai Publishing Company, New Delhi.
13	Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi:10.17226/4782.
14	Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopa Shree B, Sunstar Publisher, Bengaluru, ISBN978-93-85155-70-3, 2022.
15	High-Performance Metallic Materials for Cost-Sensitive Applications, F.H. Froes, et al. John Wiley & Sons, 2010.
16	Instrumental Methods of Analysis, Dr. K. R. Mahadik, and Dr. L. Satyanarayana, Nirali Prakashan, 2020.
17	Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020.
18	Polymer Science, VR Gowariker, N V Viswanathan, Jayadev, Sreedhar, New Age Int. Publishers, 4th Edition, 2021.
19	Nanostructure materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st edition, 2002.
20	"Engineering Chemistry", O. G. Palanna, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
E Books / MOOCs/ NPTEL	
1	http://libgen.rs/ • https://nptel.ac.in/downloads/122101001/
2	https://nptel.ac.in/courses/104/103/104103019/ • https://ndl.iitkgp.ac.in/.
3	https://www.youtube.com/watch?v=faESCxAWR9k

MATERIALS CHEMISTRY AND ENERGY APPLICATIONS
(For ME/AE Branches)

Course Code:	**CHY103**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T:P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Chemistry

Course Learning Objectives:

1	To learn the working and applications of electrodes, batteries, fuel cells, solar cells, and green hydrogen systems
2	To identify corrosion types, prevention methods, and the basics of electroplating and electroless plating
3	To study the types, properties, and uses of polymers, composites, lubricants, and nanomaterials
4	To learn analytical methods (colorimetry, conductometry, potentiometry) and apply phase rule to material systems
5	To understand fuel types, calorific value, engine knocking, and production of biofuels

UNIT-I

ELECTRODES AND ENERGY SYSTEMS — **09 Hours**

Electrode Systems: Introduction; types of electrodes; Reference electrode - introduction, calomel electrode – construction, working, advantages and applications; Ion selective electrode – introduction, Glass electrode - construction, working and advantages of glass electrode, determination of pH using glass electrode, Concentration cell – definition, construction, working, and numerical problems;

Energy Systems: Introduction to batteries; classification of batteries; construction, working and applications of Li-ion battery; Fuel cells – introduction, construction, working and applications of methanol-oxygen fuel cell; Introduction to green energy; construction and working of solar photovoltaic cell, advantages, and disadvantages; production of green hydrogen by water splitting using PEM, advantageous of green hydrogen

UNIT II

CORROSION SCIENCE AND METAL FINISHING — **09 Hours**

Corrosion Science: Introduction; electrochemical theory of corrosion (taking Fe as example); mechanism of rusting, Corrosion types – differential metal corrosion, differential aeration corrosion, pitting corrosion and stress corrosion; factors affecting corrosion – primary and secondary factors, corrosion penetration rate – numerical problems; corrosion control – metal coating (galvanization, tinning), anodization, sacrificial anode method

Metal Finishing: Introduction; technological importance of metal finishing; Electroplating – definition, principle; factors affecting electroplating, electroplating of chromium (hard and decorative) and its applications; Electroless plating – definition, advantages, application of electroless plating of copper in the manufacture of PCB, comparison between electroplating and electroless plating

UNIT-III

POLYMERS AND NANOMATERIALS — **09 Hours**

Polymers: Introduction; classification based on origin, structure, methods of polymerization, response to heat and tacticity; molecular weight of polymers: number average molecular weight, weight average molecular weight and poly dispersion index (PDI) - numerical problems; Glass transition temperature – definition, factors and significance; Moulding – compression, injection and extrusion methods; Elastomers – introduction, vulcanization of rubber, synthesis, properties and applications of silicone rubber; Adhesives – definition, synthesis and applications of epoxy resin; Polymer composites – introduction, synthesis, properties and applications of carbon fiber; Lubricants – introduction, classification, properties and applications of lubricants.

Nanomaterials: Introduction; classification based on dimension; synthesis of nanomaterials by top-down approach (photolithography) and bottom-up approach (sol-gel method); synthesis (CVD technique), properties and applications of carbon nanotubes.

UNIT- IV

METALS, ALLOYS AND PHASE RULE — **09 Hours**

Metals and alloys: Requirements of metals used in engineering applications, classification of metals- ferrous

and nonferrous, properties of metals-mechanical, thermal , electrical and magnetic properties of metals. Properties and applications of ferrous alloys- types of steels: plain carbon steels, and stainless steels, Properties and applications of non-ferrous metals- aluminium, copper, magnesium, titanium, nickel Properties and applications of non-ferrous alloys: brass, bronze, duralumin, Al-Si alloys, Al NiCo.
Phase rule: Gibbs phase rule; significance of terms involved; phase diagram, One-component system- water system, reduced phase rule; Two-component system - Lead-Silver system, separation of silver from argentiferous lead by Pattinson's process

UNIT-V

CHEMICAL FUELS **09 Hours**

Introduction; classification of chemical fuels; calorific value – gross calorific value and net calorific value; Determination of calorific value of a solid/liquid fuel using Bomb Calorimeter – numerical problems; Cracking of fuel – definition, fixed bed catalytic cracking; Reforming of fuel; Knocking – mechanism of knocking in gasoline engine and diesel engine, octane number, cetane number; Biofuels – power alcohol, advantages of power alcohol, production of biodiesel by trans-esterification method, advantages of biodiesel

List of Experiments (Any ten)

1.	Determination of strength of an acid in Pb-acid battery. (acid base titration)
2.	Determination of Total Hardness of a sample of water using disodium salt of EDTA.
3.	Estimation of iron in TMT bar by diphenylamine/external indicator method.
4.	Estimation of CaO in the cement solution by EDTA method.
5.	Determination of COD of waste water.
6.	Conductometric estimation of strong acid /weak acid with standard NaOH solution
7.	Conductometric estimation of acid mixture with standard NaOH solution.
8.	Potentiometric estimation of FAS using standard K2Cr2O7 solution.
9.	Determination of pKa of vinegar using pH sensor (Glass electrode).
10.	Determination of the viscosity coefficient of a given liquid using Ostwald's viscometer.
11.	Estimation of Copper present in electroplating effluent by optical sensor (colorimetry).
12.	Colorimetric determination of iron.
13.	Estimation of sodium present in soil/effluent sample using a flame photometer.
14.	Synthesis of biodiesel (Demonstration).
15.	Synthesis of zinc oxide Nanoparticles (Demonstration).
16.	Synthesis of polyurethane (Demonstration).

Course Outcomes: At the end of the course students will be able to

1	Analyze the working of electrodes, batteries, fuel cells, solar cells, and green hydrogen systems in engineering applications.
2	Apply suitable corrosion prevention methods, including electroplating and electroless plating techniques.
3	Categorize polymers, composites, lubricants, and nanomaterials, and evaluate their properties for engineering applications.
4	Apply analytical techniques like colorimetry, conductometry, and potentiometry to determine material properties, and interpret phase diagrams using the phase rule.
5	Calculate calorific values of different fuels, describe knocking and biofuel production processes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
CHY103.1	3	1													
CHY103.2	3	2													
CHY103.3	3	3													
CHY103.4	2	1													
CHY103.5	2	1													

1: Low 2: Medium 3: High

TEXTBOOKS:	
1	Engineering Chemistry by P.C. Jain & Monica Jain., Dhanpat Rai Publications, New Delhi.2015.
2	A Textbook of Engineering Chemistry, R. V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
3	A Textbook of Engineering Chemistry, SS Dara &Dr. SS Umare, S. Chand & Company Ltd., 12th Edition, 2011.
REFERENCE BOOKS:	
1	Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013-2ndEdition.
2	Engineering Chemistry, Satya Prakash &Manisha Agrawal, Khanna Book Publishing, Delhi.
3	Essentials of Physical Chemistry, Bahl & Tuli, S. Chand Publishing.
4	Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley.
5	Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing.
6	Textbook of Polymer Science, F.W. Billmeyer, John Wiley & Sons,4th Edition, 1999.
7	Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
8	Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, Mc GrawHill,2019.
9	OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell,2012
10	Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, Elzbieta Frackowiak, Wiley-VCH;1stedition,2013.
11	Handbook on Electroplating with Manufacture of Electro-chemicals", ASIAPACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda.
12	Laboratory manual in Engineering Chemistry Sudharani, Dhanpat Rai Publishing Company, New Delhi.
13	Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi:10.17226/4782.
14	Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopa Shree B, Sunstar Publisher, Bengaluru, ISBN978-93-85155-70-3, 2022.
15	High-Performance Metallic Materials for Cost-Sensitive Applications, F.H. Froes, et al. John Wiley & Sons, 2010.
16	Instrumental Methods of Analysis, Dr. K. R. Mahadik, and Dr. L. Satyanarayana, Nirali Prakashan, 2020.
17	Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020.
18	Polymer Science, VR Gowariker, N V Viswanathan, Jayadev, Sreedhar, New Age Int. Publishers, 4th Edition, 2021.

19	Nanostructure materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st edition, 2002.
20	"Engineering Chemistry", O. G. Palanna, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
E Books / MOOCs/ NPTEL	
1	http://libgen.rs/ • https://nptel.ac.in/downloads/122101001/
2	https://nptel.ac.in/courses/104/103/104103019/ • https://ndl.iitkgp.ac.in/.
3	https://www.youtube.com/watch?v=faESCxAWR9k

MATERIALS CHEMISTRY FOR DEVICES AND E-WASTE MANAGEMENT (EE/EC/ACT/VLSI and All IT branches)

Course Code:	**CHY104**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T:P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Chemistry

Course Learning Objectives:

1.	To explain the principles and applications of various electrodes and energy systems, including batteries and solar cells, in sustainable technologies
2.	To explore corrosion mechanisms and control methods, alongside metal finishing processes such as electroplating and electroless plating
3.	To understand the principles and applications of sensors, memory devices, and advanced display systems in modern engineering
4.	To examine the synthesis, properties, and applications of polymers and nanomaterials in engineering
5.	To learn the principles of green chemistry and e-waste management, emphasizing sustainable practices in engineering applications.

UNIT-I

ELECTRODES AND ENERGY SYSTEMS — **09 Hours**

Electrodes: Introduction, types of electrodes; Reference electrode - introduction, Calomel electrode – construction, working, advantages and applications; Concentration cell – definition, construction, working, and numerical problems; Ion selective electrode – introduction, glass electrode - construction, working and advantages of glass electrode, determination of pH using glass electrode, Concentration cell – definition, construction, working, and numerical problems;

Energy Systems: Introduction to batteries; classification of batteries; construction, working and applications of Li-ion battery; Flow battery – introduction, construction, working and applications of vanadium redox flow battery; Construction, working and applications of solar photovoltaic cell, advantages and disadvantages; synthesis of solar grade silicon by union carbide method

UNIT II

CORROSION SCIENCE AND METAL FINISHING — **09 Hours**

Corrosion Science: Introduction; electrochemical theory of corrosion (taking Fe as example), corrosion types – differential metal corrosion, differential aeration corrosion, pitting corrosion; factors affecting corrosion – primary and secondary factors; corrosion penetration rate – numerical problems; corrosion control – metal coating (galvanization and tinning), anodization, sacrificial anode method,

Metal Finishing: Introduction; electroplating – definition, principle, factors affecting electroplating, electroplating of chromium (hard chromium and decorative chromium); electroless plating – definition, advantages, application of electroless plating of copper in the manufacture of PCB; comparison between electroplating and electroless plating

UNIT-III

ANALYTICAL TECHNIUQES, MEMORY DEVICES AND DISPLAY SYSTEMS — **09 Hours**

Analytical technique and sensors: Conductometry- principle, instrumentation, conductometric titration of strong acid and acid mixture; Potentiometry- principle, instrumentation and application of potentiometry in the estimation of iron; determination of pKa of weak acid, Colorimetry- principle (Beer Lambert's law), instrumentation and application in determination of Cu/Fe; **Electrochemical sensors** – introduction, construction and working of electrochemical sensors for detection oxides of sulphur (Industry), diclofenac (medicine); disposable sensors and their advantages

Memory Devices: Introduction; basic concepts of electronic memory; classification of electronic memory devices; types of organic memory devices (organic molecules, polymeric materials, organic-inorganic hybrid materials)

Display Systems: Liquid crystals (LCs) – introduction; classification of LCs and types of mesophases; electro-optic effect; Liquid Crystal Display (LCD) unit – construction and application in numerical display; characteristics, working and applications of organic light emitting diode (OLED) and quantum light emitting diode (QLED)

UNIT IV

POLYMERS AND NANOMATERIALS | **09 Hours**

Polymers: Introduction; classification based on origin, structure, methods of polymerization, response to heat; Molecular weight of polymers: number average molecular weight, weight average molecular weight and poly dispersion index (PDI) - numerical problems;; **Polymer composites** – introduction, synthesis, properties and applications of carbon fiber; **Conducting polymers** – introduction, conducting mechanism of polyacetylene by oxidative and reductive doping, applications of conducting polymers.

