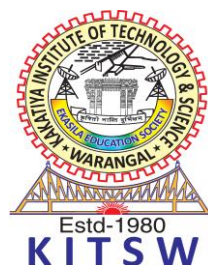


B.TECH. CURRICULUM
ACADEMIC YEAR: 2024 -25

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(DATA SCIENCE)

Undergraduate Rules and Regulations-2024 (URR-24)
In accordance with the National Education Policy 2020
w.e.f. AY: 2024-25

Regulations Governing the
Choice Based Credit System with
Multiple Entry and Multiple Exit Options
with
Competency-Focused Outcome Based Curriculum (CF-OBC)



DEPARTMENT OF Computer Science & Engineering (Data Science)
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL - 506 015 TELANGANA
(UGC Autonomous Institute Under Kakatiya University, Warangal)

TABLE OF CONTENTS

S. No.	Contents	Page No.
1.	Institute Vision and Mission	3
2.	Department Vision and Mission	3
3.	Program Educational Objectives	4
4.	Program Learning Outcomes	6
5.	Design of Curriculum	7
6.	Undergraduate Rules and Regulations under URR24	10
7.	B. Tech CSE (Data Science) - Curriculum (KITSW-URR-24)	27
8.	Multidisciplinary Open Elective Courses (MOPEC) Baskets	38
9.	Program Elective Courses (PEC)	39

History:

PROGRAM	DESCRIPTION	
	INTAKE	NBA ACCREDITATION
UG in B.Tech. Computer Science and Engineering (Data Science)	<ul style="list-style-type: none"> Started with an intake of 60 in the year 2023 	<ul style="list-style-type: none"> NA

INSTITUTE VISION AND MISSION

INSTITUTE VISION

To make our students technologically superior and ethically strong by providing quality education with the help of our dedicated faculty & staff and thus improve the quality of human life

INSTITUTE MISSION

- M1 ■ To provide latest technical knowledge, analytical & practical skills, managerial competence and interactive abilities to students, so that their employability is enhanced
- M2 ■ To provide strong human resource base to cater to the changing needs of the industry and commerce
- M3 ■ To inculcate a sense of brotherhood and National Integrity

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE):

VISION AND MISSION

VISION

Attain Center of Excellence in Data Science through exceptional education, training, and research aligned with National Educational Policy, fostering innovation, multidisciplinary holistic learning, and inclusivity to meet the evolving demands of industry and society.

MISSION

- M1: Cultivate a qualitative approach and uphold rigorous standards to equip students with a profound understanding of the core principles and concepts in Data Science and its interdisciplinary domains.
- M2: Inspire students to pursue continuous learning, fostering their technical, communication, and managerial skills, enabling them to excel in a dynamic field. Empower them to embrace the latest advancements and technologies in computer science, ensuring a successful career founded on professional ethics.
- M3: Engage students in analyzing, designing, and experimenting with contemporary research challenges in Data Science. Empower them to address global socio-economic, political, and environmental issues through innovative solutions and impactful contributions.

PROGRAM EDUCATIONAL OBJECTIVES

- PEO1: Technical Competence:**
Apply the fundamental knowledge of the core courses of computer science and Data Science for developing the effective and transformational software solutions.
- PEO2: Successful Career**
Excel in profession, higher education and entrepreneurship with updated technologies in software, Data Science based domains.
- PEO3: Soft Skills and Life-long Learning**
Exhibit professional ethics, effective communication and team work in solving contemporary knowledge engineering problems and to excel in social innovations

PEO TO MISSION MAPPING

	M1	M2	M3
PEO1	3	3	2
PEO2	3	3	3
PEO3	2	2	3

PEO Statements	Mission Statements	Mapping Level	Justification
PEO1	M1	3	A strong foundation in M1 principles is crucial for developing effective and transformational software solutions, which directly aligns with PEO1's objective of applying fundamental knowledge to real-world problems.
	M2	3	Technical expertise requires staying updated with new technologies and methodologies, aligning perfectly with PEO1's goal of leveraging updated knowledge for software development.
	M3	2	While M3 is more focused on engaging students in contemporary research challenges and innovative solutions, it still supports the development of technical expertise by exposing students to real-world problems and interdisciplinary applications. Therefore, it contributes to PEO1.
PEO2	M1	3	A deep understanding of core principles in AI and ML is foundational for a successful career. Mastery of these principles ensures that graduates are well-prepared for various professional roles, higher education, or entrepreneurial endeavors.
	M2	3	Continuous learning and skill enhancement are vital for career success. M2's focus on fostering technical, communication, and managerial skills ensures that students are well-rounded and

PEO Statements	Mission Statements	Mapping Level	Justification
			adaptable, which is crucial for thriving in a dynamic and evolving field.
	M3	3	Addressing contemporary research challenges and contributing to innovative solutions prepare students for high-impact careers. The ability to solve global issues using AI and ML not only makes students highly employable but also positions them as leaders in their fields, directly supporting the objective of a successful career.
PEO3	M1	2	While M1 primarily focuses on technical knowledge, understanding core principles also indirectly supports the development of professional ethics and effective communication. This foundational knowledge is essential for team work and problem-solving in professional settings.
	M2	2	M2's emphasis on continuous learning, communication, and managerial skills is directly relevant to PEO3. The focus on professional ethics and embracing new technologies supports life-long learning and the development of soft skills necessary for effective teamwork and social innovation.
	M3	3	Engaging students in real-world research challenges and encouraging them to address global issues inherently requires teamwork, effective communication, and ethical considerations. This mission strongly supports the development of soft skills and fosters a commitment to life-long learning, making it highly relevant to PEO3.

PROGRAM SPECIFIC OBJECTIVES

PSO1: (Sustainable Software Solutions)	Develop and maintain high-quality, sustainable software solutions that address real-world complex engineering problems by applying the fundamentals of computer science, engineering, and data science knowledge.
PSO2: (Data Science for Societal Development)	Design, configure, and implement data science applications that benefit society and promote development by adapting to the latest advancements and updates in the field.

PO/PSO TO PEO MAPPING

PO's/PSO's		PEO1	PEO2	PEO3
PO1	Engineering Knowledge	3	3	2
PO2	Problem Analysis	3	2	2
PO3	Design/Development of solutions	3	3	2
PO4	Conduct investigation of complex problems	3	2	2
PO5	Modern tool usage	3	2	2
PO6	The engineer and society	1	1	2
PO7	Environment and sustainability	1	1	3
PO8	Ethics	1	3	3
PO9	Individual and Teamwork	3	3	2
PO10	Communication	2	3	3
PO11	Project management and finance	2	2	2
PO12	Lifelong Learning	2	2	3
PSO1	Sustainable Engineering Software Solutions	3	3	2
PSO2	Data Science for Societal Development	3	3	2

DESIGN OF CURRICULUM

Salient Features

- The URR24 regulations are inline with the National Education Policy 2020 (NEP 2020) and the AICTE model curriculum to provide multidisciplinary holistic education to produce well-rounded engineering graduates.
- Multiple Entry Multiple Exit (MEME) option.
- Multidisciplinary four year UG programme with award of following degrees
 - B. Tech.
 - B. Tech. with “Minor”
 - B. Tech. “Honours”
 - B. Tech. “Honours with Research”
- 170 + Credit Liberal Engineering Education.
- A strong program core of 19 courses and 4 baskets of program electives to ensure the breadth and depth in a chosen domain of studies. Program electives are arranged either to grow in a specified vertical or have diversified exposure.
- Full semester industry internship to the interested students.
- Aggressive model of “Learning-by-doing” in the form of PRACTICUM.
- Activity Based Learning (ABL) about Life, Literature and Culture is embedded in to the curriculum in four semesters, ensuring all dimensional holistic growth of the learner. These four activity based mini courses are offered as two sequels namely Social Empowerment Activities (SEA) and Self Accomplishment Activities (SAA).
- These regulations follow holistic approach of education, ensures strong science, mathematics foundation and program core, develops expertise in domain vertical through sequel of electives, ensures significant exposure of additional discipline through “Minor” programme, challenges good learners through “Honours” programme and for the research oriented students through “Honours with Research” programme.
- Along with Major and Minor disciplinary courses, students are expected to learn Multidisciplinary open elective courses (MOPEC), skill enhancement courses (SEC), ability enhancement courses (AEC), value added courses (VAC), activity based learning (AL) and experiential learning (EL) towards multidisciplinary holistic education and for increased employability.
- These regulations provide competency-focused outcome based curriculum (CF-OBC) for skill development, multidisciplinary learning, wider access, inclusiveness and entrepreneurship.
- In our CF-OBC, each course has an additional component of “Contents for self-study”, which is carefully designed to ensure additional hours of learners engagement. The learner thus is nurtured towards the “Self-Learning” and “lifelong learning” which are essential attributes of a 21st Century learner. The same is incorporated in the scheme of instructions in the form of (i) Outside the class work (self-study) hours, (ii) total engagement hours for every course.
- In summary, these regulations are expected to develop technical competencies, through courses from programme core, programme electives, engineering science and basic science; and also develop generic competencies, soft skills, social, physical, mental and spiritual personality through carefully articulated courses from MOPEC baskets, Liberal

Learning and Humanities sequels. Thus, offers a unique “T-Shaped” liberal “Pi-Model” of Engineering Education

The Curriculum consists of the following components of study:

BSC	Basic Science Course	ABL-SAA	Self- Accomplishment Activities
HSMC	Humanities and Social Sciences including Management Course	ABL-SEA	Social Empowerment Activities
ESC	Engineering Science Course	VAC	Value Added Course
PCC	Program Core Course	AEC	Ability Enhancement Course
PEC	Program Elective Course	EXL	Experiential Learning
MOPEC	Multidisciplinary Open Elective Course	SEC	Skill Enhancement Course

Multidisciplinary Open Electives Courses (MOPEC)

The Curriculum provides four slots of open electives with fourteen baskets. This is planned to give exposure to interdisciplinary and cross disciplinary domains. The courses in these baskets are planned both at department and institute level. Students can choose any combination of these courses (not floated by the parent department) to get familiar with other domains of learning.

Practicum

The curriculum provides ample opportunities for experiential learning (learning-by-doing) to impart important skills like problem solving, critical thinking and communication. Under experiential learning the PRACTICUM is a semester long project work included in I to IV semesters, having a weightage of 1 credit in each semester. Under PRACTICUM, the students are expected to implement a micro level project (at a level of course project) solving a practical problem or a project based on the combination of different theory or lab courses being studied in a corresponding semester. The experiential learning is continued in the form of a Seminar in fifth semester, a mini project in sixth semester, major project in seventh & eight semesters and mandatory 6-8 week internship during summer breaks.

A batch of students (according to Roll Numbers) will be allotted to each of the course handling teachers of the corresponding semester. The teacher will be assigning a micro level project to each student. At the end of the semester the student will demonstrate a prototype / working model / system / process and submit a four to six page report. Course teacher is expected to evaluate the allotted batch of students and submit grades to the HoD. There will not be ESE for PRACTICUM. The batch of students will be allotted to a course handling teacher on the basis of series of Roll Numbers, similar to the allotment done for tutorial matrix.

Example: The project work under PRACTICUM for the course EDC may be

1. Standalone Rectifier with Filter
2. A Zener Diode based Regulator
3. Development of DC Power Adapter
4. A Small Audio Amplifier
5. A Calp Switch
6. Electronic Bell

The URR-24 focuses on CF-OBC with program depth component in terms of Program Core Courses (PCCs) and Program Elective Courses (PECs)

Program Core Courses (PCC)

The curriculum offers nineteen core courses referred to as Program Core. Several academic models from reputed institutions in the country and outside the country are studied in

articulating this Program Core, to make curriculum globally competitive. The courses are augmented with laboratory components as per the need.

Program Electives Courses (PEC)

The curriculum offers four baskets of Program Electives, each basket having identified courses corresponding to the programme specializations called verticals. This enables learners to grow in a domain-specialization or domain-vertical. The student can opt courses in sequel (PEC-1 to PEC-4) in any of the specific vertical or across the verticals.

Activity-Based Learning (ABL) about Life, Literature and Culture

Activity based learning (ABL) is blended with the Curriculum for ensuring holistic growth of the learner. These activity based minicourses are offered as two sequels namely “SEA” (Social Empowerment Activities) and “SAA” (Self Accomplishment Activities).

According to Dr. K. M. Munshi, “Education will fail ignominiously in its objective if it manufactures only a robot and called him an economic man stressing the adjective economic and forgetting the substantive man. A university cannot afford to ignore the cultural aspects of education whatever studies it specializes in. Science is a means, not an end. Whereas culture is an end in itself. Even though you may ultimately become a scientist, a doctor, or an engineer, you must, while in college, absorb fundamental values which will make you a man of culture”.

The NEP-2020 quotes, “Higher education must develop good, well-rounded and creative individuals, with intellectual curiosity, spirit of service and a strong ethical compass”. Moving towards a more liberal undergraduate education is one of the most important feature of the NEP2020”.

The needs of the 21st century require, that liberal broad-based multidisciplinary education become the basis for all higher education. This will help develop well-rounded individuals that possess critical 21st century capacities in fields across arts, humanities, sciences, social sciences, and professional, technical, and vocational crafts, an ethic of social engagement, and rigorous specialization in a chosen field or fields. Such a liberal education would be, in the long run, the approach across all undergraduate programs, including those in professional, technical, and vocational disciplines.

Imaginative and flexible curricular structures will enable creative combinations of disciplines for students to study, thus demolishing currently prevalent rigid boundaries and creating new possibilities for lifelong learning. The notion of ‘knowledge of many arts’- i.e. what is called ‘liberal arts’ in modern times – must be brought back to Indian education, as it is exactly the kind of education that will be required for the 21st century”.

To ensure holistic development of the learner, an attempt has been made in this curriculum to blend engineering education appropriately with arts, humanities, crafts, ethic of personal and social engagement to ensure holistic development of the learner. Activity based liberal learning courses covering life, literature, and culture are added. Every learner is expected to take one such course in first four semesters. We strongly believe that these four liberal learning modules will expose the learners to multidisciplinary and holistic education as envisaged in NEP2020.