Nanomaterials: Introduction; classification based on dimension; catalytic and thermal properties of nanoparticles; synthesis of nanomaterials by top-down approach (photolithography) and bottom-up approach (sol-gel method); synthesis by CVD technique

UNIT-V

E-WASTE MANAGEMENT | **09 Hours**

E-waste management: Introduction; sources of e-waste; composition, characteristics and need of e-waste management; health hazards due to exposure to e-waste; heavy metals present in the E-waste and their ill effect on health and environment. Extraction of metals from e-waste- Pretreatment, Pyrometallurgy- smelting, combustion, incineration and pyrolysis. Hydrometallurgy- Use of different leaching agents in metal extraction, Metal recovery- Use of solvents, adsorption, ion exchange and electrodeposition, extraction of gold and copper from e-waste. . Role of stakeholders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies).

List of Experiments (Any ten)

1.	Determination of strength of an acid in Pb-acid battery.
2.	Determination of Total Hardness of a sample of water using disodium salt of EDTA.
3.	Estimation of iron in TMT bar by diphenylamine/external indicator method.
4.	Conductometric estimation of strong acid/weak acid with standard NaOH solution.
5.	Conductometric estimation of acid mixture with standard NaOH solution.
6.	Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution.
7.	Determination of pKa of vinegar using pH sensor (Glass electrode).
8.	Determination of the viscosity coefficient of a given liquid using Ostwald's viscometer.
9.	Estimation of Copper present in electroplating effluent by optical sensor (colorimetry).
10.	Colorimetric determination of iron.
11.	Estimation of Sodium present in soil/effluent sample using a flame photometer.
12.	Synthesis of biodiesel (Demonstration).
13.	Synthesis of Iron-oxide Nanoparticles (Demonstration).
14.	Synthesis of polyurethane (Demonstration).

Course Outcomes: At the end of the course students will be able to

1	Apply the principles, types, and applications of various electrodes and energy systems, such as batteries and solar cells, in promoting sustainability in engineering
2	Apply corrosion control techniques, including metal finishing methods like electroplating and electroless plating, in real-world engineering contexts.
3	Analyze the principles and evaluate the applications of sensors, memory devices, and display systems in modern engineering technologies.
4	Analyze the synthesis, properties, and practical applications of polymers and nanomaterials in various engineering fields.
5	Apply the principles of green chemistry and assess e-waste management strategies, focusing on sustainability and environmental impact in engineering practices.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	PSO↓		
CHY104.1	3	1												
CHY104.2	3	2												
CHY104.3	3	2												

CHY104.4	2	1												
CHY104.5	2	1												

1: Low 2: Medium 3: High

TEXTBOOKS:	
1	Engineering Chemistry by P.C. Jain & Monica Jain., Dhanpat Rai Publications, New Delhi.2015.
2	A Textbook of Engineering Chemistry, R. V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
3	A Textbook of Engineering Chemistry, SS Dara &Dr. SS Umare, S. Chand & Company Ltd., 12th Edition, 2011.
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1	Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013-2ndEdition.
2	Engineering Chemistry, Satya Prakash &Manisha Agrawal, Khanna Book Publishing, Delhi.
3	Essentials of Physical Chemistry, Bahl & Tuli, S. Chand Publishing.
4	Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley.
5	Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing.
6	Textbook of Polymer Science, F.W. Billmeyer, John Wiley & Sons,4th Edition, 1999.
7	Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
8	Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, Mc GrawHill,2019.
9	OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell,2012
10	Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, Elzbieta Frackowiak, Wiley-VCH;1stedition,2013.
11	Handbook on Electroplating with Manufacture of Electro-chemicals", ASIAPACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda.
12	Laboratory manual in Engineering Chemistry Sudharani, Dhanpat Rai Publishing Company, New Delhi.
13	Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi:10.17226/4782.
14	Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopa Shree B, Sunstar Publisher, Bengaluru, ISBN978-93-85155-70-3, 2022.
15	High-Performance Metallic Materials for Cost-Sensitive Applications, F.H. Froes, et al. John Wiley & Sons, 2010.
16	Instrumental Methods of Analysis, Dr. K. R. Mahadik, and Dr. L. Satyanarayana, Nirali Prakashan, 2020.
17	Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020.
18	Polymer Science, VR Gowariker, N V Viswanathan, Jayadev, Sreedhar, New Age Int. Publishers, 4th Edition, 2021.
19	Nanostructure materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st edition, 2002.
20	"Engineering Chemistry", O. G. Palanna, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
E-Books / MOOCs/ NPTEL	
1	http://libgen.rs/ • https://nptel.ac.in/downloads/122101001/
2	https://nptel.ac.in/courses/104/103/104103019/ • https://ndl.iitkgp.ac.in/.
3	https://www.youtube.com/watch?v=faESCxAWR9k

ENVIRONMENTAL SCIENCE AND SUSTAINABILITY

Course Code:	**CIV104**	**Course Type**	**BSC**
Teaching Hours/Week (L: T: P)	**2:0:0**	**Credits**	**02**
Total Teaching Hours	**30**	**CIE + SEE Marks**	**50+50**
Prerequisite	*		

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to:

1.	To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation
2.	To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters
3.	To facilitate the understanding of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
4.	To familiarize the concept of sustainable development goals.
5.	To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles.

UNIT-I

ENVIRONMENT AND BIODIVERSITY — **06 Hours**

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In- situ and ex-situ.

ENVIRONMENTAL POLLUTION — **06 Hours**

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

RENEWABLE SOURCES OF ENERGY — **06 Hours**

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Bio energy, Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT-II

SUSTAINABILITY AND MANAGEMENT — **06 Hours**

Sustainability- concept, needs and challenges-environmental, social and economic aspects of sustainability- Sustainable Development Goals-targets, indicators and intervention areas-Protocols-Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint, water Foot print Environmental management in industry-A case study

SUSTAINABILITY PRACTICES — **06 Hours**

Zero waste and R concept, Circular economy, LCA standards-ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: green buildings, green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization-Socio- economic and technological change

Course Outcomes: At the end of the course student will be able to

1.	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

2.	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
3.	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
4.	To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
5.	To demonstrate the knowledge of sustainability practices and identify green materials, energy Cycles and the role of sustainable urbanization

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CIV001.1	1	2				2	3	2					1	3	
CIV001.2	1	1	2			2	3	2					1	3	
CIV001.3	2	1				2	3	2					1	3	
CIV001.4	2	1				2	3	2					1	3	
CIV001.5	1	1				2	3	2					1	3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Anubha Kaushik and C. P. Kaushik ‘s ―Perspectives in Environmental Studies‖, 6th Edition, New Age International Publishers ,2018.
2.	Benny Joseph, _Environmental Science and Engineering ‘, Tata McGraw-Hill, New Delhi, 2016.
3.	Gilbert McMasters, _Introduction to Environmental Engineering and Science‘, 2nd edition, Pearson Education, 2004

REFERENCE BOOKS:

1.	R.K. Trivedi, _Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards ‘, Vol. I and II, Enviro Media. 38 Edition 2010.
2.	Cunningham, W.P. Cooper, T.H. Gorhani, _Environmental Encyclopedia‘, Jaico Publ., House, Mumbai, 2001.
3.	Dharmendra S. Sengar, _Environmental law ‘, Prentice Hall of India PVT. LTD, New Delhi, 2007.
4.	Rajagopalan, R, _Environmental Studies-From Crisis to Cure ‘, Oxford University Press, Third Edition, 2015.
5.	Erach Bharucha ―Textbook of Environmental Studies for Undergraduate Courses‖ Orient Blackswan Pvt. Ltd. 2013
6.	R.K. Trivedi, _Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards ‘, Vol. I and II, Enviro Media. 38. Edition 2010.

BIOLOGY FOR ENGINEERS

Course Code:	BTY111	Course Type:	BSC
Teaching Hours/Week (L: T: P)	1:0:0	Credits:	01
Total Teaching Hours	15+0+0	CIE + SEE Marks:	50+50

Teaching Department: Biotechnology

Course Objectives:

1.	To learn the types of cells, biomolecules and life processes
2.	To know the applications inspired by nature in various streams and real-life scenarios.

UNIT-I

INTRODUCTION FOR BIOLOGY FOR ENGINEERS — **05 Hours**

Why Biology for Engineers? Living cell Types & Properties: Prokaryotes - Bacteria, Viruses and Fungi, Eukaryotes - Plant and Animal Cells, Biomolecules, Life Processes at Cellular Level.

UNIT-II

APPLICATIONS INSPIRED BY NATURE & REAL-LIFE SCENARIOS — **10 Hours**

Composites in Construction, Termite Mound architecture, Countercurrent heat exchangers, Design of Aeroplan, helicopter and submarine, Information Theory and Biology, SONAR, Medical Devices. Recent scenarios in Environment, Agriculture and Medical Technology.

Course Outcomes: At the end of the course students will be able to

1.	Ascertain the importance of Biology and understand the basics of cell and life processes
2.	Draw the inspiration from nature in engineering design and visualize the application of biology in recent scenarios

Course Outcomes Mapping with Program Outcomes & PSO

Program outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
BTY111.1	3	3	-	-	-	-	-	-	1	-	-	1
BTY111.2	3	3	-	-	-	-	-	-	1	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Suraishkumar, G.K. *Biology for Engineers*, Oxford University Press India, 2019.
2.	Chakraborty, T, Akthar, N *Biology for Engineers*, PHI learning Print Book ISBN: 9789391818142 eBook ISBN: 9789391818197

REFERENCE BOOKS:

1.	Rao C.V., *Biology for Engineers*, 2021
2.	Raven, P. H. and Johnson, G. B. *Biology*. 4th Ed. WCB publishers, 2010.
3.	Ethier, R. S. and Simmons, C. A. *Introductory biomechanics*- From cells to organisms. Cambridge University Press, 2012

Engineering Science Courses

CELL AND MOLECULAR BIOLOGY

Course Code:	**BTY112**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P)	**3:0:0**	**Credits:**	**03**
Total Teaching Hours	**45+0+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Biotechnology

Course Objectives:

1.	To understand the basics of cells and organelles with their function
2.	To study types of cell communications
3.	To learn the various aspects of DNA replication
4.	To learn the various aspects of prokaryotic and eukaryotic transcription and translation.
5.	To learn the components and the mechanism of gene regulation.

UNIT - I

CELL STRUCTURE — **09 Hours**

Introduction to Cell Biology: Historical aspect of cell biology, Cell Theory, The Diversity and Commonality of Cells. Cytoplasmic matrix, Cell organelles and Functions, Cell Cycle: Division, Regulation and Significance, Microscopy: Optical and Electron (types and general principle) Live cell Imaging

UNIT - II

CELL INTERACTION AND COMMUNICATION — **09 Hours**

Cytoskeleton: Types, Composition and Functions. Cell Interactions: Cell Junctions, Cell-cell adhesion, Interaction of cells and extracellular matrix. Cell Communications: General principles, Cell Signaling Modes, Mechanism of cells sensing their environment.

UNIT - III

REPLICATION — **09 Hours**

Replication of DNA, models of replications in prokaryotes and eukaryotes. Mechanism of DNA replication, RNA-dependent synthesis of RNA and DNA: Reverse transcription (reverse transcriptase), telomerase as specialized reverse transcriptase, DNA damage and repair.

UNIT - IV

TRANSCRIPTION AND TRANSLATION — **09 Hours**

Bacterial RNA polymerase, its structure and function, sigma factor cycle, eukaryotic RNA polymerases. Mechanism of transcription in prokaryotes and eukaryotes. Transcription factors, Genetic codon, and its usage. Mechanism of translation, Differences between prokaryotic and eukaryotic protein synthesis.

UNIT - V

REGULATION OF GENE EXPRESSION — **10 Hours**

Gene regulation, lac Operon model, positive versus negative regulation of gene expression, regulation of eukaryotic gene expression, transcriptional control. Hormonal regulation of gene expression, Steroid receptors; DNA binding motifs in pro- and eukaryotes. Analysis of Gene expression using Molecular Methodology.