(END OF THE SALIENT FEATURES OF URR24)

Undergraduate Rules and Regulations - 2024 (URR-24)

In accordance with the National Education Policy 2020, w.e.f. AY: 2024-25

1. **Title:**

URR-24 Regulations governing the Choice Based Credit System (CBCS) with Multiple Entry and Multiple Exit (MEME) options with Competency-Focused Outcome Based Curriculum (CF-OBC)

2. **Scope:**

These regulations are applicable to the undergraduate programmes being offered by the Institute

3. **Duration of Programmes:**

The undergraduate degree should be of four years duration, with multiple entry and multiple exit (MEME) options. The maximum duration for a student for completing the degree requirement is as per NEP2020/UGC/AICTE guidelines. Four years multidisciplinary undergraduate programme allows the opportunity to experience the full range of holistic and multidisciplinary education with a focus on major and minor subjects as per the student's preference. The four-year programme may also lead to a degree with Research, if the student completes a rigorous research project in the major area(s) of study. The undergraduate programmes shall extend over four academic years (eight semesters).

With multiple entry and multiple exit options, the students can exit after the completion of one academic year (two semesters) with the UG certificate in CSE; UG Diploma in CSE (Data Science) after the study of two academic years (four semesters); and B. Voc. in CSE (Data Science) degree after the completion of three academic years (six semesters). The successful completion of four years undergraduate programme would lead to B. Tech. in CSE (Data Science) degree with optional Minor/Honours/ Honours with Research.

4. **Credit Requirement:**

As per the guidelines released by UGC under National Higher Education Qualification Framework (NHEQF), for Multiple Entry and Multiple Exit (MEME) in Academic Programmes offered in Higher Educational Institutions, the students shall complete the courses equivalent to minimum credit requirements as shown in the table given below for the award of UG certificate, UG diploma, Bachelor degree, Postgraduate diploma and Master's degree:

Qualification Type and Credit Requirements		
NHEQF Levels	Exit with	Credit Requirements
4.5	Undergraduate Certificate (in the field of learning/ discipline) for those who exit after the first year (two semesters) of the undergraduate programme. (Programme duration: first year or two semesters of the	36-40

Qualification Type and Credit Requirements		
NHEQF Levels	Exit with	Credit Requirements
	undergraduate programme)	
5	Undergraduate Diploma (in the field of learning/ discipline) for those who exit after two years (four semesters) of the undergraduate programme. (Programme duration: First two years or four semesters of the undergraduate programme)	72-80
5.5	Bachelor's Degree (Programme duration: Three years or six semesters).	108-120
6	Bachelor's Degree (Honours/ Research) (Programme duration: Four years or eight semesters).	144-160
6.5	Post-Graduate Diploma for those who exit after the successful completion of the first year or two semesters of the two-year Master's degree programme. (Programme duration: One year or two semesters of the Post-Graduate programme)	36-40
7	Master's Degree (Programme duration: Two years or four semesters after obtaining Bachelor's degree).	72-80
7	Master's Degree (Programme duration: One year or two semesters after obtaining a four-year Bachelor's degree (Honours/Research)).	36-40
8	Doctoral Degree	Minimum prescribed credits for course work and a thesis with published work

* Details of course-wise credits are described in the later part of the Regulations.

5. Commencement:

These Regulations in accordance with National Education Policy 2020 shall come into force from Academic Year 2024-25 onwards. These regulations shall be implemented from the academic year as mentioned below.

NHEQF Level	Programme	From Academic Year
Undergraduate Programme		
Level 4.5	Undergraduate Certificate (One year or two semesters)	2024-25
Level 5	Undergraduate Diploma (Two years or four semesters)	2025-26
Level 5.5	Bachelor's Degree (Three years or six semesters)	2026-27
Level 6	Bachelor's Degree with Honours/ Research (Four years or eight semesters)	2027-28

6. Eligibility Criteria:

- (i) **Level 4.5:** The students who have successfully completed Grade 12 / Intermediate with MPC or its equivalent course shall be eligible for admission to the first year degree programme
- (ii) **Level 5:** The students who have successfully completed Level 5 of the undergraduate programme at this Institute or any other HEIs registered on Academic Bank of Credits Portal
- (iii) **Level 5.5:** The students who have successfully completed Level 6 of the undergraduate programme at this Institute or any other HEIs registered on Academic Bank of Credits Portal
- (iv) **Level 6:** The students who have successfully completed Level 7 (bachelor degree of three years or six semesters) of undergraduate programme at this Institute or any other HEIs registered on Academic Bank of Credits Portal

7. Academic Bank of Credits (ABC):

The Academic Bank of Credits (ABC), a national-level facility promotes the flexibility of curriculum framework and interdisciplinary/ multidisciplinary academic mobility of students across the HEUs in the country with appropriate “credit transfer” mechanism. It is mechanism to facilitate the students to choose their own learning path to attain a Certificate / Diploma / Degree, working on the principle of multiple entry and exit as well as anytime, anywhere, and any level of learning. ABC will enable the integration of multiple disciplines of higher learning leading to the desired learning outcomes including increased creativity, innovation, higher order thinking skills and critical analysis. ABC will provide significant autonomy to the students by providing an extensive choice of courses for a programme of study, flexibility in curriculum, novel and engaging course options across a number of higher education disciplines / institutions.

7.1 Operationalization of ABC:

Shall appoint institutional nodal officer for ABC as per UGC directives. The nodal officer shall be responsible for proper operationalization of ABC within the college and with the university.

The ABC related operations shall be as follows:

- (i) The MEME option for student is facilitated at the undergraduate and postgraduate levels.
- (ii) It would facilitate credit accumulation through the facility created by the ABC scheme in the “Academic Bank Account” opened for students across the country to transfer and consolidate the credits earned by them by undergoing courses in any of the eligible HEIs. The eligibility of HEIs to offer courses shall be as per UGC (Establishment and Operationalization of ABC scheme in Higher Education) Regulations 2021 dated 28.7.2021 and changes therein notified by the UGC from time to time.
- (iii) The ABC allows credit redemption through the process of commuting the accrued credits in the Academic Bank Account maintained in the ABC for the purpose of fulfilling the credits requirements for the award of certificate/ diploma/ PG diploma/ degree by the authorized HEIs
- (iv) Upon collecting a certificate, diploma, PG diploma or degree, all the credits earned

till then, in respect of that certificate, diploma, PG diploma or degree shall stand debited and redeemed from the account concerned.

- (v) HEIs offering programmes with the MEME system need to register in the ABC to enable acceptance of multidisciplinary courses, credit transfer, and credit acceptance.
- (vi) The validity of credits earned will be for a maximum period of seven years or as prescribed by the UGC
- (vii) The procedure for depositing credits earned, its shelf life, redemption of credits, would be as per UGC (Establishment and Operationalization of ABC scheme in Higher Education) Regulations 2021 dated 28.7.2021 and changes therein notified by the UGC from time to time

7.2 Monitoring, Support and Quality by Universities and ABC:

- (i) It shall be the responsibility of Registered HEIs, to monitor the development and operationalization of the ABC programme at the university level and at the level of their affiliated colleges
- (ii) Registered HEIs shall offer teachers training, staff training, mentoring, academic and administrative audit and other measures for improving the quality of performance of the ABC facility and promotion of holistic and multidisciplinary education with the support of ABC
- (iii) The quality assurance of the implementation of ABC at the level of the registered university shall be looked by the Director, Examinations and Evaluation of the Institute of the officer nominated by him different from ABC nodal officer, under the directives and guidance of Controller of Examinations of the Institute
- (iv) The Institute shall upload, annually, on its website, a report of its activities related to the Academic Bank of Credits, as well as of measures taken by it for Quality Assurance, Quality Sustenance and Quality Enhancements
- (v) The Grievance Redressal Committee constituted by the examination section shall be responsible for addressing the Grievance and appeals related to ABC

8. Building Competencies through Pedagogy:

Effective learning requires appropriate competency focused outcome based curriculum (CF-OBC), an apt pedagogy, continuous formative assessment and adequate student support. The intention is to contextualize curriculum through meaningful pedagogical practices, which determine learning experiences directly influencing learning outcomes expected competencies. ICT will be used in creating learning environment that connects learners with content, peers and instructors all through the learning process respecting pace of learners. The faculty shall follow innovative learner centric pedagogical approaches:

- (i) Classroom process must encourage rigorous thinking, reading and writing, debate, discussion, peer learning and self-learning
- (ii) The emphasis is on critical thinking and challenge to current subject orthodoxy and develop innovative solutions. Curricular content must be presented in ways that invite questioning and not as a body of ready knowledge to be assimilated or reproduced. Faculty should be facilitators of questioning and not authorities on

- knowledge.
- (iii) Classroom teaching should focus on the ‘how’ of things i.e. the application of theory and ideas. All courses including social sciences and humanities shall have design project and practicums to enable students get relevant hands-on experiences
 - (iv) Learning must be situated in the Indian context to ensure that there is no sense of alienation from their context, country and culture
 - (v) Classroom processes must address issues of inclusion and diversity since students are likely to be from diverse cultural, linguistic, socio-economic and intellectual backgrounds
 - (vi) Cooperative and peer supported activities shall be part of empowering students to take charge of their own learning
 - (vii) Faculty shall have the freedom to identify and use the pedagogical approach that is best suited to a particular course and student
 - (viii) Pedagogy PBL (Problem/Project Based Learning) shall be brought into practice as part of curriculum. Experiential learning in the form of practicum, seminar, mini project, major project and internship with a specified number of credits is made mandatory
 - (ix) The course faculty shall provide the “Contents for self-study”, and motivate the learners to engage in outside the class work learning (self-learning). The learner thus is nurtured towards the “Self-Learning” and “life-long learning” which are essential attributes of a 21st Century learner
 - (x) Blended Learning (BL) mode shall be used to help learners develop 21st century skills. BL should be carefully implemented and should not be replacing classroom time as a privilege
 - (xi) The UGC regulations, 2021 on Credit Framework for Online Learning Courses through SWAYAM, facilitates an institution to allow up to 40 percent of the total courses being offered in a particular programme in a semester through massive open online courses (MOOCS) offered by the SWAYAM / NPTEL and other e-learning platforms. Students shall be encouraged to complete equivalent courses through SWAYAM / NPTEL and other e-learning platforms, approved by the BoS chair and Dean AA, towards obtaining required credits where ever necessary.

9. Skill Enhancement, Ability Enhancement, Value Added Courses through e-learning:

Students shall be encouraged to obtain the required credits related to the skill enhancement courses (SECs), ability enhancement courses (AECs) and value added courses (VAC) through MOOCS platforms such as:

- (i) SWAYAM
- (ii) SWAYAM PLUS
- (iii) IIM-B
- (iv) University LMS
- (v) CEC
- (vi) NPTEL
- (vii) IGNOU
- (viii) Infosys Spring Board
- (ix) Future Skills Prime (digital skilling ecosystem developed by Govt. Of India and NASSCOM)
- (x) Wadhavani Foundation

- (xi) Tata Strive
- (xii) Any other platform approved by the BoS chair and Dean AA

After completing such courses, students have to submit the certificate to the concerned department and then after verification of the certificate the respective department will communicate the credits earned to the Dean, Academic Affairs for approval and onward transmission to examination section of the institute to deposit the credits in academic bank of credits (ABC).

10. Conformance to NEP 2020

10.1 MULTIPLE EXIT OPTIONS

S. No.	Exit Description	Exit Point	Degree/Certificate offered	Goal
1.	First Exit	After completion of First year.	UG Certificate in CSE (Data Science)	The student should be employable as Technical Assistant (CSE(Data Science)) in any industry/organization.
2.	Second Exit	After completion of Second year.	UG Diploma in CSE (Data Science)	The student should be employable as Technician (CSE (Data Science))in any industry/organization.
3.	Third Exit	After completion of Third year.	B. Voc in CSE (Data Science)	The student should be employable as Technical Supervisor (CSE (Data Science)) in any industry/organization.
4.	Normal Exit	After completion of Fourth year.	B.Tech. in CSE (Data Science)	The student should be employable as an Engineer (CSE (Data Science)) in any relevant industry/organization.

10.2 MULTIPLE ENTRY OPTIONS

S. No.	Entry Descriptions	Entry Point	Eligibility
1.	Normal (First) Entry	I-Sem. of the program	As per the TGSCHE guidelines & through Common Entrance Examination TSEAPCET
2.	Second Entry	III-Sem. of the program	The successful completion of first year with UG certificate in CSE from our institute.
3.	Third Entry	V-Sem. of the program	The successful completion of UG Diploma in CSE (Data Science) from our institute.
4.	Fourth Entry	VII -Sem. of the program	The successful completion of B. Voc in CSE (Data Science) from our institute.

- (i) **No. of maximum exits** : as per NEP2020/UGC/AICTE guidelines on MEME
- (ii) **No. of maximum entry** : as per NEP2020/UGC/AICTE guidelines on MEME
- (iii) **Maximum gap between exit and entry** : as per NEP2020/UGC/AICTE guidelines on MEME
- (iv) **Academic Bank of Credits shall be maintained**

11. Options for Degree Certificate

- (i) Learners who earn a minimum of total 170 credits will be **awarded “B.Tech”. degree which confirms to NEP 2020 requirements of multidisciplinary holistic education.**
- (ii) Fast Learners will have the following options to earn **B. Tech. degree with Honours/ Minor.**

- a) ***B.Tech with “Minor” degree (with additional 18 credits): 170+18 Credits***

Students opting for Minor degree in identified cutting-edge technologies offered by other departments, have to successfully complete four theory courses (each of 4 credits) and two lab courses (each of 1 credit) during the semester break. One theory & One lab course have to be completed during 5th and 6th semesters. During 7th and 8th semesters one theory course to be completed. All four theory courses will have to be completed through MOOCS and lab courses will be offered by respective department offering the Minor Degree.

- b) ***B.Tech with “Honours” degree (with additional 18 credits): 170+18 Credits***

Students opting for Honours degree have to successfully complete four theory courses (each of 4 credits) and two lab courses (each of 1 credit) as per the specified list of subjects by their own department. One theory & One lab course have to be completed during 5th and 6th semesters. During 7th and 8th semesters one theory course to be completed. All four theory courses will have to be completed through MOOCS and lab courses will be offered by respective department offering the Minor Degree.

- c) ***B.Tech-“Honours with Research” degree (with additional 18 credits by research): 170+18 credits***

Students are expected to complete 2-months research internship in summer after 2nd year (5 credits), 3rd year (5 credits) and work towards individual research based project during 4th year. They have to complete one course on “Research Methodology” through MOOCS or can complete a one week FDP on “Research Methodology”, during 7th semester (4 credits) and finally publish a research paper in a journal indexed by SCI/SCOPUS/WEB OF SCIENCE (4 credits).

11.1 Summary of requirements for earning additional credits leading to “Minor”, “Honours” and “Honours with Research” degrees:

Semester	B. Tech with “Minor”	B. Tech with “Honours”	B. Tech “Honours with Research”
I	-	-	-
II	-	-	-
III	-	-	-
IV	-	-	-
Summer break after 2 nd year	-	-	2-Months Research Internship -I (5 credits)
V	1 theory (4 credits) + 1 lab (1 credit)	1 theory (4 credits) + 1 lab (1 credit)	-
VI	1 theory (4 credits) + 1 lab (1 credit)	1 theory (4 credits) + 1 lab (1 credit)	-
Summer break after 3 rd year	-	-	2-Months Research Internship -II (5 credits)
VII	1 theory (4 credits)	1 theory (4 credits)	“Research Methodology” Theory Course (4 Credits)
VIII	1 theory (4 credits)	1 theory (4 credits)	One research publication in Journal indexed by SCI / SCOPUS / Web of Science (4 Credits)
Total additional credits to be earned	18	18	18

11.2 Credit requirements for four different options of the B. Tech Degree

	I	II	III	IV	V	VI	VII	VIII	Total
B. Tech	20	23	23	23	23	22	21	15	170
B. Tech with Minor	20	23	23	23	23+5*	22+5*	21+4*	15+4*	170+18*
B. Tech with Honours	20	23	23	23	23+5*	22+5*	21+4*	15+4*	170+18*
B. Tech. Honours with Research	20	23	23	23	23+5*	22	21+5* +4*	15+4*	170+18*

*Optional additional Credits leading to Minor/Honours/Honours with Research as applicable

11.3 Options for earning of “Additional Points” for Honours certification

S. No.	Activity	Points earned		Maximum Limit	
1	Success in the GATE Exam	Percentile	Points	8 Points	
		Above 98	8		
		Above 95	6		
		Above 90	4		
		Qualified	2		
		SCI Journal: 8 Points			8 Points
		SCOPUS / Web of Science Journal: 4 Points			
		Patent: 4 Points			
3	Winning Prestigious Technical Competition at National Level#	Rank	Points	6 Points	
		1	4		
		2	3		
		3	2		
4	Completion of PG level MOOCS	Percentile	Points	6 Points	
		Above 95	6		
		Above 90	5		
		Above 80	4		

Note: As the activities mentioned in the above Table of 12.3 are aimed at an additional professional dimension to the professional personality of the learners, each Point earned is given 1 credit equivalency. Thus, Honours registered students are allowed to accumulate a maximum of 8 additional Points through these activities equivalent to two courses (8 credits) of Honours curriculum requirement.

12. Distribution of Courses:

(i) Humanities & Social Sciences including Management (HSMC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	HSMC 01	U24MH105	English Communication and Report Writing	I	2
2.	HSMC 02	U24MB505X	Management Basket	V	3
3.	HSMC 03	U24MH508	Technical English	V	1
Total:					6

(ii) Basic Science Courses (BSC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	BSC 01	U24MH101	Differential Calculus and Ordinary Differential Equations	I	3
2.	BSC 02	U24CY102B	Engineering Chemistry	I	4
3.	BSC 03	U24MH201	Matrix Theory and	II	3

S. No.	Course Type	Course Code	Course Name	Semester	Credits
			Vector Calculus		
4.	BSC 04	U24PY202B	Engineering Physics	II	4
5.	BSC 05	U24MH301F	Essential Mathematics and Statistics for Data science	III	3
Total:					17

(iii) Engineering Science Courses (ESC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	ESC 01	U24EC111	Switching Theory and Logic Design	I	3
2.	ESC 02	U24DS104	Programming for Problem Solving with C	I	4
3.	ESC 03	U24ME107	Engineering Graphics through CAD	I	1
4.	ESC 04	U24DS204	Data Structures through C	II	4
5.	ESC 05	U24EE205B	Basic Electrical Engineering	II	4
Total:					16

(iv) Program Core Courses (PCC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	PCC 01	U24DS203	Computer Architecture and Organization	II	3
2.	PCC 02	U24DS302	Advanced Data Structures	III	4
3.	PCC 03	U24DS303	Operating Systems	III	3
4.	PCC 04	U24DS304	Autometa Theory and Compiler Design	III	3
5.	PCC 05	U24DS305	Object Oriented Programming through Java	III	4
6.	PCC 06	U24DS401	Database Management Systems	IV	4
7.	PCC 07	U24DS402	Artificial Intelligence	IV	3
8.	PCC 08	U24DS403	Software Engineering	IV	3
9.	PCC 9	U24DS404	Computer	IV	3

S. No.	Course Type	Course Code	Course Name	Semester	Credits
			Networks		
10.	PCC 10	U24DS405	Python Programming	IV	4
11.	PCC 11	U24DS502	Web Programming	V	4
12.	PCC 12	U24DS503	Design and Analysis of Algorithms	V	3
13.	PCC 13	U24DS504	Predictive Analytics and Data Mining	V	4
14.	PCC 14	U24DS602	Computer Vision and Image Processing	VI	3
15.	PCC 15	U24 DS603	Machine Learning	VI	4
16.	PCC 16	U24 DS604	DevOps	VI	4
17.	PCC 17	U24DS703	Big Data Analytics	VII	4
18.	PCC 18	U24DS704	Cloud Computing	VII	3
19.	PCC 19	U24DS705	Ethical Hacking	VII	3
Total:					66

(v) Program Elective Courses (PEC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	PEC 01	U24DS601X	Program Elective -I / MOOCs-I	VI	3
2.	PEC 02	U24DS702X	Program Elective -II/ MOOCs-II	VII	3
3.	PEC 03	U24DS802X	Program Elective - III / MOOCs-III	VIII	3
4.	PEC 04	U24DS803X	Program Elective - IV / MOOCs-IV	VIII	3
Total:					12

(vi) Experiential Learning Courses (ELC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	ELC	U24EL108	Practicum-1	I	1
2.	ELC	U24EL209	Practicum-2	II	1
3.	ELC	U24EL308	Practicum-3	III	1
4.	ELC	U24EL408	Practicum-4	IV	1
5.	ELC	U24EL509	Seminar	V	1
6.	ELC	U24EL608	Mini Project	VI	1
7.	ELC	U24EL706	Internship Evaluation	VII	1
8.	ELC	U24EL707	Major Project Phase -1 /Industrial Internship -1	VII	4
9.	ELC	U24EL804	Major Project Phase -2 /Industrial Internship -2	VIII	6
Total:					17

(vii) Indian Knowledge System Courses (IKSC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values - I)	Student Induction Programme	-
2.	IKSC	U24IK506B	Universal Human Values -II	V	2
3.	IKSC	U24IK606B	Essence of Indian Traditional Knowledge	VI	2
Total:					4

(viii) Multidisciplinary Open Electives Courses (MOPEC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	MOPEC 01	U24OE501YYX	MOPEC Elective -I	V	3
2.	MOPEC 02	U24OE701YYX	MOPEC Elective -II	VII	3
3.	MOPEC 03	U24OE801YYX	MOPEC Elective -III	VIII	3
Total:					9

(ix) Value Added Courses (VAC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	VAC 01	U24VA106	Sports & Yoga	I	-
2.	VAC 02	U24VA109	SEA - I / SAA-I	I	1
3.	VAC 03	U24CY206	Environmental Studies	II	-
4.	VAC 04	U24VA210	SEA-2 / SAA -2	II	1
5.	VAC 05	U24VA306	Soft & Interpersonal Skills	III	2
6.	VAC 06	U24VA309	SEA-3 / SAA -3	III	1
7.	VAC 07	U24VA406B	Quantitative Aptitude and Logical Reasoning	IV	2
8.	VAC 08	U24VA409	SEA - 4 / SAA - 4	IV	1
Total:					8

(x) Skill Enhancement Courses (SEC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	SEC 01	U24SE208	Programming Skill Development (PSD) Lab - 1	II	1
2.	SEC 02	U24SE307	Programming Skill Development (PSD) Lab - 2	III	1
3.	SEC 03	U24SE407	Programming Skill	IV	1

S. No.	Course Type	Course Code	Course Name	Semester	Credits
			Development (PSD) Lab - 3		
4.	SEC 04	U24SE507	Programming Skill Development (PSD) Lab - 4	V	1
5.	SEC 05	U24SE607	Programming Skill Development (PSD) Lab - 5	VI	1
Total:					5

(xi) Ability Enhancement Courses (AEC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	AEC 01	U24AE110	Expert Talk Series-1	I	1
2.	AEC 02	U24AE207	Idea Lab Makerspace	II	1
3.	AEC 03	U24AE211	Expert Talk Series-2	II	1
4.	AEC 04	U24AE310	Expert Talk Series-3	III	1
5.	AEC 05	U24AE410	Expert Talk Series-4	IV	1
6.	AEC 06	U24AE510	Expert Talk Series-5	V	1
7.	AEC 07	U24AE609	Expert Talk Series-6	VI	1
Total:					7

(xii) Startup and Entrepreneurship Courses (SEC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	STE 01	U24ST605X	Startups & Entrepreneurship Basket	VI	3
Total:					3

(xiii) Activity Based Learning (ABL) @ Value Added Courses:

Activity Based Learning (ABL) @ Value Added Courses

- Students are required to earn 4 credits through the first four semesters (2 credits from Social Empowerment Activities-SEA and 2 credits from Self Accomplishment Activities-SAA)
- If a student is not able to attend/ fulfill performance requirements, he/she shall be dropped from the course and will have to repeat by enrolling in the forthcoming semesters.
- The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i2RE) shall act as nodal units for activities listed under SEA/SAA.

Social Empowerment Activities - SEA

- These activities are designed to uplift and empower a group or community. The emphasis is on collective benefit, social change, and improving the conditions or capabilities of a community or specific group within society.
- These are categorized under four groups namely
 1. **Swachh Bharat** (Clean India)

The aim of activities under Swachh Bharat is to promote cleanliness, hygiene, and sanitation across India.
 2. **Shikshit Bharat**(Educated India)

The aim of activities under Shikshit Bharat is to ensure inclusive and equitable quality education for all, promoting lifelong learning opportunities.
 3. **Samruddha Bharat**(Prosperous India)

The aim of activities under Samrudha Bharat is to promote economic growth, self-reliance, and prosperity for all citizens.
 4. **Surakshit Bharat**(Safe India)

The aim of activities under Surakshit Bharat is to ensure the safety, security, and well-being of all citizens.

Self-Accomplishment Activities - SAA

- These activities are centered on individual growth, personal development, and self-improvement. The emphasis is on enhancing one's own skills, knowledge, and well-being.
- These are categorized under four groups namely
 1. **Socho Bharat** (Think India)

The aim of activities under Socho Bharat is to foster critical thinking, innovation, and intellectual development among citizens.
 2. **Sanskrit Bharat** (Cultured India)

The aim of activities under Sanskarit Bharat is to preserve, promote, and celebrate India's rich cultural heritage, traditional values, and ethical practices by nurturing morals, fostering social harmony and creating awareness and appreciation of India's rich history.
 3. **Saksham Bharat** (Empowered India)

The aim of activities under Saksham Bharat is to empower individuals and communities with the skills, resources, and opportunities needed to achieve self-reliance and economic independence by fostering physical fitness, discipline, teamwork leadership and mental resilience.

4. Sunder Bharat (Beautiful India)

The aim of activities under Sunder Bharat is to enhance the aesthetic and environmental beauty of India, making it a visually pleasing and environmentally sustainable country by emphasizing the importance of culture and heritage.

Table: SEA

Group	Guiding club/ center	Code of activity (U24VAYYY)*	Title of activity
SEA Group-1: Swachh Bharat	NSS	SE101	Clean India – Green India (River/Beach/Mohalla/School/Campus/Govt offices Cleaning)
		SE102	Waste Management/Waste Segregation Surveys
		SE103	Village Empowerment / NSS camp in village for a week
		SE104	Healthy habits-happy schools/Medical camps in schools / peer health
		SE105	Lifesaving skills / school clinics /First Aid training for a week
		SE106	Sustainable living /Surveys and Estimation for roof tops
		SE110	Any other activity approved by Dean Academic Affairs
SEA Group-2: Shikshit Bharat	Humanity Club	SE201	Peer mentoring /Mentoring of School Children
		SE202	Rural digital revolution / Digital Literacy for yielders & Participation in “Teach-for-India” movement
		SE203	Empowering learners -schools /Value addition for deprived schools
		SE204	Peer Mentoring /Mentoring junior (first year) students at KITSW
		SE205	Learning by Teaching /Teaching Assistantship at KITSW/Teaching AIDE
		SE206	Enriching Education/Development of learning material for schools/ITIs
		SE210	Any other activity approved by Dean Academic Affairs
SEA Group-3: Samruddha Bharat	C-i2RE	SE301	Great Grass Root Innovations
		SE302	Innovation and Creativity/ Critical Thinking and Problem solving
		SE303	Team work and collaboration
		SE304	Leadership & Entrepreneurship
		SE305	Design Thinking
		SE306	Work with START-UP at KITSW
		SE310	Any other activity approved by Dean Academic Affairs
SEA Group-4: Surakshit	NCC	SE401	NCC participation/National Integrity
		SE402	Basics of fire safety/Community safety
		SE403	Disaster Management
		SE404	Environmental health & sustainability
		SE405	Road safety

Bharat	SE406	Pollution control
	SE410	Any other activity approved by Dean Academic Affairs

Code of each activity shall be: U24VAYYY + activity code of SEA/SAA

Example: U24VAYYYSE101 (for the activity Clean India – Green India (River/ Beach/Mohalla /School/ Campus/ Govt offices Cleaning) under SEA Group1 Swacch Bharath)

Table: SAA

Group	Guiding club/ center	Code of activity (U24VAYYY)*	Title of activity
SAA Group-1: Socho Bharat	Literary Club	SA101	Study of Green & White Revolutions in India
		SA102	Study of any 2 Government Missions or National Policies
		SA103	Study of India's top 2 problems
		SA104	Study of World's top 2 problems
		SA105	Study of one department of the Central/ State Government
		SA106	Study of one of the identified Books on leadership or innovation
		SA110	Any other activity approved by Dean Academic Affairs
SAA Group-2: Sanskarit Bharat	Team - UHV	SA201	Values and Ethos of KITSW
		SA202	Philosophy of religion (any)
		SA203	Study of Life Management / Kindle Life / Life Empowerment and Enriching Program or any other book cited.
		SA204	Study of any of GREAT sons of INDIA (Ex. Gandhi, Ambedkar, Phule, Savarkar, Sardar Patel, Nehru, Shivaji, JRD Tata etc)
		SA205	Harmony in FAMILY & SOCIETY
		SA206	Harmony in NATURE
		SA210	Any other activity approved by Dean Academic Affairs
SAA Group-3: Saksham Bharat	Sports Club	SA301	Physical Fitness, Self-defence for Women, Target based Physical Exercise for example-Running (Test 5 kms in a stretch), Swimming (Test 1 km in a stretch), Walking (Test 20 kms in a stretch), Trekking (7days), Cycling
		SA302	Sports - Representation of Institute at University level/Inter college level and above in ANY sport
		SA303	Pran-vidya (Yoga & Pranayama), Jeevan-vidya (work-life balance)
	Technical club	SA304	Participation in National Tech Fest, AICTE-Hackathon, industry floated global and National competitions, Robocon, BAHA etc
		SA305	Participation in National level or State level bodies in professional bodies like ISTE/IEEE/CSI/IETE etc.
		SA306	Present research papers at National and international conferences