Course Outcomes: At the end of the course students will be able to

1.	Understand the basics of cells, organelles, and their division
2.	Ascertain the significance of cell cycle and use of microscopes

3.	Examine the importance of DNA replication
4.	Examine the importance of transcription and translation
5.	Appraise the concept of gene regulation and expression, in eukaryotes and prokaryotes

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**PSO↓**		
												1	**2**	**3**
BTY112.1	1	1	-	-	-	-	-	-	-	-	-	1	-	1
BTY112.2	1	1	-	-	-	-	-	-	-	-	-	1	-	1
BTY112.3	-	2	-	-	-	1	-	-	-	-	-	1	-	3
BTY112.4	-	2	-	-	-	1	-	-	-	-	-	1	-	2
BTY112.5	-	2	-	-	-	-	-	-	-	-	-	1	-	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Alberts, B. et al., Molecular Biology of the Cell, 5th Ed., Garland Sci., 2007.
2.	Freifelder, D. Essentials of Molecular Biology, 2nd Ed., Narosa Book Distributors Pvt. Ltd., 2008.
3.	Gardener, J. Principles of genetics, 8th Ed., Wiley India Pvt Ltd, 2012.
4.	Rastogi, S. C. Cell Biology, 3rd Ed., New Age International, 2005

REFERENCE BOOKS:

1.	Watson, J. D et al., Molecular Biology of the Gene,7th Ed., Pearson Education, 2013.
2.	Lodish, H., Baltimore, D. & Darnell, J. Molecular Cell Biology, 4th Ed., WH Freeman, 2000.
3.	Karp, G. Cell and Molecular Biology-Concepts and Experiments, 6th Ed., John Wiley & Sons Inc., 2010
4.	Ringo, J. Fundamental Genetics, Cambridge University Press, 2004.

ENGINEERING MECHANICS

Course Code:	**CIV111**	**Course Type**	**ESC**
Teaching Hours/Week (L: T:P)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**45**	**CIE + SEE Marks**	**50+50**
Prerequisite	**-**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Develop** the analytical skills to solve coplanar concurrent force system
2.	**Solve** non – concurrent force system and **analyze** cylinders and strings using equilibrium conditions.
3.	**Identify** different types of supports, loadings and **analyze** determinate beams
4.	**Analyze** plane truss, block and ladder friction
5.	**Understand** centroid and moment of inertia of regular geometrical areas

UNIT-I

Fundamentals of Force Systems — **09 Hours**

Engineering mechanics: basic idealizations, definition of force, characteristics of a force, classification of force system, principle of transmissibility.

Resultant of coplanar concurrent force system: resolution of a force, composition of forces, resultant and equilibrant, resultant of coplanar concurrent force system, numerical examples.

UNIT-II

Moments, Couples, and Equilibrium of Rigid Bodies — **09 Hours**

Resultant of Coplanar non-concurrent force system: Moment of a force, couple, characteristics of couple, Equivalent force - couple system; Varignon's theorem, resultant of coplanar non-concurrent force system, numerical examples, numerical examples.

Equilibrium of rigid bodies: Definition, conditions of equilibrium for coplanar concurrent force system, concept of free body diagram, equilibrium of coplanar concurrent force system, numerical examples.

UNIT-III

Support Reactions and Beam Analysis — **09 Hours**

Support Reactions: Types of beams, loads, and supports, support reactions for statically determinate beams with point load (normal and inclined), uniformly distributed load (UDL), uniformly varying loads (UVL), and moments, numerical examples.

Analysis of determinate beams using excel (self study).

UNIT-IV

Analysis of Trusses and Friction — **09 Hours**

Analysis of Trusses: Introduction, Classification of trusses, analysis of plane perfect trusses by the method of joints, numerical examples.

Friction: Theory of friction, types of friction, Coulomb's laws of friction, limiting friction, angle of friction, block friction and ladder friction, numerical examples.

UNIT-V

Centroid and Moment of Inertia of Plane Areas — **09 Hours**

Centroid: Centroid of plane areas, locating the centroid of rectangular, triangular and circular areas using method of integration, centroid of simple composite areas, numerical examples.

Moment of Inertia: Moment of inertia of an area, polar moment of inertia, radius of gyration, perpendicular axis theorem and parallel axis theorem; moment of inertia of rectangular, triangular, and circular areas from the method of integration, numerical examples.

Course Outcomes: At the end of the course student will be able to

1.	**Solve** resultant of coplanar concurrent force system.
2.	**Determine** the resultant of coplanar non-concurrent force system by **applying** Varignon's Theorem and **solve** for unknown forces in the cylinders and strings using equilibrium conditions.
3.	**Explain** the types of beams, supports, loadings and **find** the support reactions for

	determinate beams.
4.	**Find** the forces in the members of the truss using method of joints and to **find** the static frictional force in block and ladder
5.	**Determine** the centroid and moment of inertia of regular geometrical areas about the reference axes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CIV111.1	**3**	**2**											**1**	**1**	
CIV111.2	**3**	**2**											**1**	**1**	
CIV111.3	**3**	**2**											**1**	**1**	
CIV111.4	**3**	**2**											**1**	**1**	
CIV111.5	**3**	**2**											**1**	**1**	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Ferdinand L. Singer "*Engineering Mechanics*" Harper and Row Publishers, New York, 3rd edition,2015.
2.	Bhavikatti,S.S, *"Engineering Mechanics"*, Vikas Publishing House Pvt. Ltd., New Delhi. 17th edition,2018

REFERENCE BOOKS:

1.	Ferdinand P. Beer and E. Russel Johnson, "*Mechanics for Engineers: Statics and dynamics*" McGraw-Hill Book Company, New York.4th edition,1987.
2.	Timoshenko,Young,J.V Rao and S.Patil inS.I Units "*Engineering Mechanics"* McGraw-Hill Book Company, New Delhi.5th edition,2013
3.	Merium J.L, Kraige L.G, *Engineering Mechanics* Vol.I & II Wiley Publishers.1993
4.	McLEAN and Nelson,"*Engineering Mechanics"*(Schaum's outline Series), McGraw-Hill Book Company, New Delhi, 5th edition, 1997

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/112/106/112106286/
2.	http://nptel.vtu.ac.in/econtent/courses/BS/CIV1323/index.php
3.	https://lecturenotes.in/notes/15363-note-for-element-of-civil-engineering-and-mechanics-ecem-by-vtu-rangers

PROBLEM SOLVING THROUGH PROGRAMMING

Course Code:	**CSE103**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**45+0+30**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Any

Course Objectives:

Make students learn the basics of C programming language including the basic data types, Operators and Evaluating expressions in C.
Apply the concepts of decision making and looping in problem solving to demonstrate its usage using simple programs.
Design and implement efficient C programs using arrays and strings to manage and manipulate data effectively.
Demonstrate the usage of Pointers and User-defined functions, code reusability in problem solving along with parameter passing and returning with the help of user defined functions.
Demonstrate the usage of structures and File handling that are essential for understanding the concepts with simple examples.

UNIT-I

Introduction To Computer and C language, Operators and Expressions: **09 Hours**

Introduction to computers: Introduction to Computer System and problem solving, Program Development steps, Introduction to Programming Languages, input and output devices, Algorithm, Flowchart, Designing efficient programs. Evolution & Characteristics of C Language, Structure of a C Program, C Compilation Model. Characters set, C tokens, Keywords and identifiers, Constants, Variables, Data Types, and Declaration of Variables. Formatted and Unformatted Input/Output :Formatted I/O: printf() ,scanf() ,Unformatted I/O: getchar(), putchar() ,gets() and puts(), Command line arguments.

Operators and Expressions: Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment, Decrement operators, Conditional(Ternary) operator, Bitwise operators, Special Operators. Arithmetic expressions, Evaluation of expressions, Precedence of operators, Type conversions in expressions, Operator precedence and associativity.

UNIT-II

Decision control and Looping statements: **09 Hours**

Decision making and Branching: Decision making with if statement, Simple if Statement, the if...else statement, Nesting of if...else statements, The else...if ladder, The switch statement.

Decision making and Looping: The for statement, the while statement, the do...while statement**,** Jump statements (goto, break, continue).

UNIT-III

Arrays and Strings: **09 Hours**

Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions, Multidimensional arrays-Two dimensional arrays, operations on two-dimensional arrays, two-dimensional arrays to functions, Example Programs on arrays: linear search, binary search, selection sort, bubble sort.

Strings: Declaring and Initializing strings, String manipulation functions, String input and output
functions.

UNIT-IV

Pointers, Functions: **09 Hours**

Introduction to pointers: declaration and initialization of pointers, accessing the address of the

variable, accessing the variable through the pointer.
Functions: Introduction using functions, Function definition, function declaration, function call, return statement, passing parameters to functions-call by value, call by reference, storage classes, scope of variables, recursive functions, Example Programs on Functions.

UNIT-V

Structures, Files:	**09 Hours**

Structures: Defining Structure, Declaration of Structure Variable, Accessing Structure members, copying and comparing structure variable, operation on individual member, nesting of structures, Array of structures. Application of pointers and function on Structures.
Files: Basic file operations: Open, Close, Read, Write.

List of Experiments

Part-A

1.	Write a C program to find the roots of a quadratic equation $ax^2+bx+c=0$.
2.	Write a C program to find the sum of all the digits and occurrence of a digit in the number.
3.	Write a C program to find the GCD and LCM of given two numbers using Euclid‘s method.
4.	Write a C program to print the prime numbers in a given range.
5.	Write a C program to perform a binary search for a given key integer in a single dimensional array of numbers in ascending order and report success or failure in the form of a suitable message.
6.	The books in the library are randomly placed on the shelves. Design a C program that sorts the books based on ISBN ,Use bubble sort to implement the program.
7.	Write a C program to find if a given string is a palindrome or not using string manipulation functions.
8.	An event registration system takes inputs from the command line: Participant Name, Age, and Event Name. Write a C program to display the details.

Part-B

1.	Design, develop and execute a program in C to read two matrices A(M x N) and B(p x q) and compute the product of A and B.
2.	Write a C program using functions readmat( ), rowsum ( ), colsum ( ), totsum ( ) and printmat( ) to read the values into a two dimensional array A, find the sum of all the elements of a row, sum of all the elements of a column, find the total sum of all the elements of the two dimensional array A and print the results.
3.	Write a C program to input N integer numbers into a single-dimensional array, sort them into ascending order using selection sort technique, and then to print both the given array and the sorted array with suitable headings.
4.	Write a C program to read N integers into an array A and find the sum of elements using pointers.
5.	Write a C program to perform a linear search for a given key integer in a single-dimensional array of numbers and report success or failure in the form of a suitable message using functions.
6.	Write a C program to enter the information like name, register number, marks in 6 subjects of N students into an array of structures, and find the average & display grade based on average for each student.
7.	A college department wants to store and retrieve student names and marks for an internal audit. Write a C program that saves the data to a file named students.txt and then reads and displays the contents to verify the information.
8.	Design a C program that accepts two numerical values and an arithmetic operator (+, -, *, /) as command-line arguments. The program should compute and display the result of the specified operation.

Course Outcomes: At the end of the course student will be able to:

1	**Describe** the basics of computer systems, basics of C and the process of problem-solving aspects using algorithmic solutions for a given problem.
2	**Apply** the knowledge to develop the C program using control statements such as branching and looping constructs for a given problem.
3	**Demonstrate** the ability to implement and analyze operations on arrays and strings to solve computational problems.
4	**Apply** the concept of pointers along with code reusability, parameter passing, and return values to develop efficient and maintainable C programs using functions.
5	**Implement** and **demonstrate** the use of structures and file handling mechanisms in C programs.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	PSO↓ 1	PSO↓ 2
CSE103.1	2	1	-	-	-	-	-	1	-	-	-	1	3
CSE103.2	3	2	1	-	-	-	-	1	-	-	-	1	3
CSE103.3	3	2	1	-	-	-	-	1	-	-	-	1	3
CSE103.4	3	2	1	-	-	-	-	1	-	-	-	1	3
CSE103.5	3	2	1	-	-	-	–	1	-	-	-	1	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1	E. Balaguruswamy, Programming in ANSI C,Tata McGraw Hill, 8th edition, 2019/ E. Balaguruswamy, Programming in ANSI C,Tata McGraw Hill, 9th edition, 2024(available in Amazon).
2	Byron Gottfried, Programming with C, Shaums outlines series, 4th edition, 2018.
3	Computer fundamentals and programming in C, Reema Thareja, Oxford University, 3rd edition, 2023.

REFERENCE BOOKS:

1	Yashwant Kanetkar, Let Us C, 17th edition, BPB Publications, New Delhi, 2018.
2	Rajiv Khanna, Computer Concepts and C Programming, New Age International Pvt Ltd Publishers, 2nd edition, 2011.
3	Kernighan & Ritchie, —The C Programming (ANSI C)‖, Prentice Hall; 2nd edition, 1998.

E Books / MOOCs/ NPTEL

1	http://www.lysator.liu.se/c/bwk-tutor.html#introduction
2	C programming Tutorial by Mark Burgers http://markburgess.org/CTutorial/C-Tut-4.02.pdf
3	http://nptel.ac.in/courses/106105085/4

IT SKILLS

Course Code:	**CSE121**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P)	**0:0:2**	**Credits:**	**01**
Total Teaching Hours:	**0+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Any Dept.

Course Objectives:

1.	Demonstrate the basics of Android Programming.
2.	Design and develop effective static web pages.
3.	Describe the basic concepts of Cloud.
4.	Analyze data using Microsoft Excel.
5.	Create interactive gaming applications through Scratch coding.

Suggested List of Experiments

1	**Design and create simple game using MIT-scratch/Code.org** • Design and create a catch game using MIT scratch coding. • Design and create a Jumping game using MIT scratch coding. • Design and create pong game using MIT scratch coding.
2	**Design and create simple android applications using MIT app inventor.** • Create an application to display a "Hello, World!" message on screen. Application should also display the current time and date. • Implement an application to change the background colour and image of the screen. • Create a simple calculator which can perform basic arithmetic operations like addition, subtraction, multiplication, or division depending upon the user input. • Build a bouncing ball app or make a ball bounce around on the screen (on a Canvas). • Write an application to send SMS using MIT app inventor and also implement a text-to-speech application by passing text from the user.
3	**HTML and CSS** HTML: Basic Tags - paragraph, headings, Hyperlinks, image, tables, HTML forms.
4	HTML Lists: Unordered Lists, Ordered Lists and Definition list.
5	Create a form for a survey on the topic of your choice. Include a variety of answer options, including text fields, dropdowns, radio buttons, checkboxes, and a submit button. Use CSS to improve the look of your form.
6	Design and create web page for a travel book /recipe book with more than 3 pages, add table to list places /recipes (iframe, hyperlink)
7	**Create user account and demonstrate use of Google drive, Google docs, Google Form.** • Upload and share any files and folders in google drive using different file permissions. • Creation of google forms for applications such as a registration form, feedback form,quiz etc. • Creation of google docs with citation from websites.
8	**Data Analysis using Microsoft Excel.** • Basic Excel Formulas: Concatenate(),Len(),Days(), Net workdays(), Count(), Counta(), If(), Iferror(), Find(), Search(),Left(), Right() and Rank(). • Conditional Math: Learn to use SUMIF(), SUMIFS(), AVERAGE(), AVERAGEIF(), AVERAGEIFS(), COUNTIF(), COUNTIFS() to add cells only when certain conditions are met.

	• VLOOKUP with Approximate or Exact Match: Learn to use VLOOKUP to find an approximate or exact match and return the corresponding value, work with INDEX, MATCH, and HLOOKUP as alternatives to the VLOOKUP function. • Conditional Formatting: Apply the different rules to the values of the cell in sheets to carry out the analysis of data. • Optimizing Data: Sorting, Filtering, Excel PivotTables • Data Validation: Use Data Validation to ensure that users enter valid data in input cells, o restrict users' ability to enter invalid data in cells by providing them with a drop-down list of valid options. • Data Visualization in Excel-Charts by generating various types of charts.

Course Outcomes: At the end of the course student will be able to

1.	Develop Applications using Scratch Coding, android programming and design attractive and effective Static Web pages.
2.	Analyze the basic concepts of Cloud and utilize Microsoft Excel to conduct data analysis.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
CS121.1	3	2	2	-	2	-	-	-	-	-	-	-	-	-	2
CS121.2	3	2	1	-	2	-	-	-	-	-	-	-	-	-	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Suman M, Chinmaya Dash, R Sreenivas Rao "Digital Fluency", Himalaya Publishing House Pvt. Ltd., 2021.
2.	MelwynAmrithraj, Prem Sagar, Pradeep, "Digital Fluency", Himalaya Publishing House Pvt. Ltd., 2021.
3.	R G Saha, Dr. Kantesha S, Niha Asif, "Digital Fluency", Himalaya Publishing House Pvt. Ltd., 2021.

REFERENCE BOOKS:

1.	Randy Connolly and Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India.

E Books / MOOCs/ NPTEL

1.	https://www.sas.com/en_in/insights/analytics/machine-learning.html
2.	https://www.aig.com/IoT
3.	14 Types of Phishing Attacks That IT Administrators Should Watch For (syscloud.com)
4.	6 Common Phishing Attacks and How to Protect Against Them (tripwire.com)
5.	Important Applications of Cloud Computing (jigsawacademy.com)
6.	Phishing Attack Prevention: How to Identify & Avoid Phishing Scams in 2021 | Digital GuardianIT Security FAQ (udel.edu)

APPLIED DIGITAL LOGIC DESIGN

Course Code:	**ECE101**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T:P)	**2:0:2:0**	**Credits:**	**3**
Total Teaching Hours:	**30+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Electronics and Communication Engineering

Course Objectives:

1	To enable students to understand and simulate fundamental concepts of digital electronics including number systems, binary arithmetic, logic gates, and Boolean algebra.
2	To introduce methods for simplifying Boolean expressions and verifying them through simulation using basic logic gates.
3	To equip students with the knowledge and simulation skills to analyze and design combinational logic circuits.
4	To provide students with an understanding of flip-flops and their simulation for sequential circuit behavior.
5	To enable students to apply flip-flops in the design and simulation of sequential circuits such as shift registers and counters.

UNIT-I

Fundamentals of Digital Design — **06 Hours**

Difference between Analog and Digital Signals, Number Systems: Decimal, Binary, Octal and Hexadecimal. Binary Addition and Subtraction, Digital Logic Gates, Boolean Algebra, Boolean Functions: Canonical Forms, Completely and Incompletely Specified Functions

UNIT-II

Simplification of Boolean expressions — **06 Hours**

Simplification of Boolean Functions using Boolean Algebra, Karnaugh Maps, Quine-McCluskey (up to four variables), Realization of Boolean functions using Basic Gates

UNIT-III

Combinational Logic Circuits — **06 Hours**

Introduction to Combinational Logic Circuits, Half/Full Adders/Subtractors, Parallel Adders/Subtractors, Binary Comparators, Decoders, Encoders, Multiplexers.

UNIT-IV

Sequential Logic Circuits — **06 Hours**

Basic Bistable Element, SR Flip-Flop, D Flip Flop, JK Flip Flop, T Flip Flop, Master Slave JK Flip Flop, Characteristic Equations, Conversion of Flip Flops.

UNIT-V

Applications of Flip Flops — **06 Hours**

Design of Shift Register using D- flip flop, Design of Counters: Asynchronous counters using T-flip flop, Synchronous Counters using D-flip flop and T Flip Flop.

List of Experiments
(Use this section wherever applicable, else delete this section)

1.	Introduction to Simulation tool
2.	Simulation of Basic Logic Gates and Binary Arithmetic Operations
3.	Simulation and Verification of Simplified Boolean Functions using K-Map and Logic Gates
4.	Simulation and verification of a Half Adder and Full adder
5.	Simulation and verification of a Half subtractor and Full subtractor
6.	Simulation and verification of a Binary Adder and Multiplexer Circuit
7.	Simulation and verification of D,T,SR and JK Flip-Flops
8.	Simulation of Flip-Flops and Conversion Between Flip-Flop Types
9.	Simulation of 4-bit Shift Register and Asynchronous Counters
10.	Simulation of 4-bit Shift Register and Synchronous Counters

Course Outcomes: At the end of the course student will be able to:

1	Demonstrate binary operations, convert between number systems, and simulate basic digital logic circuits using Boolean functions.
2	Simplify Boolean functions using Boolean algebra, Karnaugh maps, and the Quine-McCluskey method, and simulate the implementation using basic logic gates.
3	Design and simulate combinational circuits such as adders, subtractors, comparators, decoders, encoders, and

	multiplexers.
4	Describe, simulate, and analyze various flip-flops, perform conversions, and determine their characteristic equations.
5	Design and simulate shift registers and both asynchronous and synchronous counters using appropriate flip-flops.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	PSO↓ 1	PSO↓ 2
ECE101.1	3	2	2		3							3	2
ECE101.2	3	2	3		3							3	2
ECE101.3	3	2	3		3							3	3
ECE101.4	3	2	2		3							3	2
ECE101.5	3	2	3		3							3	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Digital Principles and Design ,Donald D. Givone ,McGraw Hill, ,2002

REFERENCE BOOKS:

1	Digital Design, Morris Mano,Prentice Hall of India, 3rd Edition
2	Digital Logic Applications and Design ,John M Yarbrough ,Thomson Learning,2001
3	D. P. Kothari and J. S Dhillon,Pearson,2016
4	Fundamentals of Logic Design, Charles H Roth, Cengage Learning

E Books / MOOCs/ NPTEL

1	https://nptel.ac.in/courses/117106086

BASIC ELECTRONICS

Course Code:	ECE111	Course Type:	ESC
Teaching Hours/Week (L: T:P)	3:0:0	Credits:	3
Total Teaching Hours:	45	CIE + SEE Marks:	50+50

Teaching Department: Electronics and Communication Engineering

Course Objectives:

1	Familiarize the student with Semiconductor devices like Diodes with simple applications such as Rectifiers.
2	Familiarize the student with Semiconductor devices like Transistors with simple applications such as switch and amplifier circuits.
3	Analyze the working of simple electronic circuits involving Op-amps and Linear Regulator ICs.
4	Understand the concepts of feedback and analyze Feedback amplifier and Oscillator circuits.
5	Explore the fundamentals of Modern communication and Embedded Systems.

UNIT-I

Diodes and their Applications — **09 Hours**

Semiconductor Diode, Diode Equivalent circuits, Half Wave Rectifier, Full wave Bridge Rectifier, capacitor filter circuit (only qualitative approach). Zener Diode and its use in Voltage Regulation.

UNIT-II

Transistors and their Applications — **09 Hours**

Bipolar Junction Transistor: (npn only) Construction and operation, Common Emitter Characteristics, CE- RC coupled amplifier (frequency response excluded), BJT as a switch.Field Effect Transistor: Construction, Drain and Transfer Characteristics of n-channel Enhancement mode MOSFET, CMOS Inverter.

UNIT-III

Op-Amp & Linear IC Applications — **09 Hours**

Introduction, Op-Amp Specifications, Differential & Common-Mode operation, Op-Amp applications: Inverting/Non- Inverting Amplifier, Inverting Summer, Integrator, Differentiator, Comparator.78XX series IC Voltage Regulators.

UNIT-IV

Feedback and Oscillator Circuits — **09 Hours**

Feedback– Principle and advantages of negative feedback, Voltage series feedback amplifier, Concept of positive feedback, Op-Amp Oscillators – RC phase shift, Hartley and Colpitts's Oscillator.

UNIT-V

Fundamentals of Communication and Embedded Systems — **09 Hours**

Modern communication system scheme (Block scheme), Information source, Input Transducers, Transmitter, Channels, Receivers, Noise, Fundamentals of Cellular communication. Embedded system definition, Elements of Embedded systems, Core of Embedded systems, Microprocessor v/s Microcontroller, Sensors and Actuators with Examples.

Course Outcomes: At the end of the course student will be able to:

1	Design diode-based circuits and voltage regulators
2	Analyze the operation of transistors and CMOS inverters
3	Apply operational amplifiers in analog signal processing
4	Evaluate the effects of feedback and oscillator circuits
5	Describe the components of modern communication and embedded systems

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	PSO↓ 1	PSO↓ 2
ECE111.1	3	2	1								1	2	
ECE111.2	3	2	1					1				2	
ECE111.3	3	2	1									2	

ECE111.4	3	2	1		1						1	2	
ECE111.5	3	2	1									2	

1: Low 2: Medium 3: High

TEXTBOOKS:	
1	"Electronic Devices and Circuits" David A. Bell,PHI,5th, 2014
2	"Electronic Devices and Circuit Theory"Robert L. Boylestad, Louis Nashelsky, Pearson,11th Edition, 2016.
3	"Op-Amps and Linear Integrated Circuits", Ramakanth A Gayakwad, Pearson, 4th Edition, 2016.
4	"Introduction to Analog and Digital Communications "Simon Haykin, Wiley Publishers,2nd Edition, 2019.
5	Wireless Communications: Principles and Practice", Theodore Rappaport, Pearson, 2nd Edition, 2016.
6	"Introduction to Embedded Systems", Shibu K V,TATA Mc Graw Hill Edu,2nd Edition, 2016.
REFERENCE BOOKS:	
1	Electronic Devices"Thomas L Floyd,Pearson,9th , 2012
2	D P Kothari, I J Nagrath,.Mc Graw Hill,2nd, 2018
E Books / MOOCs/ NPTEL	
1	https://nptel.ac.in/courses/117107095
2	https://nptel.ac.in/courses/117103063
3	https://www.coursera.org/learn/electronics/syllabus
4	https://www.coursera.org/learn/diode-pn-junction-metal-semiconductor-contact specialization=semiconductor-devices
5	https://www.coursera.org/learn/transistor-field-effect-transistor-bipolarjunction-transistor specialization=semiconductor-devices

ELECTRICAL CIRCUIT ANALYSIS-I			
Course Code	**EEE101**	**Credits**	**3**
Hours/Week (L :T:P)	**3:0:0**	**CIE Marks**	**50**
Total Hours	**45**	**SEE Marks**	**50**
Exam Hours	**3**	**Course Type**	**ESC**

PREREQUISITE:

Course Objectives

1.	To familiarise the basic laws and its applications to analyse the electrical circuits.
2.	To analyse the response of electrical circuits with DC input.
3.	To analyse the response of electrical circuits with sinusoidal AC input.
4.	To explain the concept of resonance in electrical circuits.
5.	To understand the concept of electromagnetism and its relevance in electrical machines.