		SA310	Any other activity approved by Dean Academic Affairs
SAA Group-4: Sunder Bharat	MDF	SA401	Institute representation in prestigious cultural fests/competitions
		SA402	Dance (Bharatanatyam /Kathak /Lavani /Western Dance). <i>Only for beginners</i>
		SA403	Music composition / Learning musical instrument (Any type). <i>Only for beginners.</i>
		SA404	Film Appreciation/Dramatics/Seeing through Painting
		SA405	Making short film/Photography
		SA406	Sculptures (focusing on themes of unity, peace and environmental conservation)
		SA410	Any other activity approved by Dean Academic Affairs

Code of each activity shall be: U24VAYYY + activity code of SEA/SAA

Example: U24VAYYYSA101 (for the activity Study of Green & White Revolutions in India under SAA Group1 Socho Bharat)

13. SUMMARY OF CURRICULUM COMPONENTS

S.NO.	CATEGORY	COURSE COMPONENT	TOTAL COURSES	TOTAL CREDITS	CURRICULUM CONTENT (%OF CREDITS)
1	HSMC	Humanity, Social Sciences and Management Courses	3	6	3.53
2	BSC	Basic Science Courses	5	17	10.00
3	ESC	Engineering Science Courses	5	16	9.41
4	PCC	Program Core Courses	19	66	38.82
5	PEC	Program Elective Courses	4	12	7.06
6	MOPEC	Multidisciplinary Open Elective Courses	3	9	5.29
7	ELC	Experiential Learning Courses	9	17	10.00
8	IKSC	Indian Knowledge System Courses	3	4	2.35
9	VAC	Value Added Courses	8	8	4.71
10	SEC	Skill Enhancement Courses	5	5	2.94
11	AEC	Ability Enhancement Courses	7	7	4.12
12	STE	Startups and Entrepreneurship Courses	1	3	1.76
Total			72	170	100

The curriculum supports approximately 60% of Theory and 40% of Lab including PW. Online courses are optional.

14. SEMESTER WISE COURSE / CREDIT DISTRIBUTION

Semester	Number of Courses / Number of Credits (<i>Course Category wise</i>)												
	BSC	ESC	HSMC	PCC	MOPEC	PEC	SEC	VAC	ELC	AEC	IKSC	STE	TOTAL
I	2/7	3/8	1/2	-				2/1	1/1	1/1	1/-		11/20
II	2/7	2/8		1/3			1/1	2/1	1/1	2/2			11/23
III	1/3			4/14			1/1	2/3	1/1	1/1			10/23
IV				5/17			1/1	2/3	1/1	1/1			10/23
V			1/1	3/11	1/3		1/1		1/1	1/1	1/2	1/3	10/23
VI			1/3	3/11		1/3	1/1		1/1	1/1	1/2		09/22
VII				3/10	1/3	1/3			2/5				07/21
VIII					1/3	2/6			1/6				04/15
Total	5/17	5/16	3/6	19/66	3/9	4/12	5/5	8/8	9/17	7/7	3/4	1/3	72/170
% Weightage of Course Category	10% (17/170)	9.41% (16/170)	3.53% (6/170)	38.82% (66/170)	5.29% (9/170)	7.05% (12/170)	2.94% (5/170)	4.70% (8/170)	10% (17/170)	4.11% (7/170)	2.35% (4/170)	1.76% (3/170)	100 % (72/170)

* Seminar- 1 C , Mini Peoject- 1 C, Intership Evaluation-1C, Major Project : 4+6

B. Tech (CSE (Data Science)) –CURRICULUM (KITSW-URR24)
SEMESTER-WISE CURRICULUM WITH SCHEME OF INSTRUCTIONS

Abbreviations

L	Lecture Hour	O	Outside the Class Work (Self Study) Hours
T	Tutorial Hour	E	Total Engagement in Hours
P	Practical Hour	C	Credit Assigned

I SEMESTER

Stream – II

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	
-	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values - I)					-	
1	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	2	1	-	6	9	3
2	BSC	U24CY102B	Chemistry from Pool-III	2	1	2	5	10	4
3	ESC	U24EC111	Switching Theory and Logic Design	2	1	-	4	7	3
4	ESC	U24DS104	Programming for Problem Solving with C	2	1	2	5	10	4
5	HSMC	U24MH105	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA106	Sports & Yoga	-	-	2	2	4	-
7	ESC	U24ME107	Engineering Graphics through CAD	-	-	2	2	4	1
8	ELC	U24EL108	Practicum-I	-	-	-	4	4	1
9	VAC	U24VA109X XXXX	SEA - I/ SAA-I	-	-	-	2	2	1
10	AEC	U24AE110	Expert Talk Series-1	-	-	-	1	1	1
Total:				10	4	8	34	56	20
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				NIL					

Pool - III (Chemistry)		
S. No.	Course Code	Course Title
1.	U24CY102A	Engineering Chemistry (for Mechanical Engineering)
2.	U24CY102B	Engineering Chemistry (Common to CSM, CSD, CSN, CSO & IT)

II SEMESTER

Stream-II

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24PY202B	Physics from Pool-I	2	1	2	5	10	4
3	PCC	U24DS203	Computer Architecture and Organization	2	1	-	4	7	3
4	ESC	U24DS204	Data Structures through C	2	1	2	5	10	4
5	ESC	U24EE205B	Basic Electrical Engineering	2	1	2	5	10	4
6	VAC	U24CY206	Environmental Studies	2	-	-	2	4	-
7	AEC	U24AE207	Idea Lab Makerspace	-	-	2	2	4	1
8	SEC	U24SE208	Programming Skill Development (PSD) Lab - 1	-	-	2	2	4	1
9	ELC	U24EL209	Practicum-2	-	-	-	4	4	1
10	VAC	U24VA210X XXXX	SEA-2/ SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
Total:				12	5	10	38	65	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				NIL					

Pool - I (Physics)		
S. No.	Course Code	Course Title
1.	U24PY202A	Engineering Physics (for Mechanical Engineering)
2.	U24PY202B	Engineering Physics (Common to CSM, CSD, CSN, CSO & IT)

Pool - II (Basic Electrical Engineering)		
S. No.	Course Code	Course Title
1.	U24EE205A	Basic Electrical and Electronics Engineering (for Mechanical Engineering)
2.	U24EE205B	Basic Electrical Engineering (Common to CSM, CSD, CSN, CSO & IT)

Bridge Courses for exit:

Successful completion of two subjects (6-Credits) during 2-months internship at the institute
OR

Successful completion of two suitable skill based courses (external) to qualify for Certification

A. After First Year: (UG Certificate in CSE(Data Science))

(i) The candidate should pass any two of the following additional courses (ITI Level) during the 2-Months internship at institute

Exit Option to Qualify UG Certificate in CSE(Data Science): Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
12	PCC	U24DS212X	Introduction to Python Programming	2	-	2	-	4	3
13	PCC	U24 DS213X	Programming with Java	2	-	2	-	4	3
14	PCC	U24 DS214X	Introduction to Databases	2	-	2	-	4	3
15	PCC	U24 DS215X	Fundamentals of Computer Networks	2	-	2	-	4	3
16	PCC	U24 DS216X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify for Certification.

Exit Option to Qualify UG Certificate in CSE(Data Science): Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
17	SEC	U24SE217X	Core Python Programming Reference: https://www.netacad.com/courses/programming/pcap-programming-essentials-python	-	-	6	-	6	3
18	SEC	U24SE218X	Java Fundamentals Reference: https://learn.oracle.com/ols/learning-path/java-fundamentals/55593/55578	-	-	6	-	6	3
19	SEC	U24SE219X	Database Foundations Reference: https://academy.oracle.com/en/solutions-curriculum-database.html	-	-	6	-	6	3
20	SEC	U24SE220X	Introduction to Unix Operating System Reference: https://www.coursera.org/learn/hands-on-introduction-to-linux-commands-and-shell-scripting	-	-	6	-	6	3
21	SEC	U24SE221X	Networking Fundamentals Reference: https://www.netacad.com/courses/networking/ccna-introduction-networks	-	-	6	-	6	3
22	SEC	U24SE222X	Any other skill based course approved by BoS Chair and Dean AA	-	-	6	-	6	3

III SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	
1	BSC	U24MH301F	Essential Mathematics and Statistics for Data science	2	1	-	6	9	3
2	PCC	U24DS302	Advanced Data Structures	2	1	2	5	10	4
3	PCC	U24DS303	Operating Systems	2	1	-	5	10	3
4	PCC	U24DS304	Automata Theory and Compiler Design	2	1	-	4	7	3
5	PCC	U24DS305	Object Oriented Programming through Java	2	1	2	5	10	4
6	VAC	U24VA306	Soft & Interpersonal Skills	2	-	-	2	4	2
7	SEC	U24SE307	Programming Skill Development (PSD) Lab - 02	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309XX XXX	SEA-3/ SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
Total:				12	5	6	36	61	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				"Programming in C" bridge course for Non-CS/IT Lateral Entry students					

* Branch Specific Mathematics:

Branch Specific Mathematics (Pool-4)		
S. No.	Course Code	Course Title
1.	U24MH301A	Numerical and Statistical Methods (for Civil Engineering)
2.	U24MH301B	Applied Mathematics (for Mechanical Engineering)
3.	U24MH301C	Applied Mathematics (Common to ECI, EEE & ECE)
4.	U24MH301D	Discrete Mathematics and Probability Statistics (Common to CSE, CSN, CSO & IT)
5.	U23MH301E	Essential Mathematics and Statistics for Machine learning (for CSM)
6.	U24MH301F	Essential Mathematics and Statistics for Data science (for CSD)

* Dean AA will allot the courses QALR(Stream-I), Soft & Interpersonal Skills(Stream-II), to the branches as per Stream-I and Stream-II.

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	
1	PCC	U24DS401	Database Management Systems	2	1	2	5	10	4
2	PCC	U24DS402	Artificial Intelligence	2	1	-	5	10	3
3	PCC	U24DS403	Software Engineering	2	1	-	4	7	3
4	PCC	U24DS404	Computer Networks	2	1	-	4	7	3

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
5	PCC	U24DS405	Python Programming	2	1	2	5	5	4
6	VAC	U24VA406B	Quantitative Aptitude and Logical Reasoning	2	-	-	2	4	2
7	SEC	U24SE407	Programming Skill Development (PSD) Lab-3	-	-	2	2	4	1
8	ELC	U24EL408	Practicum-4	-	-	-	4	4	1
9	VAC	U24VA409XX XXX	SEA - 4/ SAA - 4	-	-	-	2	2	1
10	AEC	U24AE410	Expert Talk Series-4	-	-	-	1	1	1
11	VAC*	U24CY411*	Environmental Studies*	2*	1*	-	2*	5*	3*
Total:				12	5	6	34	59	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				NIL					

**For Lateral Entry Students Only*

* Dean AA will allot the courses QALR (Stream-II), Soft & Interpersonal Skills (Stream-I), to the branches as per Stream-I and Stream-II.

Bridge Courses for exit:

Successful completion of two subjects (6-Credits) during 2-months internship at the institute
OR

Successful completion of two suitable skill based courses (external) to qualify for Certification

B. After Second Year: (UG Diploma in CSE (Data Science))

(i) The candidate should pass any two of the following additional courses (Diploma Level) during the 2-Months internship at institute

Exit Option to Qualify UG Diploma in CSE (Data Science): Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24DS412X	Machine Learning	2	-	2	-	4	3
2	PCC	U24DS413X	Computer Vision and Image Processing	2	-	2	-	4	3
3	PCC	U24DS414X	Data Warehousing and Data Mining	2	-	2	-	4	3
4	PCC	U24DS415X	Web Technologies	2	-	2	-	4	3
5	PCC	U24EC416X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify for Diploma.

Exit Option to Qualify UG Diploma in in CSE (Data Science): Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE417X	Introduction to Machine Learning using Python Reference: https://www.shiksha.com/online-courses/machine-learning-course-dcodl2	-	-	6	-	6	3
2	SEC	U24SE418X	Introduction to Computer Vision Reference: https://onlinecourses.nptel.ac.in/no_c19_cs58/preview	-	-	6	-	6	3
3	SEC	U24SE419X	R Programming for Data Analytics Reference: https://onlinecourses.nptel.ac.in/no_c19_ma33/preview	-	-	6	-	6	3
4	SEC	U24SE420X	Pattern Discovery in Data Mining Reference: https://www.coursera.org/learn/data-patterns	-	-	6	-	6	3
5	SEC	U24SE421X	Introduction to Web Programming Reference: https://www.shiksha.com/online-courses/web-developer-version-2-course-nsnaskl2	-	-	6	-	6	3
6	SEC	U24SE422X	Software Testing Methodologies Reference: https://onlinecourses.nptel.ac.in/no_c22_cs61/preview	-	-	6	-	6	3
7	SEC	U24SE423X	Any other course approved by BoS Chair and Dean AA	-	-	6	-	6	3

B. Tech. Honours with Research:

Students opting for B. Tech Honours with Research, shall undergo a 2-Month Mandatory Research Internship-I (5 Credits) at respective department during the summer vacation after IV Semester.

V SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE501YYX	MOPEC Elective -I#	2	1	-	3	6	3
2	PCC	U24DS502	Web Programming	2	1	2	5	10	4
3	PCC	U24DS503	Design and Analysis of Algorithms	2	1	-	4	7	3
4	PCC	U24DS504	Predictive Analytics and Data Mining	2	1	2	5	10	4
5	HSMC	U24MB505X	Management Basket*	2	1	-	2	5	3
6	IKSC	U24IK506B	Universal Human Values-II	2	-	-	2	4	2
7	SEC	U24DS507	Programming Skill Development (PSD) Lab - 4	-	-	2	2	4	1
8	HSMC	U24MH508	Technical English	-	-	2	2	4	1
9	ELC	U24DS509	Seminar	-	-	-	2	2	1
10	AEC	U24AE510	Expert Talk Series-5	-	-	-	1	1	1
Total:				12	5	8	28	53	23
Additional Learning [@] :Maximum credits allowed for Honours/Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	28
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				NIL					

#MULTIDISCIPLINARY OPEN ELECTIVES: Student has to select one course as multidisciplinary open elective from any of the MOPEC Basket of courses offered by other departments.

* Dean AA will allot the courses S&E Basket (Stream-I), Management Course Basket (Stream-II), to the branches as per Stream-I and Stream-II.

[@]List of courses for additional learning through MOOCs towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula

Management Courses Basket		
S. No.	Course Code	Course Title
1.	U24MB505A	Management Economics and Accountancy
2.	U24MB505B	Industrial Psychology
3.	U24MB505C	E-Commerece and Digital Marketing
4.	U24MB505D	Organizational Behaviour
5.	U24MB505E	Any other course approved by BoS Chair and Dean AA

VI SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PEC	U24DS601X	Program Elective -I/ MOOCs-I	2	1	-	3	6	3
2	PCC	U24DS602	Computer Vision and Image Processing	2	1	-	4	7	3
3	PCC	U24DS603	Machine Learning	2	1	2	4	9	4

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	
4	PCC	U24DS604	DevOps	2	1	2	5	10	4
5	STE	U24ST605X	Startups & Entrepreneurship Basket*	2	1	-	2	5	3
6	IKSC	U24IK606B	Essence of Indian Traditional Knowledge	2	-	-	2	4	2
7	SEC	U24DS607	Programming Skill Development (PSD) Lab - 5	-	-	2	2	4	1
8	ELC	U24DS608	Mini Project	-	-	2	2	4	1
9	AEC	U24AE609	Expert Talk Series-6	-	-	-	1	1	1
Total:				12	5	8	25	50	22
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	27
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				NIL					

@List of courses for additional learning through MOOCs towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula

B. Tech Honours with Research:

Students opting for B. Tech Honours with Research, shall undergo a 2-Month Mandatory Research Internship-II(5 Credits) at respective department during the summer vacation after VI Semester.

Startups & Entrepreneurship Basket		
S. No.	Course Code	Course Title
1.	U24ST605A	Design Thinking
2.	U24ST605B	Innovative Product Design and Development
3.	U24ST605C	Entrepreneurship
4.	U24ST605D	Design Studio
5.	U24ST605E	Any other course approved by BoS Chair and Dean AA

Bridge Courses for exit:

Successful completion of two subjects (6-Credits) during 2-months internship at the institute
OR

Successful completion of two suitable skill based courses (external) to qualify for Certification

C. After Third Year:(B.Tech Voc. in CSE (Data Science):

(i) The candidate should pass any two of the following additional courses (Degree Level) during the 2-Months internship at institute

Exit Option to Qualify B. Voc in CSE (Data Science):: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24DS610X	Big Data Analytics	2	-	2	-	4	3
2	PCC	U24DS611X	Social and Information Network Analysis	2	-	2	-	4	3
3	PCC	U24DS612X	Ethical Hacking	2	-	2	-	4	3
4	PCC	U24DS613X	Cloud Computing	2	-	2	-	4	3

Exit Option to Qualify B. Voc in CSE (Data Science):: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
5	PCC	U24EC614X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify for B. Voc in CSE (Data Science) Degree.

Exit Option to Qualify B. Voc in CSE (Data Science): Any Two (02) Skill based Courses :									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE615X	Android Application Development Reference: https://nsdcindia.org/telecom-terminal-equipment-application-developer-android-application	-	-	6	-	6	3
2	SEC	U24SE616X	Big Data & Hadoop Reference: https://onlinecourses.nptel.ac.in/no_c20_cs92/preview	-	-	6	-	6	3
3	SEC	U24SE617X	Introduction to Robotic Process Automation Reference: https://onlinecourses.nptel.ac.in/no_c20_de11/preview	-	-	6	-	6	3
4	SEC	U24SE618X	Amazon Web Services Reference: AWS Fundamentals Specialization [3 courses] (AWS) Coursera	-	-	6	-	6	3
5	SEC	U24SE619X	Cyber Security Reference: https://onlinecourses.swayam2.ac.in/nou19_cs08/preview	-	-	6	-	6	3
6	SEC	U24SE620X	Augmented Reality & Virtual Reality Reference: https://www.coursera.org/learn/ar	-	-	6	-	6	3
7	SEC	U24SE621X	Any other skill based course approved by BoS Chair and Dean AA	-	-	6	-	6	3

VII SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE701YYX	MOPEC Elective -II	2	1	-	3	6	3
2	PEC	U24DS702X	Program Elective - II/ MOOCs-II	2	1	-	4	7	3
3	PCC	U24DS703	Big Data Analytics	2	1	2	4	7	4
4	PCC	U24DS704	Cloud Computing	2	1	-	4	7	3
5	PCC	U24DS705	Ethical Hacking	2	1	-	4	7	3
6	ELC	U24DS706	Internship Evaluation*	-	-	2	-	2	1
7	ELC	U24DS707	Major Project, Phase-1/ Industrial Internship - 1	-	-	8	6	12	4
Total:				10	5	12	25	50	21
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	-	25

#MULTIDISCIPLINARY OPEN ELECTIVES: Student has to select one course as multidisciplinary open elective from any of the MOPEC Basket of courses offered by other departments.

@ List of courses for additional learning through MOOCs towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula

B. Tech Honours with Research

Students opting for B. Tech Honours with Research, shall complete Research Methodology Course(4 Credits) through MOOCs (OR) a workshop / FDP of not less than one week on "Research Methodologies" (4 Credits).

Internship Evaluation for the students opting B. Tech Honours with Research,will be done onthe 2-Month Research internship-II.

VIII SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE801YYX	MOPEC Elective -III	2	1	-	3	6	3
2	PEC	U24DS802X	Program Elective - III/ MOOCs-III	2	1	-	4	7	3
3	PEC	U24DS803X	Program Elective - IV/ MOOCs-IV	2	1	-	4	7	3
4	ELC	U24DS804	Major Project, Phase - 2/ Industrial Internship - 2	-	-	12	4	16	6
Total:				6	3	12	15	36	15
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	-	19

#MULTIDISCIPLINARY OPEN ELECTIVES: Student has to select one course as multidisciplinary open elective from any of the MOPEC Basket of courses offered by other departments.

@ List of courses for additional learning through MOOCs towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula

B. Tech Honours with Research

Students opting for B. Tech Honours with Research, shall Publish a research paper in reputed journal indexed by SCI/ SCOPUS/Web of Science (4 Credits).

SUMMARY

SEMESTER	I	II	III	IV	V	VI	VII	VIII	TOTAL
CREDITS	20	23	23	23	23	22	21	15	170

MULTIDISCIPLINARY OPEN ELECTIVE COURSES (MOPEC) BASKETS:

Students those who opt open elective courses will be thinking to get introduced to the courses other than their program courses to start rooting their professional goals in their breadth component of study to explore the jobs in different fields. Hence the department shall carefully offer courses under the MOPEC Basket which create interest and impart basic knowledge and skills across the domains. For example the CS/IT MOPEC basket shall consist of courses like Introduction to AI&ML, Intro. To web programming, Intro to Computer Networking, Intro. to Operating Systems and etc.

(I) CIVIL ENGINEERING:CE-MOPEC BASKET

The following Courses will be offered by Civil Engineering Department under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01CEA	Engineering Mechanics
2	U24OEX01CEB	Strength of Materials
3	U24OEX01CEC	Fluid Mechanics
4	U24OEX01CED	Advanced Surveying
5	U24OEX01CEE	Energy Efficient Buildings
6	U24OEX01CEF	Net Zero Buildings
7	U24OEX01CEG	Forensic Engineering
8	U24OEX01CEH	Smart and Resilient Buildings
9	U24OEX01CEI	Infrastructure Engineering & Management
10	U24OEX01CEJ	Disaster Response & Preparedness
11	U24OEX01CEK	Introduction to Sustainable Development
12	U24OEX01CEL	Lifeline Services & Disasters
13	U24OEX01CEZ	Any other course approved by BoS Chair and Dean AA

(II) MECHANICAL ENGINEERING: ME-MOPEC BASKET

The following Courses will be offered by Mechanical Engineering Department under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01MEA	3D Printing Technologies
2	U24OE X01MEB	Joy of Mechanical Engineering
3	U24OE X01MEC	Introduction to Engineering Design
4	U24OE X01MED	Research Methodology
5	U24OE X01MEE	Thermal Science & Engineering
6	U24OEX01MEF	Automotive Pollution & Control
7	U24OEX01MEG	Applications of AI/ML in Mechanical Engineering
8	U24OEX01MEH	Computer Integrated Manufacturing
9	U24OEX01MEI	Elements of Automobile Engineering
10	U24OEX01MEJ	Finite Element Methods for Engineers
11	U24OEX01MEK	Design of Heat transfer equipment
12	U24OEX01MEL	Alternate Fuels
13	U24OEX01MEM	Digital Manufacturing
14	U24OEX01MEN	Industrial Engineering
15	U24OEX01MEO	Robotics Engineering
16	U24OEX01MEP	Composite Materials
17	U24OEX01MEQ	Jet Propulsion and Rocketry

18	U24OEX01MER	Cooling of Electronic Devices and circuits
19	U24OEX01MEZ	Any other course approved by BoS Chair and Dean AA

(III) ECE: EC -MOPEC BASKET

The following Courses will be offered by ECE and ECI DepartmentS under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01ECA	Analog and Digital Electronics
2	U24OEX01ECB	Digital Electronics
3	U24OEX01ECC	Signals and Systems
4	U24OEX01ECD	Computer Architecture and Organization
5	U24OEX01ECE	Embedded System Design
6	U24OEX01ECF	Microprocessor and Microcontrollers
7	U24OEX01ECG	Linear Integrated Circuits
8	U24OEX01ECH	Digital Image Processing
8	U24OEX01ECI	Principles of Communication Systems
10	U24OEX01ECJ	Digital Signal Processing and Applications
11	U24OEX01ECK	Basic VLSI Design
12	U24OEX01ECL	Radar Engineering
13	U24OEX01ECM	Optical Communications and Networks
14	U24OEX01ECN	Wireless and Mobile Communications
15	U24OEX01ECO	Satellite Communications
16	U24OEX01ECP	Wireless Sensor Networks
17	U24OEX01ECQ	Microwave Communications
18	U24OEX01ECR	Introduction to Nanotechnology
19	U24OEX01ELZ	Any other course approved by BoS Chair and Dean AA

(IV) ECI: CI-MOPEC BASKET

The following Courses will be offered by ECI Departments under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01CIA	Fundamentals of Instrumentation
2	U24OEX01CIB	Switching Theory and Logic Design
3	U24OEX01CIC	Signals and Systems
4	U24OEX01CID	Digital Signal Processing and Applications
5	U24OEX01CIE	Sensors and Actuators
6	U24OEX01CIF	Fundamentals of VLSI
7	U24OEX01CIG	LabVIEW Programming
8	U24OEX01CIH	PLC and DCS
8	U24OEX01CII	Microcontrollers and Applications
10	U24OEX01CIJ	Internet of Things
11	U24OEX01CIK	Non - Destructive Testing
12	U24OEX01CIZ	Any other course approved by BoS Chair and Dean AA

(V) CSE: CS-MOPEC BASKET

The following Courses will be offered by CSE Departments under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01CSA	Operating Systems
2	U24OEX01CSB	Design and Analysis of Algorithms
3	U24OEX01CSC	Software Engineering
4	U24OEX01CSD	Compiler Design
5	U24OEX01CSE	Data Mining
6	U24OEX01CSF	Cryptography & Network Security
7	U24OEX01CSG	High Performance Computing
8	U24OEX01CSH	Software Quality Assurance & Testing
9	U24OEX01CSZ	Any other course approved by BoS Chair and Dean AA

(VI) IT ENGINEERING: IT-MOPEC BASKET

The following Courses will be offered by IT Departments under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01ITA	Computer Networks
2	U24OEX01ITB	Ethical hacking
3	U24OEX01ITC	Programming with C++
4	U24OEX01ITD	Web Design Technologies
5	U24OEX01ITE	Software Project Management
6	U24OEX01ITF	Java Full stack development
7	U24OEX01ITG	DevOps
8	U24OEX01ITH	NET Programming
9	U24OEX01ITI	Software Testing and Quality Assurance
10	U24OEX01ITZ	Any other course approved by BoS Chair and Dean AA

(VII) ELECTRICAL ENGINEERING: EE-MOPEC BASKET

The following Courses will be offered by EEE Department under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01EEA	Linear Control Systems
2	U24OEX01EEB	Introduction to Electric Vehicles
3	U24OEX01EEC	Renewable Energy Systems
4	U24OEX01EED	Smart Electric Grid
5	U24OEX01EEE	Generation & Utilisation of Electric Energy
6	U24OEX01EEF	Energy Auditing
7	U24OEX01EEG	Network Analysis and Synthesis
8	U24OEX01EEH	Power Electronics
9	U24OEX01EEZ	Any other course approved by BoS Chair and Dean AA

(VIII) CSE (DATA SCIENCE): DS-MOPEC BASKET

The following Courses will be offered by CSE(D) Department under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01DSA	Exploratory Data Analysis with R Programming

2	U24OEX01DSB	Predictive Analytics and Data Mining
3	U24OEX01DSC	Big data Analytics
4	U24OEX01DSD	Machine Learning
5	U24OEX01DSE	Deep Learning
6	U24OEX01DSF	Data Visualization
7	U24OEX01DSG	Social and Information Network Analysis
8	U24OEX01DSH	Web Scraping with Python
9	U24OEX01DSI	Introduction to MLOps
10	U24OEX01DSZ	Any other course approved by BoS Chair and Dean AA

(IX) CSE (AI & ML) : AI-MOPEC BASKET

The following Courses will be offered by the CSE(AM&ML) Department under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01AIA	Artificial Intelligence
2	U24OEX01AIB	Machine Learning
3	U24OEX01AIC	Deep Learning
4	U24OEX01AID	Computer Vision and Image Processing
5	U24OEX01AIE	Natural Language Processing
6	U24OEX01AIF	Exploratory Data Analysis with Python
7	U24OEX01AIG	Robotic Process Automation
8	U24OEX01AIH	Prompt Engineering for Generative AI
9	U24OEX01AII	MLOps Architecture for LLMs
10	U24OEX01AIZ	Any other course approved by BoS Chair and Dean AA