Course Contents

UNIT – 1	**9 Hours**

Network reduction techniques

Introduction to DC circuits, series circuits, parallel circuits, series-parallel circuits, star/delta transformation, source transformation.

UNIT – 2	**9 Hours**

Analysis of DC circuits

Analysis of DC multi loop circuit for both independent and dependent sources: mesh, node, super mesh and super node.

UNIT – 3	**9 Hours**

Analysis of AC circuits

Instantaneous value, RMS values, Average value, Form factor, Peak factor (sine and square waveform).
Analysis of R, L, C, RL, RC and RLC series circuits.

UNIT – 4	**9 Hours**

AC multiloop circuit analysis

Analysis of AC multi loop circuit for both independent and dependent sources: mesh, super mesh(restricted to 2 loops only) node, super node (restricted to 2 nodes only).

Resonance

Series and parallel circuit, half power frequencies, Q factor, bandwidth.

UNIT – 5	**9 Hours**

Concept of magnetic circuits

Statically induced emf (Self and Mutually induced emf) (transformer concepts), Dynamically induced emf (DC generator, motor concepts).

Coupled circuits

Coefficient of coupling, dot convention for coupled coils and analysis of simple coupled circuits.

Course Outcomes

At the end of the course student will be able to

1.	Analyse the DC Circuits using network reduction techniques.
2.	Analyse the DC Circuits using mesh and nodal techniques.
3.	Understand the AC electrical circuit concepts and analyse the AC electrical circuits.
4.	Analyse the AC Circuits with /without variable frequency source.
5.	Understand the electromagnetic concepts and apply them in analysis of electrical machines.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11

EEE101.1	3	2					1	1			
EEE101.2	3	2					1	1			
EEE101.3	3	2					1	1			
EEE101.4	3	2					1	1			
EEE101.5	3	2					1	1			

1: Low 2: Medium 3: High

TEXTBOOKS

Sl. No	Textbook Title	Author /s	Publisher	Edition / Year of publication
1.	Electrical Technology	Edward Hughes	Pearson Education	10th edition 2010.
2.	Electric circuits	A. Chakrabarthi	Dhanpath Rai and company	6th edition 2014.
3.	Engineering Circuit Analysis	W.H. Hayt and J.E Kemmerley	McGraw Hill	8th edition 2014.

REFERENCE BOOKS

Sl. No	Textbook Title	Author /s	Publisher	Edition / Year of publication
1.	Electrical Engineering Fundamentals	Vincent Del Toro	Pearson	2nd edition, 2015.
2.	Electrical Technology	H. Cotton,	CBS publishers	7th edition, 2005.
3.	Basic Electrical Engineering	A. Mittle and V. N. Mittle	Tata McGraw Hill	2005.

ELEMENTS OF ELECTRICAL ENGINEERING			
Course Code	**EEE102**	**Credits**	**3**
Hours/Week (L :T:P)	**3:0:0**	**CIE Marks**	**50**
Total Hours	**45**	**SEE Marks**	**50**
Exam Hours	**3**	**Course Type**	**ESC**
PREREQUISITE:	**NIL**		
Course Objectives			
1.	To understand fundamental electrical laws and apply graph theory to analyze electrical circuits.		
2.	To analyze single-phase AC circuits and calculate power and power factor.		
3.	To understand conventional and non-conventional power generation and basics of power transmission.		
4.	To explain power distribution systems and principles of DC-DC converters.		
5.	To understand the fundamentals of electrical machines, protection devices and power supply systems		
Course Contents			
UNIT – 1			**9 Hours**
Graph Theory in Electrical Circuits			
Ohm's law, Kirchhoff Laws (KVL, KCL). Graph Representation: Nodes, Branches, Linear graph of a network, Tie set and Cut-set Matrix, Incidence Matrix, Analysis of resistive network using cut-set and tie-set			
UNIT – 2			**9 Hours**
Analysis of AC Circuits			
Instantaneous values, RMS values, Average values, Form factor, Peak factor. Single-phase AC Circuits: R, L, C, RL, RC, RLC Circuits, Power Factor, Power			
UNIT - 3			**9 Hours**
Introduction to Power System			
Energy Sources (Conventional -Hydro, Nuclear, Thermal, Hydroelectric power plants & Non-conventional- Solar, Wind, Tidal), Basic power plant components, Voltage levels in generation Transmission System Overview (HVAC & HVDC), Transmission Voltage Levels (Low, Medium, High, Extra High Voltage)			
Overview of Power Distribution			
Primary & Secondary Distribution, Distribution Voltage Levels (415V, 230V)			
UNIT - 4			**9 Hours**
Introduction to DC-DC Conversion			
Working principle and application of Buck Converter, Boost Converter, Uninterruptible Power Supply (UPS)- Block Diagram & Working			
Electric Vehicles (EV)			
Fundamentals, Block diagram of EV and its components, Motors used in EV			
UNIT - 5			**9 Hours**
Overview of Electrical Machines, Protective Devices			
Magnetic Circuits Concepts, dot convention, Transformers -Working Principle, Types, Applications Electrical Machines: DC Motor, Stepper Motor - working principle and applications Protective devices-Fuse, MCB Earthing – Necessity, Types, Ground and neutral concept			
At the end of the course student will be able to			
1.	Analyze resistive electrical circuits using graph theory and Kirchhoff laws.		

2.	Solve single-phase AC circuits and evaluate power quantities.
3.	Identify and differentiate among various energy sources and explain the structure of the power system.
4.	Explain the working of DC-DC converters and components used in Electric Vehicle.
5.	Describe the working principles of transformers, electrical machines, protective devices.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11
EEE102.1	3	2					1	1			
EEE102.2	3	2					1	1			
EEE102.3	3	2					1	1			
EEE102.4	3	2					1	1			
EEE102.5	3	2					1	1			

1: Low 2: Medium 3: High

TEXTBOOKS

Sl. No	Textbook Title	Author /s	Publisher	Edition / Year of publication
1.	Electrical Technology	Hughes Edward	Pearson Education Publications	10th edition, 2010.
2.	Electrical Power Systems	C.L. Wadhwa	New Age International	7th edition, 2016
3.	Power Electronics: Circuits, Devices and Applications	Muhammad H. Rashid	Pearson Education	4thedition, 2017

REFERENCE BOOKS

Sl. No	Textbook Title	Author /s	Publisher	Edition / Year of publication
1.	Basic Electrical Engineering	D.P. Kothari and I.J. Nagrath	McGraw Hill Education	4th edition, 2019
2.	500 Solutions of Problems in Electrical Engineering Part I	Parker Smith	CBS	2003

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING			
Course Code	**EEE103**	**Credits**	**3**
Hours/Week (L :T:P)	**3:0:0**	**CIE Marks**	**50**
Total Hours	**45**	**SEE Marks**	**50**
Exam Hours	**3**	**Course Type**	**ESC**

PREREQUISITE:

Course Objectives

1.	To get familiarized with the DC circuit analysis.
2.	To understand the working principle of transformers and electrical machines.
3.	To understand the working of Semiconductor Diodes, Zener Diodes and its applications.
4.	To understand the construction, working and characteristics of BJT and MOSFET
5.	To understand the working of Op-Amp and their applications

Course Contents

UNIT – 1 — **9 Hours**

Circuit Fundamentals

Basic nodal and mesh analysis excited by independent DC voltage sources, Power and Energy. Generation of sinusoidal voltage, frequency, average value, root mean square value, form factor and peak factor of generated voltage , phasor representation of alternating quantities.
Analysis of R, L, C, RL, RC and RLC series circuits, Real power, reactive power, apparent power and power factor.

UNIT – 2 — **9 Hours**

Transformers and Electrical machines

Transformers: Necessity of transformers, principle of operation, Types and construction of single-phase transformers, EMF equation, losses and efficiency.
DC Motor: Principle of operation, back emf and its significance, Torque equation characteristics and speed control (armature & field) of DC shunt motor.
Three-phase induction Motor: Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor.

UNIT - 3 — **9 Hours**

Diodes, Transistors and their applications

Semiconductor Diode, Diode equivalent circuits, Half Wave Rectifier, Full Wave Bridge Rectifier. Zener Diode and its use in voltage regulation.

UNIT - 4 — **9 Hours**

Transistors

Construction and operation, BJT as a switch, Working and Characteristics of n-channel Enhancement type MOSFET, Common source amplifier, DC load line analysis, MOS Inverter.

UNIT - 5 — **9 Hours**

Op-Amp and Linear IC Applications

Introduction, Op-Amp Specifications, Differential & Common-Mode operation, Op-Amp applications:
Inverting/Non-Inverting Amplifier, Summing, Integrator, Differentiator, Comparator, 555 Timer IC in Astable mode, 78XX series IC Voltage Regulators.

Course Outcomes

At the end of the course student will be able to

1.	Analyse DC and AC electrical circuits to determine the circuit parameters
2.	Describe the construction, operating principle of Transformers, DC motors and Induction motors to study the performance characteristics.
3.	Analyse the characteristics of p-n junction diode and Zener diode to understand their operation in specific applications
4.	Describe the construction and operation of BJT and FET to operate as a switch
5.	Describe the working principles of Op-Amp and signal processing circuits.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11
EEE103.1	3	2					1	1			
EEE103.2	3	2					1	1			
EEE103.3	3	2					1	1			
EEE103.4	3	2					1	1			
EEE103.5	3	2					1	1			

1: Low 2: Medium 3: High

TEXTBOOKS

Sl. No	Textbook Title	Author /s	Publisher	Edition / Year of publication
1.	Electrical Technology	Hughes Edward	Pearson Education Publications	10th edition, 2010.
2.	Electronic Devices and circuit theory	Boylestad Robert L, Nashelsky Louis	PHI	11th edition, 2016.

REFERENCE BOOKS

Sl. No	Textbook Title	Author /s	Publisher	Edition / Year of publication
1.	Electrical Technology	H. Cotton,	CBS publishers	7th edition, 2005
2.	Operational Amplifier and Linear IC's	David A Bell	Oxford University	3rd edition, 2011

COMPUTER AIDED ENGINEERING GRAPHICS

Course Code:	**MEC101**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P)	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**30+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1. To impart and inculcate understanding of the theory of projection and concepts like dimensioning, conventions and projection of points and lines in different quadrants of projection system. To know and understand the projection of different plane surfaces.
2. To impart the knowledge on understanding and drawing of different solid objects in different positions.
3. To draw the orthographic views of the simple machine parts. To draw isometric projection of solid objects individually or in combination

UNIT-I	**10 Hours**

Introduction

Introduction Computer Aided Engineering Graphics, BIS conventions, Types of lines, Dimensioning, Geometrical constructions, Introduction to software.

Orthographic Projection: Planes of Projection, First angle projection, reference line. Conventions employed for drawing

Projection of points: Points located in first, second, third and fourth quadrants.

Projection of Lines (First angle projection only): True and apparent lengths, true and apparent inclinations.

Projection of Plane surfaces (First angle projection only)	**11 Hours**
Projection of polygons like Triangle, Square, Rectangle, Pentagon, Hexagon & Circle	

UNIT-II	**12Hours**

Projection of Solids (First angle projection only)

Projection of right regular solids: Prisms, Pyramids, cone, Cylinder in different positions

UNIT-III	**12Hours**

Isometric projection

Isometric scale, Isometric projection of combination (only two) of solids like cube, regular prism, pyramids, cone, cylinder, frustums of pyramid & cone, sphere and simple machine components

Conventional Pictorial View into Orthographic Views

Recognizing circle, arc of circle, curved surfaces, square, rectangular surfaces, plane surfaces inclined to the direction of Views, rib etc.