(X) CSE (NETWORKS): CN-MOPEC BASKET

The following Courses will be offered by CSE(N) Department under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01CNA	Computer Networks
2	U24OEX01CNB	Cloud Computing
3	U24OEX01CNC	Block Chain Technologies
4	U24OEX01CND	Internetworks and Virtualization
5	U24OEX01CNE	Network Automation
6	U24OEX01CNF	Platforms and System Security
7	U24OEX01CNG	Data Centre Networking
8	U24OEX01CNH	Fundamentals of Cyber Security & Tools
9	U24OEX01CNI	SDN for real networks
10	U24OEX01CNZ	Any other course approved by BoS Chair and Dean AA

(XI) CSE (IOT) : IN-MOPEC BASKET

The following Courses will be offered by CSE(IOT) Department under MOPEC basket to the students of other branches:

V/VII/VIII SEMESTER		
1	U24OEX01INA	Programming with IoT boards
2	U24OEX01INB	Python for IoT
3	U24OEX01INC	IoT Architecture and Protocols
4	U24OEX01IND	Artificial IoT

5	U24OEX01INE	IoT frameworks
6	U24OEX01INF	IIoT
7	U24OEX01ING	Cyber Physical Systems
8	U24OEX01INH	Privacy & Security for IoT
9	U24OEX01INI	Edge and fog computing
10	U24OEX01INZ	Any other course approved by BoS Chair and Dean AA

(XII) MATHEMATICS: MT-MOPEC BASKET

The following Courses will be offered by M&H Department under MOPEC basket to the students of all branches:

V/VII/VIII SEMESTER		
1	U24OEX01MTA	Operations Research
2	U24OEX01MTB	Computational Number Theory
3	U24OEX01MTC	Integral Equations & Integral Transforms
4	U24OEX01MTD	Fuzzy Set Theory and Its Applications
5	U24OEX01MTE	Complex Analysis and Applications
6	U24OEX01MTF	Discrete Mathematics and Graph Theory
7	U24OEX01MTA	Partial Differential Equations and Applications
8	U24OEX01MTB	Probability Theory and Stochastic Processes
9	U24OEX01MTC	Descriptive Statistics with R software
10	U24OEX01MTD	Numerical Linear Algebra
11	U24OEX01MTE	Applied Linear Algebra in AI and ML
12	U24OEX01MTF	Matrix Computation and Applications
13	U24OEX01MTA	Reliability Theory
14	U24OEX01MTB	Numerical Methods for Partial Differential Equations
15	U24OEX01MTZ	Any other course approved by BoS Chair and Dean AA

(XIII) ENGLISH :EN-MOPEC BASKET

The following Courses will be offered by M&H Department under MOPEC basket to the students of all branches:

V/VII/VIII SEMESTER		
1	U24OEX01ENA	Creative Writing
2	U24OEX01ENB	Public Speaking
3	U24OEX01ENC	Conversational English
4	U24OEX01END	Exam Skills
5	U24OEX01ENE	English for Competitive Examinations
6	U24OEX01ENF	Comprehensive Reading
7	U24OEX01ENG	Corporate Writing
8	U24OEX01ENH	Scientific English
9	U24OEX01ENI	Foundation for IELTS/TOEFL
10	U24OEX01ENJ	Narrative Skills
11	U24OEX01ENK	Professional Writing
12	U24OEX01ENL	English Language Enhancement
13	U24OEX01ENZ	Any other course approved by BoS Chair and Dean AA

(XIV) PHYSICS: PY-MOPEC BASKET

The following Courses will be offered by PS Department under MOPEC basket to the

students of all branches:

V/VII/VIII SEMESTER		
1	U24OEX01PYA	Science and Technology of Non-Conventional Energy
2	U24OEX01PYB	Laser Systems for Industrial and Engineering Applications
3	U24OEX01PYC	Optical Fiber Communication
4	U24OEX01PYD	Nanomaterials
5	U24OEX01PYE	Fundamentals of Electromagnetism
6	U24OEX01PYF	Solid State Physics
7	U24OEX01PYG	Modern Materials
8	U24OEX01PYH	Experimental Physics
9	U24OEX01PYI	Thermodynamics
10	U24OEX01PYZ	Any other course approved by BoS Chair and Dean AA

(XV) CHEMISTRY:CY-MOPEC BASKET

The following Courses will be offered by PS Department under MOPEC basket to the students of all branches:

V/VII/VIII SEMESTER		
1	U24OEX01CYA	Nano Bio-Technology
2	U24OEX01CYB	Computational Chemistry
3	U24OEX01CYC	Biosensors and Applications
4	U24OEX01CYD	Fundamentals of Quantum Chemistry
5	U24OEX01CYE	Stereochemistry
6	U24OEX01CYF	Advanced Polymer Chemistry
7	U24OEX01CYG	Principles and Applications of NMR Spectroscopy
8	U24OEX01CYH	Organic Reaction Mechanisms
9	U24OEX01CYI	Basic Organic Chemistry
10	U24OEX01CYZ	Any other course approved by BoS Chair and Dean AA

(XVI) COMMERCE & MANAGEMENT :CM-MOPEC BASKET

The following Courses will be offered by MBA Department under MOPEC basket to the students of all branches:

V/VII/VIII SEMESTER		
1	U24OEX01CMA	Principles of Accountancy
2	U24OEX01CMB	Finance for Engineers
3	U24OEX01CMC	Management Principles
4	U24OEX01CMD	Organizational Behavior
5	U24OEX01CME	Project Management
6	U24OEX01CMF	Operations Management
7	U24OEX01CMG	Consumer Psychology
8	U24OEX01CMH	Principles of Marketing Management
9	U24OEX01CMZ	Any other course approved by BoS Chair and Dean AA

(XVII) LIBERAL ARTS* :LI-MOPEC BASKET

Students opting Liberal Art courses under MOPEC shall complete the courses through SWAYAM / NPTEL or any other MOOCS platform:

V/VII/VIII SEMESTER		
1	U24OEX01LIA	Indian Language-I
2	U24OEX01LIB	Indian Language-II

3	U24OEX01LIC	Psychology for Well-Being
4	U24OEX01LID	Foreign Language-I
5	U24OEX01LIE	Foreign Language-II
6	U24OEX01LIF	Introduction to Indian Art -An Appreciation
7	U24OEX01LIG	Drama Appreciation
8	U24OEX01LIH	Cultural Studies
9	U24OEX01LIH	Film Appreciation
10	U24OEX01LIJ	Ethics in Engineering Practice
11	U24OEX01LIZ	Any other course approved by BoS Chair and Dean AA

* Through MOOCS only

(XVIII) ARTS*: AR-MOPEC BASKET

Students opting Arts courses under MOPEC shall complete the courses through SWAYAM / NPTEL or any other MOOCS platform:

V/VII/VIII SEMESTER		
1	U24OEX01ARA	Anthropolgy
2	U24OEX01ARB	Ancient India
3	U24OEX01ARC	Constitution of INDIA
4	U24OEX01ARD	Medieval India
5	U24OEX01ARE	Geography
6	U24OEX01ARF	Modern India
7	U24OEX01ARG	Indian Polity
8	U24OEX01ARH	Indian Economy
9	U24OEX01ARZ	Any other course approved by BoS Chair and Dean AA

* Through MOOCS only

(XIX) LAW*: LW-MOPEC BASKET

Students opting Laws courses under MOPEC shall complete the courses through SWAYAM / NPTEL or any other MOOCS platform:

V/VII/VIII SEMESTER		
1	U24OEX01LWA	Law for Engineers
2	U24OEX01LWB	Environmental Law
3	U24OEX01LWC	Labour Law
4	U24OEX01LWD	IPR and Patent Law
5	U24OEX01LWE	Industrial Law
6	U24OEX01LWF	Companye Law
7	U24OEX01LWG	Administrative Law
8	U24OEX01LWH	Alternative Dispute Resoluion
9	U24OEX01LWZ	Any other course approved by BoS Chair and Dean AA

(XX) I²RE :IE-MOPEC BASKET

Students opting I²RE courses under MOPEC shall complete the courses through SWAYAM / NPTEL or any other MOOCS platform:

V/VII/VIII SEMESTER		
1	U24OEX01IEA	Understanding Incubation & Entrepreneurship
2	U24OEX01IEB	Innovation, Business Models & Entrepreneurship
3	U24OEX01IEC	Innovation & Startup Policy
4	U24OEX01IED	Entrepreneurship & IP Strategies

5	U24OEX01IEE	Digital Marketing Strategies
6	U24OEX01IEF	Leadership, Innovation and Entrepreneurship
7	U24OEX01IEG	Economics of Innovation
8	U24OEX01IEH	Strategic Management
9	U24OEX01IEI	Social Innovation in Industry 4.0
10	U24OEX01IEJ	Design, Technology & Innovation
11	U24OEX01IEZ	Any other course approved by BoS Chair and Dean AA

PROGRAM ELECTIVE COURSES (PEC)

There are four slots allotted to Program Elective Courses (PECs)

VERTICAL/ PE	PE1	PE2	PE3	PE4
VERTICAL 1: Visual Computing	U24DS601A: Deep Learning	U24DS702A: Natural Language Processing with Transformers	U24DS802A: Prompt Engineering for Generative AI	U24DS803A: MLOps Architecture for LLMs
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			
VERTICAL 2: Computer Communications and Cyber Security	U24DS601B: Advanced Computer Networks	U24DS702B: Cryptography and Network Security	U24DS802B: Block Chain Technologies	U24DS803B: Cyber Security and Digital Forensic
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			
VERTICAL 3: Internet of Things	U24DS601C: Fundamentals of IoT	U24DS702C: IoT Architectures and Protocols	U24DS802C: Industrial IoT	U24DS803C: Privacy and Security in IoT
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			
VERTICAL 4: Data Analytics	U24DS601D: Exploratory Data Analysis with R Programming	U24DS702D: Social and Information Network Analysis	U24DS802D: Web Scraping with Python	U24DS803D: Introduction to MLOps
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			
VERTICAL 5: Programming	U24DS601E: Mobile Application Development	U24DS702E: UNIX Shell Programming	U24DS802E: Introduction to NoSQL	U24DS803E: Matlab
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			

I SEMESTER**Stream – II**

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
-	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values - I)						-
1	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	2	1	-	6	9	3
2	BSC	U24CY102B	Chemistry from Pool-III	2	1	2	5	10	4
3	ESC	U24EC111	Switching Theory and Logic Design	2	1	-	4	7	3
4	ESC	U24DS104	Programming for Problem Solving with C	2	1	2	5	10	4
5	HSMC	U24MH105	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA106	Sports & Yoga	-	-	2	2	4	-
7	ESC	U24ME107	Engineering Graphics through CAD	-	-	2	2	4	1
8	ELC	U24EL108	Practicum-I	-	-	-	4	4	1
9	VAC	U24VA109X XXXX	SEA - I/ SAA-I	-	-	-	2	2	1
10	AEC	U24AE110	Expert Talk Series-1	-	-	-	1	1	1
Total:				10	4	8	34	56	20
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				NIL					

DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS			
Class: B.Tech. I -Semester		Branch: Common to all branches	
Course Code:	U24MH101	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-6-9	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: convergence of an infinite series and differential calculus			
LO2: partial differentiation and its applications			
LO3: differential equations of first order and first degree along with certain applications			
LO4: higher order linear differential equations and applications			
UNIT-I			9 Hrs
Infinite Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests-Limit form, Integral test, D'Alembert's Ratio test, Cauchy's root test			
Differential Calculus and its applications: Fundamental theorems-Rolle's theorem (Geometrical interpretation), Lagrange's mean value theorem (Geometrical interpretation), Cauchy's mean value theorem, Taylor's theorem (Generalized mean value theorem), Expansions of functions- Maclaurin's series, Taylor's series, Maxima and Minima-Conditions, Practical problems (rectangle, right circular cylinder, cone)			
<i>Self-Learning Topics (SLTs): Review of basic concepts of limit, continuity and differentiability [Reference 1: topic (3.1,3.2,3.5,4.1)]</i>			
<i>Alternating series [(Text 1: topic 9.12, Solved problems: 9.16,9.17, Practice problems: exercise 9.7(1, 7)]</i>			
<i>Additional problems on fundamental theorems [(Text 1: topic 4.3, Solved problems: 4.13(i),4.14,4.17, Practice problems: exercise 4.4 (1(i),1(ii), 3(ii), 10(i), 10(ii))]</i>			
<i>Additional problems on Maclaurin's series [(Text 1: topic 4.4, Solved problems: 4.20, Practice problems: exercise 4.5 (3, 5)]</i>			
UNIT-II			9 Hrs
Partial differentiation and its applications: Functions of two or more variables, Partial derivatives, Total derivative, Change of variables, Jacobians, Functional relationship, Geometrical Interpretation-Tangent plane and Normal to a surface, Taylor's theorem for function of two variables (without proof), Errors and approximations, Total differential, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers, Differentiation under the integral sign			
<i>Self-Learning Topics (SLTs):</i>			
<i>Leibnitz rule of Differentiation under the integral sign for variable limits [(Text 1: topic 5.13(2)), Solved problems: 5.54, Practice problems: exercise 5.11 (1)]</i>			
<i>Additional problems on maxima and minima of function of two variables [(Text 1: topic 5.11 (1), Solved problems: 5.42, 5.43, Practice problems: exercise 5.10 (1(i),1(ii),1(iii))].</i>			
<i>Additional problems on Lagrange's methods of undetermined multipliers [(Text 1: topic (5.12), Solved problems: 5.45, 5.48, Practice problems: exercise 5.10 (3(i) ,3(ii))]</i>			