Course Outcomes: At the end of the course student will be able to

- Gain proficiency in interpreting technical drawings and symbols used in Engineering and apply the theoretical concept of orthographic projection to solve problems involving points in all four quadrants, lines and plane surfaces in first quadrant.
- Apply principle of orthographic projection to create accurate representation of solid objects.
- Acquire the skill required to interpret technical drawing and create precise Isometric projection and orthographic views...

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	PSO↓	
↓ Course Outcomes												1	1
MEC101.1	3	1	0	0	0	0	0	1	1	0	2	2	1
MEC101.2	3	1	0	0	3	0	0	1	1	0	2	2	1
MEC101.3	3	1	0	0	3	0	0	1	1	0	2	2	1
MEC101.4	3	1	0	0	3	0	0	1	1	0	2	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Engineering Drawing by N. D. Bhat & V. M. Panchal, Pramod R. Ingle, 53 Ed., Charotar Publishing House, Gujarat, 2014.
2. Engineering Drawing by K R Gopalakrishna, Subhas publishers, Bangalore, 32nd edition, 2012.

REFERENCE BOOKS

1. A Text book of Engineering Graphics and Drafting by P. S. GILL, 11th Ed.2009, S. K. Kataria & sons, ISBN- 8185749612, 9788185749617, New Delhi.
2. A Text book of Engineering Drawing by K. L. Narayanan & Kannaiah P, Radiant Publishing House, 9th Edition, 2012.
3. A Primer on computer aided Engineering Drawing, Published by VTU, Belgaum, 8thedition, 2011.
4. Engineering Drawing and Computer Graphics, Shah, Pearson, 2010.
5. Textbook on Engineering Drawing, Narayana, SciTech Publishers, 1 December 2011
6. Engineering Graphics, Agarwal & Agarwal, TMH, Second edition, 2013
7. Publications of Bureau of Indian Standards
   a) IS 10711 – 2001: Technical products documentation – Size and lay out of drawing sheets.
   b) IS 9609 (Parts 0 & 1) – 2001: Technical products documentation – Lettering.
   c) IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
   d) IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
   e) IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

ELEMENTS OF MECHANICAL ENGINEERING			
Course Code:	**MEC112**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P)	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**45**	**CIE + SEE Marks:**	**50+50**
Teaching Department: Mechanical Engineering			

Course Objectives:

Students belonging to all branches of Engineering are made to learn certain fundamental topics related to mechanical engineering so that they will have a minimum understanding of mechanical systems, equipment and processes.

1. Understand the principles of energy sources, formation of steam and boilers.
2. Know the working principles of pumps, compressors, and turbines.
3. Understand basic principles of I. C. Engines, Future mobility and Refrigeration, Air-Conditioning.
4. Understand the basic principles of power transmission and metal joining processes.
5. Understand the different machining operations, automation, and robotics.

UNIT-I — **09 Hours**

Introduction to Mechanical Engineering (Overview only):
Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors. Biomaterials, Biomedical applications, implants, Additive manufacturing.

Heat Transfer & Steam Formation
Definition, Modes of heat transfer with examples, Laws of Thermodynamics, Steam Formation and its applications.

Energy Sources and Power Plants:
Energy sources Types, Basic working principles of Hydel power plant, Thermal power plant, nuclear power plant, Solar power plant, Tidal power plant and Wind power plant.

UNIT-II — **09 Hours**

Pumps and compressors: Introduction, Working principles of Centrifugal Pump and Single Stage Reciprocating Compressor.

Turbines: Working principles of Impulse and Reaction steam turbines (De Laval and Parson's turbines), Water turbines (Pelton wheel, Kaplan, and Francis turbines), Gas turbines (Open and Closed cycles).

UNIT-III — **09 Hours**

Introduction to IC Engines: Components and working principles, 4-Stroke Petrol and Diesel engines, Application of IC Engines, performance of IC engines (Simple numericals).

Insight into future mobility technology; Electric and Hybrid Vehicles, Components of Electric and Hybrid Vehicles. Advantages and disadvantages of Electric Vehicles (EVs) and Hybrid vehicles.

Introduction to Refrigeration and Air Conditioning: Principle of refrigeration, Refrigerants and their desirable properties. Working principle of VCR refrigeration system, working principle of room air conditioner & Applications of air Conditioners

UNIT-IV — **09 Hours**

Mechanical Power Transmission & Metal Joining Processes:

Gear Drives: Types - spur, helical, bevel, worm and rack and pinion, velocity ratio, simple and compound gear trains (simple numerical problems)

Belt Drives: Introduction, Types of belt drives (Flat and V-Belt Drive, Timing belts), length of the belt and tensions ratio (No derivations, simple numerical problems).

Joining Processes: Soldering, Brazing and Welding, Definitions, classification of welding process, Arc welding, Gas welding, (types of flames), TIG welding, MIG welding and Fusion welding.

UNIT-V	09 Hours

Machine Tool Operations:

Lathe: Principle of working of a center lathe, lathe operations: Turning, facing, knurling, thread cutting, taper turning by swiveling the compound rest,

Drilling Machine: Working of simple drilling machine, drilling operations: drilling, boring, reaming, tapping, counter sinking, counter boring,

Milling Machine: Working and types of milling machine, milling operations: plane milling, end milling and slot milling.

(No sketches of machine tools, sketches to be used only for explaining the operations).

Mechatronics and Automation: Meaning, Need for automation, Types - Fixed, Programmable & Flexible automation. Elements of automated systems, Open and Closed loop control systems, Introduction to CNC machines.

Robotics: Introduction, Robot Anatomy, Classification based on Robot Configuration, Applications of Robots.

Course Outcomes: At the end of the course student will be able to

- Explain the principles of energy sources, formation of steam and Energy sources.
- Discuss the working principles of pumps, compressors, and turbines.
- Explain basic principles of I. C. Engines, Future mobility and Refrigeration, Air-Conditioning.
- Discuss the basic principles of power transmission and metal joining processes.
- Explain the different machining operations, automation, and robotics.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	PSO→ 1	PSO→ 2
MEC112.1	3	1	-	-	-	1	1	-	1	-	-	-	-
MEC112.2	3	1	-	-	-	-	-	-	1	-	-	-	-
MEC112.3	3	2	-	-	-	-	-	-	1	-	-	-	-
MEC112.4	3	2	-	-	-	-	-	-	1	-	-	-	-
MEC112.5	3	2	-	-	-	-	1	1	1	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. K.R.Gopalkrishna, "A text Book of Elements of Mechanical Engineering" Subhash Publishers, Bangalore, 2010

2. Mikell P. Groover, "Automation, Production Systems & CIM", 3rd Edition, PHI, 2012

3. V.K. Manglik, "Elements of Mechanical Engineering", PHI Publications, 2013.

REFERENCE BOOKS

1. S. Trymbaka Murthy, "A Text Book of Elements of Mechanical Engineering", 4th Edition 2006, Universities Press (India) Pvt. Ltd, Hyderabad.

2. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt Ltd, Mumbai,7th Edition,2012.

3. Pravin Kumar, "Basic Mechanical Engineering", 2013 Edition, Pearson.

E Books / MOOCs/ NPTEL
1. https://nidm.gov.in/iec.asp (Study material of National Institute of Disaster management)

ENGINEERING SKILL DEVELOPMENT PRACTICE			
Course Code:	**MEC121**	**Course Type**	**ESC**
Teaching Hours/Week (L: T: P)	**0:0:2**	**Credits**	**01**
Total Teaching Hours	**30**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:
After the completion of the course, the students will be able to

1.	Explain the concept of laser cutting and RC Airplanes and Sheet metal works. Prepare small models and using the above concepts.
2.	Discuss the IoT and the components of IoT systems and conduct simple experiments using IoT kit.

UNIT-I

14 Hours

Introduction to Laser Cutting: Working principle, safety precautions.
- Material Compatibility: MDF and acrylic.
- Design & Software: Basics of vector graphics using Inkscape or AutoCAD.
- Machine Operation: Setting power, speed, and focus; file preparation.

Experiments:

- Basic Shape Cutting – Cutting simple geometric shapes on MDF and acrylic.
- Engraving on Acrylic – Engraving text and patterns with different power settings.
- Press-Fit Assembly – Designing and assembling interlocking components.
- Slot and Tab Design – Fabricating structures using precise slot-and-tab joints.
- Gear Cutting & Mechanical Fit – Cutting gears and testing their fitment in mechanical assemblies.
- Clapper Box Assembly – Cutting and assembling parts for a clapper box mechanism.
- Multi-Layered Laser Cutting – Creating stacked designs using MDF and acrylic.
- Material Property Study – Comparing laser-cutting effects on MDF and acrylic at different power settings.

UAV model

- Assembly of Fixed wing Radio controlled UAV models – assembling of propellers, Electronic Speed Controllers (ESC), Batteries, servos and receivers fixed at different locations of the UAV model with the transmitters. Demonstration of motion of control surfaces.
- Soldering and sheet metal exercises (with 1 simple sheet metal model) and 1 electrical wiring exercise

UNIT-II

16 Hours

Topics:
Basics of IoT: Sensors, actuators, microcontrollers (Arduino/Raspberry Pi).
Circuit Design: Breadboarding, resistors, LEDs, and power supply.
Sensor Data Acquisition: Temperature, humidity, motion sensors.
Wireless Communication: Wi-Fi, Bluetooth, and cloud integration.
Experiments:

- LED Blinking with Microcontroller – Basic programming for on/off control.
- Temperature & Humidity Monitoring – Using a DHT11 sensor and displaying data on an LCD.
- Motion Detection Alarm – Integrating a PIR sensor with a buzzer.

IoT-Based Remote Control – Controlling a DC motor via a smartphone app

Course Outcomes

At the end of the course student will be able to

1.	Explain the concept of laser cutting and RC Airplanes and Sheet metal works. Prepare small models and using the above concepts.
2.	Discuss the IoT and the components of IoT systems and conduct simple experiments using IoT kit.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**PSO↓** **1**	**PSO↓** **2**
MEC121.1	**3**	**2**			**3**							**3**	**3**
MEC121.2	**3**	**2**			**3**							**3**	**3**

1: Low 2: Medium 3: High

TEXTBOOKS:

1	K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, **"Elements of Mechanical Engineering"**, Media Promoters & Publishers Pvt Ltd, Mumbai,7thEdition,2012.
2	Introduction to IoT Sudip Misra, Anandarup Mukherjee, Arijit Roy, 2022. First Edition, Cambridge University Press. ISBN-13 978-1108959742
3	The Laser Cutter Handbook: A guide to machine set up, operation, servicing and maintenance, ASIN : B09BVXMFW4,
4	Handbook of Unmanned Aerial Vehicles. Kimon P. Valavanis • George J. Vachtsevanos Editors, Springer Science+Business Media Dordrecht 2015

ENGINEERING VISUALIZATION

Course Code:	**MEC122**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P)	**0:0:2**	**Credits:**	**1**
Total Teaching Hours:	**30**	**CIE + SEE Marks:**	**50+00**

Teaching Department: Mechanical Engineering

Course Objectives:

1. To impart and inculcate understanding of the concept of orthographic projection and projection of plane surfaces and solids in different position in first angle projection system.
2. To draw the orthographic views of the simple machine parts and to draw the isometric projection of simple solids.

UNIT-I	**03 Hours**
Chapter 1: Orthographic Projection: Introduction to orthographic projection, Quadrants, principal planes, principal views, Difference between First angle and third angle projection, Dimensioning, Conventions employed for drawing. Projection of points and projection of lines(First quadrant only)	
	09 Hours
Chapter 2: Projection of plane surface: Triangle, Square, Rectangle, Pentagon, & Hexagon in simple position (Resting on HP with inclination to HP and VP, true length with true inclination only-No Beta angle)	
UNIT-II	**12 Hours**
Chapter 3: Projection of Solids: Prisms and Pyramids in simple position (Resting on HP with inclination to HP and VP, true length with true inclination only)	
UNIT-III	**03 Hours**
Chapter 5: Isometric projection: Isometric scale, Isometric dimensions, to draw Isometric views of simple solids and machine components using their orthographic projections.	
Chapter 6: Pictorial View into Orthographic Views: Orthographic projection (First angle projection) of simple machine components using their pictorial view.	**03 Hours**

Course Outcomes: At the end of the course student will be able to

- Draw the orthographic projections of a plane for a given position using Solid Edge software.
- Draw the orthographic projections of a solids and simple machine parts for a given position using Solid Edge software.
- Draw the orthographic views of the simple machine parts. Draw isometric projection of solid objects individually or in combination using Solid Edge software.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	**PSO↓** 1	2
MEC122.1	3	1	-	-	-	-	-	-	1	1	-	2	1
MEC122.2	3	1	-	-	-	-	-	-	1	1	-	2	1
MEC122.3	3	1	-	-	-	-	-	-	1	1	-	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Engineering Drawing by N. D. Bhat & V. M. Panchal, Pramod R. Ingle, 53 Ed. 2014, Charotar Publishing House, Gujarat.
2. Engineering Drawing by K R Gopalakrishna, Subhas publishers, Bangalore , 32nd edition, 2012.