UNIT-III	9 Hrs
<p>Differential equations of first order (DE): Reorientation of differential equation of first order and first degree (Formation a differential equation, variables separable method, homogeneous equations, Linear equations), Exact differential equations, Equations reducible to exact equations,</p> <p>Applications of differential equations of first order: Orthogonal trajectories - Orthogonal trajectories of the family of curves $f(x, y, c)=0$, Physical applications- Motion of a boat across a stream, Resisted motion, Velocity of escape from the earth, Simple electric circuits - RL series circuit, Newton's law of cooling, Rate of decay of Radio-active materials, Rate of growth of population</p> <p>Self-Learning Topics (SLTs): Review of DEs of first order (Text 1: topic 11.1, 11.2, 11.3, 11.4,11.5) Solutions of Non-exact DEs by Inspection Method [(Text 1: topic 11.12(1), Solved Problems: 11.30, Practice problems: exercise 11.8 (1,3)] Additional problems on Non-exact DEs [(Text 1: topic 11.12(2,3,4,5), Solved problems: 11.33,11.35,11.36, Practice problems: exercise 11.8 (9,15)] Orthogonal Trajectories of family of curves in polar coordinates [(Text 1: topic 12.3(3), Solved problems :12.7,12.8 , Practice problems: exercise 12.2(9,10)]</p>	
UNIT-IV	9 Hrs
<p>Linear differential equations: Linear differential equations with constant coefficients, Rules for finding complementary function, Inverse operator, Rules for finding the particular integral ($Q=e^{ax}$, $\sin(ax+b)$ or $\cos(ax+b)$, x^m and $e^{ax}V(x)$), Method of variation of parameters, Linear dependence of solutions</p> <p>Applications of linear differential equations: Simple harmonic motion, Simple pendulum, Oscillations of spring, Oscillatory electrical circuit-LCR circuit, Electro-mechanical analog</p> <p>Self-Learning Topics (SLTs): Finding the particular integral of $Q(x) = x^m V(x)$ [(Text 1: topic 13.7, Solved problems: 13.16,13.17,13.19, Practice problems: exercise 13.2 (21,22)]. Additional problems on method of variation of parameters [(Text 1: topic 13.8(1), Solved problems: 13.25, 13.26, Practice problems: exercise 13.3(1,5)] Cauchy's homogeneous linear differential equation [(Text 1: topic 13.9(1), Solved problems: 13.31,13.34, Practice problems: exercise 13.4(3,6,9)]</p>	
<p>Course Learning Outcomes (COs): After completion of this course, the students should be able to...</p> <p>CO1: examine the convergence of a series and interpret mean value theorems.</p> <p>CO2: apply partial differentiation to functions of several variables in solving various engineering problems.</p> <p>CO3: apply appropriate methods of differential equations of first order and first degree to solve real life engineering problems.</p> <p>CO4: analyze the solutions of higher order linear differential equation with constant coefficients</p>	
<p>Textbook(s):</p>	

1. Grewal, B.S., *Higher Engineering Mathematics*, Khanna Publishers, Delhi, 44th edition, 2017

Reference Book(s):

1. Shanti Narayan, Dr. Mittal P.K, *Differential Calculus*, S. Chand & Co., New Delhi, 1st edition, Reprint 2014
2. Kreyszig E, *Advanced Engineering Mathematics*, Inc, U.K, John wiley & sons, 10th edition, 2020
3. S.S. Sastry, *Engineering Mathematics, Vol.II*, Prentice Hall of India, 3rd edition, 2014.

Web and Video link(s):

1. <https://youtu.be/4EYko9rdF7g?si=WUu12> NPTEL Video Lecture on Infinite series by Prof. S.K.Ray, Professor of Mathematics, IITK Kanpur.
2. https://youtu.be/0apMXhWG_W8?si=M-abw2Gq3buX5HLM NPTEL Video Lecture on Fundamental mean value theorems by Prof. Jithedra Kumar, Professor of Mathematics, IITK Kharagpur.
3. <https://youtu.be/6r5jft8xrXM?si=ryLXYVJr4-iUkdIV>; NPTEL Video Lecture on Exact Differential Equations, Prof. Jithedra Kumar, Professor of Mathematics, IIT Kharagpur.
4. https://youtu.be/kbGhrqV9AOM?si=yGyK_V7kJKGa3OaR NPTEL Video Lecture on Orthogonal Trajectories of family of curves by Prof. Aditya Sharma, Professor of Physics, IISE Bhopal.
5. <https://youtu.be/btOCUmJkrng?si=zq3nB00kplm7b5se>; NPTEL Video Lecture on Higher Order Linear Differential Equations, Prof. Jithedra Kumar, Professor of Mathematics, IIT Kharagpur.

Course Articulation Matrix (CAM):		U24MH101 DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24MH101.1	2	2	1	1	-	-	-	1	1	1	1	1	1	1
CO2	U24MH101.2	2	2	1	1	-	-	-	1	1	1	1	1	1	1
CO3	U24MH101.3	2	2	1	1	-	-	-	1	1	1	1	1	1	1
CO4	U24MH101.4	2	2	1	1	-	-	-	1	1	1	1	1	1	1
U24MH101		2	2	1	1	-	-	-	1	-	1	1	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

ENGINEERING CHEMISTRY (Common to CSM, CSD, CSN, CSO & IT)			
Class: B.Tech. I Semester		Branches: CSM, CSD, CSN, CSO& IT	
Course Code:	U24CY102B	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60%
Total Number of Teaching Hours:	60 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: electrochemical energy systems, batteries and fuel cells			
LO2: water analysis and corrosion with its preventive methods			
LO3: engineering materials and spectroscopic techniques of chemical analysis			
LO4: polymers, principles of green chemistry and their applications			
THEORY COMPONENT			
UNIT-I		9 Hrs	
<p>Electrochemical Technology and Engineering: Introduction, Specific conductance, Equivalent conductance, Effect of dilution; Conductometric titrations-Acid base titrations-Strong acid vs strong base, Strong acid vs weak base, Weak acid vs strong base, Weak acid vs weak base, Advantages of conductometric titrations; Galvanic cell, Electrode potential, Electrochemical series, Nernst equation; Potentiometric titrations-Acid base titrations and advantages of potentiometric titrations</p> <p>Batteries: Classification, Lead-acid battery, Li-ion battery</p> <p>Fuel cells: Hydrogen-oxygen fuel cell</p> <p><i>Self Learning Topics (SLTs):</i> Types of conductors (Text 1: Jain & Jain: chapter 5 topic 1), Ohms law (Text 1: Jain & Jain: chapter 5 topic 5)</p>			
UNIT-II		9 Hrs	
<p>Applied Chemistry:</p> <p>Water Technology: Introduction, Hardness of water, Estimation of hardness of water by complexometry, Alkalinity, Determination of alkalinity, Numerical problems. Determination of dissolved oxygen (DO), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Softening methods-Ion exchange method, Desalination processes, Reverse osmosis; Quality parameters of potable water (BIS and WHO)</p> <p>Corrosion: Introduction, Dry corrosion, Pilling-Bedworth rule, Wet corrosion; Factors effecting corrosion-Purity of the metal, Relative areas of anodic and cathodic parts, Nature of surface film, Humidity, pH and Temperature; Prevention methods of corrosion-Cathodic protection- Impressed current cathodic protection, Sacrificial anodic protection</p> <p><i>Self Learning Topics (SLTs):</i> Units of hardness (Text 1: Jain & Jain chapter 1 topic 5), Introduction to corrosion (Text 1: Jain & Jain: chapter 7 topic 1)</p>			
UNIT-III		9 Hrs	
<p>Engineering Materials: Nanomaterials-Introduction, Synthesis of nanomaterials- Top down and bottom-up approaches, Synthesis by sol-gel method; Nanoscale materials-Fullerenes, Carbon nanotubes and Graphene, Properties and applications, Biosensors</p> <p>Spectroscopy: Introduction to spectroscopy, Microwave spectroscopy-Principle, Selection rules, Applications; Infra-red spectroscopy-Principle, Selection rules, Applications; UV Spectroscopy-Lambert-Beer's law and its applications</p> <p><i>Self Learning Topics (SLTs):</i> Introduction to nanotechnology (Text 1: Jain & Jain: chapter 37 topic 1), Electromagnetic spectrum (Text 1: Jain & Jain; chapter 35 topic 1)</p>			

UNIT-IV	9 Hrs
<p>Polymers: Introduction, Monomer, Polymer, Types of polymerization reactions- Addition and condensation; Preparation, Properties and Applications- Polythene, Polyvinyl cyanide, Polyvinyl chloride, Bakelite, Nylon 6:6; Thermosetting resins and thermoplastic resins; Conducting polymers and their applications</p> <p>Green Chemistry: Principles of green chemistry, Synthesis of adipic acid by traditional pathway and green pathway; Green methods in electronic production, Impact of electronic waste on environment and public health</p> <p>Self Learning Topics (SLTs): Mechanism of addition polymerization (Text 1: Jain & Jain: chapter 3, topic 6); Alternative solvents for green synthesis ((Text 2: Jain & Jain: chapter 36, topic 5)</p>	
LABORATORY COMPONENT	
List of Experiments	
<ol style="list-style-type: none"> 1. Estimation of hydroxide ion by acidimetry using standard sodium carbonate solution 2. Estimation of alkalinity of water sample containing (i) carbonate; (ii) carbonate & bi carbonate in ground water 3. Estimation of alkalinity of water sample containing (i) bicarbonate; (ii) carbonate & hydroxide in potable water 4. Determination of hardness of water by complexometric method 5. Determination of dissolved oxygen in a sample of water 6. Standardization of sodium hydroxide (NaOH) by conductometry using standard hydrochloric acid (HCl) 7. Standardization of acetic acid (CH₃COOH) by conductometry using standard sodium hydroxide (NaOH) 8. Standardization of strong acid hydrochloric acid (HCl) by potentiometry using standard sodium hydroxide (NaOH) 9. Colorimetric analysis-verification of Lambert-Beer's law 10. Estimation of ferrous (Fe²⁺) ion in the given solution using potassium permanganate 11. Preparation of nanoparticles of cadmium sulphide (CdS) 12. Synthesis of polymer (phenol- formaldehyde) 	
Text Book(s):	
<ol style="list-style-type: none"> 1. Jain and Jain, <i>Engineering Chemistry</i>, Dhanpat Rai Publishing Company, 17th Edn., 2019 (chapters 1, 3, 5, 6, 7, 35, 36, 37) 2. Dornfeld, D.A., <i>Green manufacturing: fundamentals and applications</i>, Springer Science & Business Media, 2012 (chapters 5, 8, 9) 	
Reference Book(s):	
<ol style="list-style-type: none"> 1. J.C.Kuriacose and J.Rajaram, <i>Chemistry in Engineering and Technology</i>(vol.I), Tata Mc. Graw-Hills Education Pvt. Ltd., 2010 2. Shashi Chawla, <i>Text book of Engineering Chemistry</i>, 3rdEdn., Dhanpat Rai Publishers, 2003 3. S.S. Dara, S.S. Umare, <i>A Text book of Engineering Chemistry</i>, 12thEdn., S.Chand & Company Ltd., 2010 	
Web and Video link(s):	
<p>https://elearn.nptel.ac.in/shop/iit-workshops/completed/battery-cell-technology-materials-and-industrial-applications/?v=c86ee0d9d7ed NPTEL Video Lecture on Battery technology by Dr. Kothandaraman, Professor of Chemistry, IIT Madras & Dr. Raghunathan, Professor of Chemical engineering, IIT Madras</p>	
Laboratory Manual (for laboratory component):	

1. *Engineering Chemistry Laboratory manual, Department of PS, KITSW*

Course Learning Outcomes (COs)

*After completion of this course, the students should be able to,
(based on cognitive skills acquired from theory component)*

CO1: apply the concepts of electrochemical energy systems for batteries and fuel cells

CO2:interpret suitable techniques of water analysis and corrosion treatment of solid materials

CO3: apprise manufacturing of engineering materials and spectroscopic techniques of chemical analysis

CO4: apprise the synthesis,applications of engineering materials and principles of green chemistry

(based on psychomotor skills acquired from laboratory component)

CO5: determine water quality parameters-alkalinity, hardness

CO6: make use of analytical instruments for chemical analysis

CO7: determine metals present in their ores

CO8: design the synthesis ofnanomaterial and polymer

Course Articulation Matrix (CAM):		U24CY102B-ENGINEERING CHEMISTRY (Common to CSM, CSD, CSN, CSO & IT)													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24CY102B.1	2	-	-	-	1	1	1	1	1	1	1	1	1	1
CO2	U24CY102B.2	2	-	-	-	1	1	1	1	1	1	1	1	1	1
CO3	U24CY102B.3	2	-	-	-	1	1	-	1	1	1	1	1	1	1
CO4	U24CY102B.4	2	-	-	-	1	2	2	1	1	1	1	1	1	1
CO5	U24CY102B.5	2	1	-	-	-	1	-	1	1	1	1	1	1	1
CO6	U24CY102B.6	2	1	-	-	2	1	-	1	1	1	1	1	1	1
CO7	U24CY102B.7	2	1	-	-	-	1	-	1	1	1	1	1	1	1
CO8	U24CY102B.8	2	1	-	-	-	1	-	1	1	1	1	1	1	1
U24CY102B		2.00	1.00	-	-	1.20	1.12	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3 - HIGH, 2 - MEDIUM, 1 - LOW															

SWITCHING THEORY AND LOGIC DESIGN			
Class: B.Tech. I -Semester		Branch: Common to ECE, CSM, CSD	
Course Code:	U24EC111	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-6-9	CIE :	60%
Total Number of Teaching Hours:	36 Hrs	ESE :	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: number system and binary codes, minimization of switching functions.			
LO2: combinational circuits design and implementation using logic gates, adders/subtractors, multiplexer and decoders.			
LO3: implementation of sequential circuits, counters, registers using flip flops and logic gates.			
LO4: finite state machines and its minimization.			
UNIT-I		9 Hrs	
Number Systems: Review of number systems, binary weighted and non-weighted codes, binary arithmetic, 1's & 2's complement subtraction, error detecting and correcting codes, Hamming code.			
Boolean Algebra: Postulates and theorems, logic gates and truth tables, representation of switching functions using SOP & POS forms, Karnaugh map representation, minimization using K-Map.			
<i>Self Learning Topics (SLTs): Solved problems (Text1: Prob 1.3), Solved problems (Text2: example problems 1.7, 1.18, 1.25, 1.25, 1.36, 1.84, 2.8, 2.28,2.38), Don't care conditions (Text1: topic 3.6), Other two level implementations (Text1: topic 3.8).</i>			
UNIT-II		9 Hrs	
Combinational Circuits: Adders- half Adder, full Adder; subtractors-half subtractor, full Subtractor; parallel adder, Carry look ahead adder, Decoders, decoders - BCD to 7 segments, BCD to decimal. Encoders-priority encoder, Multiplexer and Demultiplexer, realization of switching functions using multiplexers and decoders.			
<i>Self Learning Topics (SLTs): decimal adder (Text1: topic 4.6), Priority encoders (Text2: topic 4.22).</i>			
UNIT-III		9 Hrs	
Sequential Circuits: Flip Flops - SR, JK, Race Around Condition in JK, JK Master Slave, D and T Flip Flops, Excitation Tables, Conversion from one type of Flip-Flop to another. Shift Registers, Bidirectional Shift Registers, Ring counter and Johnson Counter; Design of Asynchronous and Synchronous Counters (modulo-N).			
<i>Self Learning Topics (SLTs): latches (Text2: topic 6.4.1, 6.4.2), edge triggered Flip-flops (Text2: topic 6.4.3), master slave Flip Flops (Text2: topic 6.9)</i>			
UNIT-IV		9 Hrs	
State minimization: state table, state diagram, state assignment, state minimization, synthesis of synchronous, sequential circuits - sequence detectors.			
Finite State Machines: Mealy and Moore machines - capabilities and limitations of finite state machine, state equivalence and machine minimization- Merger graph and Merger table.			
<i>Self Learning Topics (SLTs): capabilities and limitations of finite state machine (Ref Text3:10.2) simplification of incompletely specified machines (Ref Text3:10.4).</i>			
Course Learning Outcomes (COs):			
<i>After completion of this course, the students should be able to,</i>			
CO1: explain number system and binary codes; prove the given Boolean identity and apply minimization techniques to obtain minimal SOP/POS forms of logic functions			

CO2: design switching functions using combinational circuits for given application
CO3: develop a sequential circuit using flip flops and logic gates for given specifications
CO4: develop finite state machine with optimum states for given specifications

Textbook(s):

1. M. Moris Mano, *Digital Design*, PHI, New Delhi, 4th edition, 2006. (Chapters 1 to 6).
2. A. Anand Kumar, *Switching Theory & Logic Design*, PHI, 2nd edition, 2014. (Chapters 1 to 4, 6, 7).