REFERENCE BOOKS

1. A Primer on computer aided Engineering Drawing, Published by VTU, Belgaum, 8thedition, 2011.
2. Engineering Drawing and Computer Graphics, Shah, Pearson, 2010
3. Engineering Graphics, Agarwal & Agarwal, TMH, Second edition, 2013
4. A Text book of Engineering Graphics And Drafting by P. S. GILL, 11th Ed.2009, S. K. Kataria & sons, ISBN- 8185749612, 9788185749617, New Delhi.

Humanities, Social Sciences and Management Courses

CONSTITUTION OF INDIA & GLOBAL CITIZENSHIP			
Course Code	**HSS101**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T:P)	**1:0:0**	**Credits**	**01**
Total Teaching Hours	**15+0+0**	**CIE + SEE Marks**	**50 + 00**

Teaching Department: Humanities

Course Objectives:

1.	To Understand the Obligations, Responsibilities, Privileges and Rights, Duties and the Role that they have to play in deciding the Administrative Machinery of the nation as citizens.
2.	To empower learners to become aware of and understand global issues and to become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies.

UNIT - I

Evolution of the Indian Constitution	**05 Hours**

Cabinet Mission Plan of 1946 – Partition Plan of 1947 and Indian Independence Act 1947, Constituent Assembly and Committees – Drafting, Enactment and Enforcement of Indian Constitution, Basic structure of Indian Constitution, Salient Features of Indian Constitution, Fundamental Rights, Fundamental Duties.

Separation of Powers (Organs of the Constitution)	**03 Hours**

Executive: Union and State
Legislature: Union and State
Indian Judicial System

UNIT - II

Structure of Government	**04 Hours**

Union: Prime Minister, Council of Ministers
State: Chief Minister, Council of Ministers
Local Self-Governance: Panchayat Raj Institutions, Urban Governance

Global Citizenship	**03 Hours**

Meaning of Global Citizenship – '*VasudhaivaKutumbakam*, Types of Global Citizenship, Globalization and Interconnectedness, Characteristics/Attributes of a Global Citizen, Rights of Global Citizenship, Responsibilities of a Global Citizen, Ethical Dimensions and Sustainability practices.

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

1.	Analyze the legalities and related issues of Indian Constitution as a fundamental law of the nation and the rights and duties of Indian Citizen.
2.	Become a responsible citizen being interconnected; has knowledge about his/her role in the community, State and the country; has a role in making the world a better place to live by applying critical thinking and ethical reasoning.

UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS

Course Code	**HSS102**	**Course Type**	**HSMC**
Teaching Hours/Week (L:T:P)	**2:0:0**	**Credits**	**02**
Total Teaching Hours	**30+0+0**	**CIE + SEE Marks**	**50 + 50**

Teaching Department: Any

Course Objectives:

1	To enable the students to appreciate the 'values', "Skills' and 'Behaviour' with an appropriate understanding of the 'self' to attain sustained happiness and prosperity with right aspirations of life
2	To develop a holistic perspective among the students towards physical needs and prosperity of life
3	To develop a holistic approach and understanding the importance of co-existence and living in harmony ensuring mutually fulfilling interaction with society and nature

UNIT - I

10 Hours

Self-exploration – Content and Process; Natural Acceptance and Empirical Validation
Continuous Happiness and Prosperity – Understanding basic human aspirations; Mindfulness and awareness of right aspirations
Right Understanding, Relationships and Physical Facilities – Requirements for the fulfillment of aspirations with correct priority - Happiness and Prosperity

UNIT - II

10 Hours

Understanding Harmony in the 'Human being' and Harmony in 'Self' – Human being as a co-existence of sentient 'I' (Self) and 'Body'; Body as an instrument

UNIT - III

10 Hours

Understanding Harmony in Family and Society – Harmony in Human Relationships; Universal harmonious order in Family, Society and Universe (Journey from Family to World Family); Personal and Professional Ethics;
Understanding Harmony in Nature and Existence – Existence as 'Co-existence'; Holistic Perception of Harmony at all levels of existence

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

1.	have better self-exploration and understanding with a capacity to identify the priorities of life
2.	Generate sustainable solutions to problems with focus on human values and value-based living
3.	Understand and practice living in harmony, co-existence and natural acceptance at all levels
4.	Be ethically upright in their personal and professional practices

Programming Language Courses

INTRODUCTION TO C PROGRAMMING

Course Code:	**CSE101**	**Course Type:**	**PLC**
Teaching Hours/Week (L: T: P)	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**30+0+30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Make students learn the basics of C programming language including the basic data types, Operators and Evaluating expressions in C.
2.	Apply the concepts of decision making and looping in problem solving to demonstrate its usage using simple programs.
3.	Apply the concepts of Arrays, User-defined functions and code reusability in problem solving along with parameter passing and returning with the help of user defined functions.
4.	Demonstrate the usage of Strings and Structures
5.	Demonstrate the usage of Pointers, and File handling that are essential for understanding the concepts with simple examples.

UNIT-I

Introduction To C Programming Language	**12 Hours**
Basic C DataTypes, operators, Operator precedence, Arithmetic expressions and type conversion.	
Decision Making and Branching:	
Decision making with if statement, Nesting of if…else statements, ternary operator, the switch statement, the go to statement, break and continue statements.,	
Decision Making and Looping:	
The while statement, the do…while statement, the for statement, Jumps in Loops.	

UNIT-II

Arrays	**12 Hours**
Arrays (1-D, 2-D) Initialization and Declaration.	
User-Defined Functions	
Argument Passing – call by value, call by reference, Category of Functions. Managing Command line arguments Examples: Linear Search, Binary Search, Bubble sort, Selection Sort, Trace and Transpose, Matrix Multiplication.	
Strings	
Declaring and Initializing strings, String manipulation functions.	

UNIT-III

Structures	**06 Hours**
Structures and Unions: Usage and nesting, Array of Structures	
Pointers and File Handling:	
Accessing of variables using Pointers, array of pointers Basic file operations: Open, Close, Read, Write, Append and concatenate	

Suggested List of Experiments

PART A

1.	Write a C program to find the roots of a quadratic equation $ax^2+bx+c=0$
2.	Write a C program to find the sum of all the digits and occurrence of a digit in the number.

3.	Write a C program to find the GCD and LCM of given two numbers using Euclid's method.
4.	Write a C program to print the prime numbers in a given range.
5.	Write a C program to find if a given string is a palindrome or not using string manipulation functions.
6.	Write a C program to input N real numbers in 1-D array. Compute mean, variance and Standard Deviation. [Mean= sum/N, Variance = Σ (Xi-mean) 2 /N, STD Deviation= √variance.]
7.	Write a C program to read N integers into an array A and find the sum of elements using pointers.
8.	Write a C program to copy contents of one file to another file.
PART B	
1.	Write a C program to perform a binary search for a given key integer in a single dimensional array of numbers in ascending order and report success or failure in the form of a suitable message.
2.	Write a C program to input N integer numbers into a single dimension array, sort them in to ascending order using selection sort technique, and then to print both the given array and the sorted array with suitable headings.
3.	Write a C program to transpose a matrix of order M x N and find the trace of the resultant matrix.
4.	Write a C program using functions to read two matrices A (M x N) and B (P x Q) and to compute the product of A and B if the matrices are compatible for multiplication.
5.	Write a C program using functions readmat( ), rowsum ( ), colsum ( ), totsum ( ) and printmat( ) to read the values into a two dimensional array A, find the sum of all the elements of a row, sum of all the elements of a column, find the total sum of all the elements of the two dimensional array A and print the results.
6.	Write a C program to perform a linear search for a given key integer in a single dimensional array of numbers and report success or failure in the form of a suitable message using functions.
7.	Write a C program to enter the information like name, register number, marks in 6 subjects of N students into an array of structures, and find the average & display grade based on average for each student.
8.	Write a C program, to implement a bubble sort technique using function to sort given N integers in ascending/ descending order as per user's preference.
9.	Write a program to demonstrate the use of pointers and files.
Course Outcomes: At the end of the course student will be able to	
1.	Describe the basics of C and the process of problem-solving aspects using algorithmic solution for a given problem. Apply the knowledge of expression solving to evaluate simple expressions and input/output statements to develop a C program.
2.	Develop the C program using control statements such as branching and looping constructs for a given problem.
3.	Apply the knowledge of code re-usability, parameter passing and returning values to develop a maintainable C program using these concepts including arrays and functions.
4.	Identify and describe the use of strings in a C program.

Average	**Grade**
80-100	Distinction
60-79	First Class
40-59	Second Class
<40	Fail

5.	Develop the C program using structures in C

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓** 1	2	3
CS101.1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CS101.2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CS101.3	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CS101.4	2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CS101.5	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	E. Balaguruswamy, "Programming in ANSI C", Tata McGraw Hill, 3rd Edition, 2004.
2.	Jacqueline A. Jones & Keith Harrow, "C Programming with Problem Solving", Pearson,

REFERENCE BOOKS:

1	Kernighan & Ritchie, "The C Programming (ANSI C)", Prentice Hall; 2ndEdition, 1998.
2	Rajiv Khanna, "Computer Concepts and C Programming", New Age International Pvt Ltd Publishers, 1st Edition, 2006.
3	Yashwant Kanetkar, "Let Us C", 5th Edition, BPB Publications, New Delhi, 2004.

E Books / MOOCs/ NPTEL:

1	http://www.lysator.liu.se/c/bwk-tutor.html#introduction
2	http://www.acm.uiuc.edu/webmonkeys/book/c_guide/
3	C programming Tutorial by Mark Burgers http://markburgess.org/CTutorial/C-Tut-4.02.pdf
4	http://nptel.ac.in/courses/106105085/4
5	https://www.lynda.com/C-training-tutorials/1249-0.html

INTRODUCTION TO PYTHON PROGRAMMING

Course Code:	**CSE102**	**Course Type:**	**PLC**
Teaching Hours/Week (L: T: P)	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**30+0+30**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Information Science and Engineering

Course Objectives:

1	Understand basic Python programming constructs.
2	Develop modular programs using Python functions.
3	Utilize Python data structures.
4	Perform file operations and apply object-oriented programming.
5	Handle exceptions and visualize data.

UNIT-I

Introduction to Python Programming — **6 Hours**

Python Concepts: Introduction to Python, Variables, Keywords, Identifiers, Literals, Comments, Operators
Control and Looping statements: if, if-else, elif, nested if, for, while, break, continue, pass

UNIT-II

Functions and Modular Programming — **6 Hours**

Design with functions: Functions Overview, Arguments and return values, Formal vs Actual arguments,
Named arguments, Recursive Functions, Lambda Functions, Modules

UNIT-III

Data Structures in Python — **6 Hours**

Data Structures: Strings and basic operations, Lists, Tuples, Sets, Dictionaries: creation and manipulation

UNIT-IV

File Handling and Introduction to Object-Oriented Concepts — **6 Hours**

Files: Create a file, read and write operations with text and CSV files
Object Oriented Concepts: Class, Object

UNIT-V

Exception Handling and Data Visualization — **6 Hours**

Exception handling: Introduction to Exceptions and Errors, Handling exceptions using try-except-else- finally
Introduction to Pandas: Data analysis and manipulation using Pandas
Data Visualization using Matplotlib: Plotting different kinds of graphs using Matplotlib

Suggested list of Experiments

1.	Experiments related to basic operation, data types, and variables.
2.	Experiments related to control and looping statements.
3.	Experiments on writing functions and parameter passing.
4.	Experiments related to the operations of lists, tuples, and dictionaries.
5.	Experiments related to working with strings.
6.	Experiments related to file handling.
7.	Experiments related to classes and objects.
8.	Experiments related to exception handling.
9.	Experiments related to data analysis and manipulation using Pandas.
10.	Experiments related to plotting graphs using Matplotlib.

Course Outcomes: At the end of the course student will be able to:

1	Apply core Python programming concepts such as variables, operators, and control flow to develop interactive programs.
2	Design and implement reusable code using functions and modules to solve real-world computational problems.
3	Manipulate and process data effectively using built-in Python data structures like strings, lists, tuples, sets, and dictionaries.
4	Demonstrate the ability to manage files and implement object-oriented principles such as classes and objects in Python.
5	Develop robust Python applications with exception handling and use data analysis and visualization tools like Pandas and Matplotlib.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	PSO↓ 1	PSO↓ 2
CS102.1	3	2	-	-	1	-	1	-	-	-	3	3	2
CS102.2	3	2	-	-	1	-	1	-	-	-	3	3	2
CS102.3	3	2	-	-	1	-	1	-	-	-	3	3	2
CS102.4	3	2	-	-	1	-	1	-	-	-	3	3	2
CS102.5	3	2	-	-	1	-	1	-	-	-	3	3	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Kenneth A. Lambert, ―The Fundamentals of Python: First Programs‖, Cengage Learning, 3rd Edition, 2023.
2	Yashwanth Kanetkar, Adithya Kanetkar, ―Let us Python‖, 6th Edition, 2023.
3	Al Sweigart, ―Automate the Boring Stuff with Python‖, 1st Edition, No Starch Press, 2015.

REFERENCE BOOKS:

1	Mark Summerfield, ―Programming in Python 3 - A Complete Introduction to the Python Language‖, Second Edition, Addison-Wesley, 2009.
2	Y. Daniel Liang, ―Introduction to Programming Using Python‖, Pearson, 2017.

E Books / MOOCs/ NPTEL

1	https://assets.openstax.org/oscms-prodcms/media/documents/Introduction_to_Python_Programming_-_WEB.pdf
2	https://baou.edu.in/assets/pdf/BSCIT_405_slm.pdf
3	https://www.iimchyderabad.com/Material/introduction-to-python-programming.pdf
4	https://cfm.ehu.es/ricardo/docs/python/Learning_Python.pdf

MATHEMATICS WITH MATLAB

Course Code:	MAT107	Course Type:	PLC
Teaching Hours/Week (L-T-P)	0:0:2	Credits:	01
Total Teaching Hours:	0+0+30	CIE + SEE Marks:	50

Teaching Department: Mathematics

Course Objectives:

This course will enable the students to learn to use MATLAB for basic operations, array handling, plotting, and solving problems using symbolic and numerical methods.

List of Experiments

1. Introduction to MATLAB: Basic Operators: Arithmetic, Logical and Relational Operators. Elementary math functions such as algebraic, trigonometric, logarithmic, exponential functions, Conditions and Loops.
2. Symbolic Computation, plotting curves, surfaces and vector fields.
3. Computation of angle between (a) radius vector and tangent (b) two curves
4. Computation of radius of curvature
5. Taylor's/ Maclaurin's series expansion of a function of a single variable.
6. Differentiation of composite and computation of partial derivatives.
7. Computation of Jacobian.
8. Computation of extreme values of multivariate functions.
9. Evaluation of double/triple integrals with constant/variable limits.
10. Computation of rank and eigen values and corresponding eigen vectors of a square matrix and also the largest eigen value and eigen vector using power method
11. Solution of system of linear equations by Gauss Seidel Method

Course Outcomes: At the end of the course student will be able to

1	Introduction to MATLAB: Basic Operators: Arithmetic, Logical and Relational Operators. Elementary math functions such as algebraic, trigonometric, logarithmic, exponential functions, Conditions and Loops.
2	Symbolic Computation, plotting curves, surfaces and vector fields.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
MAT107.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT107.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT107.3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT107.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MAT107.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1	Rudra Pratap, "MATLAB", OXFORD University press, 2010
2	Dorothy C. Attaway Ph.D., A practical introduction to prog. And problem solving, 5th edition

E Books / MOOCs/ NPTEL

1	https://www.mathworks.com › matlab › matlab_prog
2	https://www.coursera.org/specializations/mathematics-engineers
3	https://www.coursera.org/specializations/matlab-programming-engineers-scientists
4	https://www.coursera.org/learn/matlab

Ability Enhancement Courses

COMMUNICATIVE ENGLISH

Course Code	**HSS131**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P)	**1:0:2**	**Credits**	**02**
Total Teaching Hours	**15+0+30**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	Develop proficiency in phonetics, pronunciation, and effective oral communication.
2.	Strengthen foundational grammar and language skills.
3.	Improve academic writing skills for various contexts by appreciating texts.
4.	Enhance comprehension and analytical thinking through the skill of writing

Unit – I

Phonetics & Communication — **15 Hours**

- Introduction to Phonetics, IPA, stress, rhythm, and intonation.
- Rhythm, Intonation, Past Tense and Plural Pronunciation, Awareness of Accents
- Fundamentals of Communication, Barriers, Strategies, Requests and Permissions.
- Verbal and Non-Verbal Communication, Telephone etiquette, greetings, requests.
- Short Formal Speech

Practical Activities:

- Phonetic drills, speech exercises, interactive speaking activities.
- Communication and telephone conversation simulations

Unit – II

Language Skills & Grammar — **15 Hours**

- Texts – Prose & Poetry
- Grammar Essentials: Prepositions, Articles, Sentence structure.
- Language Skills: Sentence construction, comprehension, and structured writing techniques.
- Comprehension

Practical Activities:

- Grammar exercises, sentence correction, editing tasks.
- Reading comprehension exercises and discussion-based learning

Unit – III

Writing Skills — **15 Hours**

- Cohesive Devices: Conjunctions, linkers, and sequence of ideas in writing.
- Writing Skills: Paragraph development, linkers, structured writing.
- Argumentation and Refutation
- Application Letter

Practical Activities:

- Writing focused on clarity, coherence, and structure.

Course Outcomes: At the end of the course students will be able to

1.	Identify the nuances of phonetics, intonation, and pronunciation to appreciate and incorporate Received Pronunciation
2.	Interpret and assess nuances of oral communication skills and non-verbal communication for professional usage
3.	Identify, interpret, and describe the critical ideas, values, and themes to appreciate literary pieces for its language and social interpretations
4.	Implement English vocabulary in both personal and professional contexts, enhancing language proficiency while also honing effective writing skills adaptable to various forms of written communication.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
HSS131.1	1	1						2		2		3		
HSS131.2	2					2				3		3		
HSS131.3		2					3	2		3		3		
HSS131.4		2				2			2	2		2		

1: Low 2: Medium 3: High

TEXT BOOK

1.	Tidings, Victor, R. et al. (2022). A Textbook of English Language & Communication Skills.

REFERENCES

1.	Jones, D (2011). English Pronunciation Dictionary.
2.	Woods (2016). A Remedial English Grammar for Foreign Students.
3.	Kumar, S. (2011). Communication Skills. Oxford University Press.
4.	CIEFL, Hyderabad (Year). Exercises in Spoken English Part I. Oxford University Press.
5.	CIEFL, Hyderabad (Year). Exercises in Spoken English Part II. Oxford University Press.
6.	CIEFL, Hyderabad (Year). Exercises in Spoken English Part III. Oxford University Press.
7.	Zinsser, W. (1976). On Writing Well.
8.	Swan (2014). Practical English Usage. Oxford University Press.
9.	Lyons, L. H. (2006). Study Writing. Cambridge University Press.
10.	Subhashini, Victor, R. et al. (2022). A Textbook of English Language & Communication Skills.

E Resources

1.	https://www.macmillandictionary.com/dictionary/british/

ENHANCING SELF AWARENESS AND COMMUNICATION				
SEMESTER I				
Course Code	**HSS132**		**Credits**	1
CIE Marks	50**		**Hours/Week (L-T-P)**	1-0-0
Total Teaching Hours	15+0+0		**SEE Marks**	-
Exam hours	1.5 Hours		**Course Type**	Audit -No credits
Stream	All departments		**Integrated Lab**	NO
Course Component				

COURSE OUTCOMES

Students will be able to

1. reflect on their strengths and capacities
2. identify their areas of improvement
3. set and submit short term and long-term professional and personal goals
4. make a presentation on a specified topic

COURSE CONTENTS

UNIT -1- 9 HOURS

- **Self-awareness:** Identifying and mapping interests, capacities and competencies; Tree of Life exercise; Reflections on personal strengths and identifying areas of improvement.
- **Goal setting exercises:** Short term and long term personal and professional goal setting; reviewing the set goals; Listing immediate actionable steps to be taken.
- **Dealing with distractions and time management strategies:** Identifying sources of distraction; tips to deal with procrastination; effective use of screentime.

UNIT -2 6 HOURS

- **Professional Behaviours:** Professional and non-professional behaviours; Power dressing and self-grooming.
- **Professional Communication:** Language etiquettes; Practice in expressing opinions and ideas in public; Strategies to manage stage fear.

REFERENCE BOOKS

1. Eurich, T. (2017). Insight: why we're not as self-aware as we think, and how seeing ourselves clearly helps us succeed at work and in life. New York, Crown Business.
2. Seligman, M. E. P. (2011). Flourish: A visionary new understanding of happiness and well-being. Free Press.
3. American Psychological Association. The Psychology of Procrastination: Why People Put Off Important Tasks Until the Last Minute. 2010.

ONLINE RESOURCES *

Topic/Title	Link
1. A psychological perspective	https://www.verywellmind.com/what-is-self- awareness-2795023#toc-how-does-self-awareness- develop
2. Procrastination	https://jamesclear.com/procrastination

****COURSE ASSESSMENT METHOD:**
Attendance : 5 Marks [95% and above- 5 marks; 94%-90%-4 marks; 89%-85%-3 marks; 84%-80%-2 marks; 79%-75%-1 mark] If students have less than 75% attendance , they will not be allowed to attend the end semester exam. LA1: 15 Marks LA2: 15Marks (The average of two LA will be taken) MSE: 30 Marks
PEDAGOGY
1. Activity based learning 2. Case studies 3. Group discussions and presentations 4. Reflective activities

BUILDING OF PSYCHOLOGICAL ASSETS				
SEMESTER II				
Course Code	HSS133		**Credits**	1
CIE Marks**	50 marks		**Hours/Week (L-T-P)**	1-0-0
Total Teaching Hours	15+0+0		**SEE Marks**	-
Exam hours	1.5 hours		**Course Type**	AEC
Stream	All Departments		**Integrated Lab**	
Course Component				

COURSE OUTCOMES

Students will be able to

1. recognize failures as pathways to success
2. recognize the markers of a growth mindset in themselves
3. practice simple mindfulness exercises

COURSE CONTENTS

UNIT -1 **9 HOURSE**

- **Pathways to Success**: Introduction to the non-cognitive factors that are precursors to success; Suggested case studies: Sundar Pichai, Indira Nooyi
- **Learning to Fail:** Decoding failures; Why do we fail? ; Failure as an opportunity- Suggested case studies: Steve Jobs- Apple, ISRO-Chandrayaan
- **Growth mindset:** Comparing growth and fixed mindsets; techniques to develop a growth mindset; communication tools for a growth mindset.

UNIT -2- **6 HOURS**

- **Grit and Resilience:** Importance in crafting success; Tools to develop grit and be resilience. Suggested case studies: Narayana Murthy and Infosys; Ratan Tata
- **Self-regulation of Emotions:** The connect between thought, emotions and behaviours; tips to control my emotions; recognizing depression; mindfulness practice.

REFERENCE BOOKS

1. Duckworth, A. (2016). Grit: The power of passion and perseverance. Scribner/Simon C Schuster.
2. Khera, S. (2014) You Can Win: A Step-by-Step Tool for Top Achievers. ACC Black.

ONLINE RESOURCES*

Topic/Title	Link
1. TED talk by Angela Duckworth on grit	https://www.youtube.com/watch?v=H14bBuluwB8Ct=1 11s
3. 5 Practices of Highly Resilient People with Dr. Taryn Marie Stejskal:	https://www.youtube.com/watch?v=gIYHQAeOy-w

4. Learning from failure	https://hbr.org/2011/04/strategies-for-learning-from-failure
5. Carol Dweck on Growth Mindset	https://www.youtube.com/watch?v=hiiEeMN7vbQ

****COURSE ASSESSMENT METHOD:**

Attendance : 5 Marks [95% and above- 5 marks; 94%-90%-4 marks; 89%-85%-3 marks; 84%-80%-2 marks; 79%-75%-1 mark] If students have less than 75% attendance , they will not be allowed to attend the end semester exam.
LA1: 15
Marks LA2:
15Marks
(The average of two LA will be taken)
MSE: 30 Marks

PEDAGOGY

1. Activity based learning
2. Case studies
3. Group discussions and presentations
4. Reflective activities

*Additional Reading materials and online resources will be shared with the learners as required