Reference Book(s):

1. G.K. Kharate, *Digital Electronics*, Oxford University Press, Hyderabad, 1st edition, 2012.
2. R.P. Jain, *Modern Digital Electronics*, Tata McGraw-Hill, India, 4th edition, 2010.
3. Zvi. Kohavi, *Switching and Finite Automata Theory*, Cambridge University Press, 3rd edition, 2010.
4. Samuel. C. Lee & B.S. Sonde, *Digital Circuits & Logic Design*, PHI, New delhi, 1st edition, 1976.

Web and Video link(s):

1. <https://www.youtube.com/watch?v=JmJWpX2ECfI> NPTEL Video Lecture on Error Detection and Correction
2. <https://www.youtube.com/watch?v=BPBiyc0OBw> NPTEL Video Lecture on K maps
3. <https://www.youtube.com/watch?v=NHydMByCsZQ&t=638s> NPTEL Video Lecture on logic design
4. <https://www.youtube.com/watch?v=5Zstl5d5Byc> NPTEL Video Lecture on Minimization of Finite State Machines.

Course Articulation Matrix (CAM)					U24EC111: SWITCHING THEORY AND LOGIC DESIGN										
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24EC111.1	3	2	1	-	-	1	1	1	1	1	1	1	1	1
CO2	U24EC111.2	3	2	1	-	-	1	1	1	1	1	1	1	2	1
CO3	U24EC111.3	3	2	2	1	-	2	2	1	1	1	1	1	2	1
CO4	U24EC111.4	3	2	3	3	-	3	3	1	1	1	1	1	3	1
U24EC111		3	2	1.75	1	-	1.75	1.75	1	1	1	1	1	2	1

PROGRAMMING FOR PROBLEM SOLVING WITH C			
Class: B.Tech. I -Semester		Branch: Common to all branches	
Course Code:	U24DS104	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60%
Total Number of Teaching Hours:	60 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: algorithms, flow charts and develop programs with basic constructs			
LO2: control structures and array operations			
LO3: string operations and modular programming concepts with functions and recursion			
LO4: structures, unions, pointers and files in C programming			
THEORY COMPONENT			
UNIT-I		9 Hrs	
Introduction to Programming: Art of programming through algorithms and flowcharts			
Overview of C: History of C, Importance of C, Basic structure of C programs			
Constants, Variables and Data Types: Character set, C tokens, Declaration of variables, Defining symbolic constants			
Managing Input and Output Operations: Reading a character, Writing a character, Formatted input, Formatted output			
Operators and Expressions: Arithmetic, Relational, Increment, Decrement, Conditional, Logical, Bit-wise, Special operators, Arithmetic expressions, Evaluation of expressions, Operator precedence and associativity			
<i>Self Learning Topics (SLTs): Components of a computer, concept of hardware and software (Text1: chapter 1), Executing a C program (Text1: chapter 2), Type conversions in expression (Text1: chapter 4) Solved problems (Text1: chapter 2 to chapter 5), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 2 to chapter 5)</i>			
UNIT-II		9 Hrs	
Decision Making and Branching: Simple if statement, if-else statement, Nesting of if-else statements, else if ladder, switch statement, Conditional operator, goto statement			
Decision Making and Looping: while statement, do-while statement, for statement, Nested loops, Jumps in loops			
Arrays: One-dimensional arrays, Declaration of one-dimensional arrays, Initialization of one-dimensional arrays, Linear search, Two-dimensional arrays, Initializing two dimensional arrays, Multi-dimensional arrays			
<i>Self Learning Topics (SLTs): Concise test expressions (Text1: chapter 7) Dynamic arrays (Text1: chapter 8), Solved problems (Text1: chapter 6 to chapter 8), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 6 to chapter 8)</i>			
UNIT-III		9 Hrs	
Character Arrays and Strings: Declaring and initializing string variable, Reading strings from terminal, Writing strings to screen, String handling functions, Table of strings			
Modular Programming with User Defined Functions: Need for user-defined functions, Elements of user-defined functions, Definition of functions, Return values and their types, Function calls, Function declaration, Category of functions, Recursion, The scope, visibility and lifetime of variables (storage classes)			

Self Learning Topics (SLTs): Arithmetic operations on characters, comparison of strings (Text1: chapter 9), Nesting of functions, (Text1: chapter 10), Solved problems (Text1: chapter 9 & chapter 10), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 9 & chapter 10).

UNIT-IV

9 Hrs

Structures and Unions: Defining a structure, Declaring and initializing structure variables, Accessing structure members, Array of structures, Structures within structures, Unions

Pointers: Understanding pointers, Declaring and initializing pointer variables, Pointer expressions, Pointers and arrays, Pointers and character strings, Pointers to functions, Pointers and structures

File Management in C: Defining and opening a file, Closing a file, Input and output operations on sequential text files

Self Learning Topics (SLTs): Operations on individual members (Text1: chapter 11), Chain of pointers, array of pointers (Text1: chapter 12), Random access to files, Command line arguments (Text1: chapter 13). Solved problems (Text1: chapter 11 to chapter 13), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 11 to chapter 13).

LABORATORY COMPONENT

List of Experiments

1. Programs using input output functions, operators (arithmetic, relational and conditional)
2. Programs using operators (bit-wise, logical, increment and decrement)
3. Programs using conditional control structures: if, if-else, nested if
4. Programs using else if ladder, switch and goto statements
5. Programs using loop control structures: while
6. Programs using loop control structures: do-while and for
7. Programs on one dimensional array and two-dimensional arrays
8. Programs on String operations and string handling functions
9. Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
10. Programs using structures, unions, pointers to arrays and pointers to strings
11. Programs using array of pointers and pointers to structures
12. Programs on File operations and file handling functions for sequential text files

Textbook(s):

1. Balagurusamy.E, *Programming in ANSI C*, McGraw Hill, 8th edition, 2022

Reference Book(s):

4. Paul Deitel, Harvey Deitel, *C How to Program: With Case Studies Introducing Applications Programming and Systems Programming*, Pearson Education Limited, 9th edition, 2022
5. Brian W. Kernighan and Dennis Ritchie, *The C Programming Language*, Pearson Education India, 2nd edition, 2015
6. Reema Thareja, *Programming in C*, Oxford University Press, 3rd edition, 2023
7. Yashavant Kanetkar, *Let Us C*, BPB Publications, 19th edition, 2022
8. A.K.Sharma, *Computer Fundamentals and Programming in C*, Universities Press, 2nd edition, 2018

Web and Video link(s):

<https://nptel.ac.in/courses/106105171> NPTEL Video Lecture on Problem Solving through Programming in C by Prof. Anupam Basu, Professor of CSE, IIT Kharagpur.

<https://nptel.ac.in/courses/106104128> NPTEL Video Lecture on Introduction to Programming in C by Prof. Satyadev Nandakumar, Professor of CSE, IIT Kanpur

Laboratory Manual (for laboratory component):

1. *Programming for Problem Solving with C Laboratory Manual and Record Book*, Department of CSE, KITSW.

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

(based on cognitive skills acquired from theory component)

CO1: enumerate programming development steps, design an algorithm and draw a flow chart for a given application

CO2: apply logical skills for problem solving using control structures and arrays

CO3: develop string operations and modular programming with functions

CO4: analyse and implement structures, unions, pointers and files in C programming

(based on psychomotor skills acquired from laboratory component)

CO5: develop programs using operators and decision making statements

CO6: apply loops and arrays to develop a program of an application

CO7: implement string operations and develop modular programs using user-defined functions, recursion, and storage classes.

CO8: develop programs using structures, unions, pointers and files

Course Articulation Matrix (CAM):				U24DS104: PROGRAMMING FOR PROBLEM SOLVING WITH C											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24DS104.1	2	1	1	1	-	-	-	1	1	1	1	2	1	2
CO2	U24DS104.2	2	2	2	1	-	-	-	1	1	1	1	2	2	2
CO3	U24DS104.3	2	2	3	1	-	-	-	1	1	1	1	2	2	2
CO4	U24DS104.4	2	2	3	2	-	-	-	1	1	1	1	2	2	2
CO5	U24DS104.5	1	1	1	1	1	-	-	1	1	1	1	2	1	2
CO6	U24DS104.6	1	2	2	2	1	-	-	1	1	1	1	2	2	2
CO7	U24DS104.7	1	2	3	2	1	-	-	1	1	1	1	2	2	2
CO8	U24DS104.8	1	2	3	2	1	-	-	1	1	1	1	2	2	2
U24DS104		1.5	1.75	2.25	1.5	1	-	-	1	1	1	1	2	1.75	2

ENGLISH COMMUNICATION AND REPORT WRITING			
Class: B.Tech. I-Semester		Branch: Common to all branches	
Course Code:	U24MH105	Credits:	2
Hours/Week (L-T-P-O-E):	2-0-0-3-5	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Objectives (LOs): <i>This course will develop students' knowledge in/on...</i> LO1: basic grammar principles, reading speed, forming new words, making coherent paragraphs and also promoting ethical values for meaningful life. LO2: speaking or writing correct sentences, writing effective letters and improving their self-worth. LO3: critical reading ability, writing conclusive reports and additionally inculcating positive thinking. LO4: abridging varieties of lengthy texts and maintaining emotional balance.			
UNIT-I			9Hrs
GRAMMAR <ul style="list-style-type: none"> Tenses-Structures-usage-examples-exercises for practice Sentence Correction-Correct use of Tenses, Verb forms, Punctuation. VOCABULARY <ul style="list-style-type: none"> Word formation: Prefixes-Suffixes-Sentence Formation with newly formed words READING SKILL <ul style="list-style-type: none"> Definition-Sub skills of Reading-Emphasis on Skimming-Purpose- How to skim through the text-Examples, Exercises for practice WRITING PRACTICES <ul style="list-style-type: none"> Paragraph Writing- Definition-Organizing Principles of paragraphs -Making a paragraph through hints/graphs and pictures-Coherence-Linking Devices-Systematic Development of Ideas Paraphrasing-Précising lengthy expressions for clarity and brevity LIFE SKILLS: Ethical Values and Humanity The Last Leaf: A Short Story by O. Henry <i>Self Learning Topics (SLTs):</i> Articles-(Text 2,Unit-II), English Vocabulary (Text 2,Unit-I, Unit-II, Unit-III) Verb Forms (Reference book 1,Topic :31), Tenses (Reference book 1,Topics: 16,17,18,19) Reported Speech (Reference book 2, Exercises for Practice, Topics : 161-167)			
UNIT-II			9 Hrs

<p>GRAMMAR</p> <ul style="list-style-type: none"> Tenses-Revision-Exercises for practice Subject-Verb Agreement Reported Speech-Transformation Sentence Correction -Emphasis Concord ,Report Speech, Sentence Structures <p>VOCABULARY</p> <ul style="list-style-type: none"> Synonyms-Antonyms-Single Word Substitutes-Popular Abbreviations <p>READING STRATEGY</p> <ul style="list-style-type: none"> Emphasis on Scanning the Text-Purpose-Advantages-Examples, Exercises and Practice through Teamwork <p>WRITING PRACTICES</p> <ul style="list-style-type: none"> Letter Writing- Effective Letter Writing Techniques-Information Seeking Letters-Job Application Letters- Apology Letters-Explanation to Memos- E-mails-Cover Letters- Resume <p>LIFE SKILLS: Determination</p> <ul style="list-style-type: none"> How I Became a Public Speaker: An essay by George Bernard Shaw <p><i>Self Learning Topics (SLTs):</i></p> <p><i>English Vocabulary (Text 2,Unit-I,Unit-II,Unit-III),Tenses (Reference book 3,Topic-30, Exercises,30.1,30.2,30.3)</i></p>	
UNIT-III	9 Hrs
<p>GRAMMAR</p> <ul style="list-style-type: none"> Tenses-Revision- Exercises for Practice Nouns- Prepositions-Adverbs-Adjectives Sentence Correction: Correct Use of tenses, nouns, prepositions, adverbs and adjectives <p>VOCABULARY</p> <ul style="list-style-type: none"> Phrasal Verbs-Technical Words-Latin Words <p>READING STRATEGY</p> <ul style="list-style-type: none"> Intensive Reading-purpose-Types of Comprehension Questions-Examples, Exercises and Practice through Teamwork <p>WRITING PRACTICES</p> <ul style="list-style-type: none"> Report Writing-Definition-Purpose-Qualities of a Good Report- Formal and Informal Reports-Report Format-Sample Reports-Exercises Emphasis on Technical Reports <p>LIFE SKILLS: Positive Attitude</p> <ul style="list-style-type: none"> Be the Best of Whatever You Are: A Poem by Douglas Malloch <p><i>Self Learning Topics (SLTs):</i></p> <ul style="list-style-type: none"> <i>Parts of Speech (Text book 1,Unit-I),Tenses (Reference book 1, Topics-16,17,18,19) Phrasal Verbs (Reference book 3)</i> 	
UNIT-IV	9 Hrs
<p>GRAMMAR</p> <ul style="list-style-type: none"> Tenses-Revision-Exercises for Practice Clauses- Conjunctions-Transformation of Sentences Sentence Correction (Based on Parts of Speech)- Clauses- Tenses <p>VOCABULARY</p>	

<ul style="list-style-type: none"> • Appropriate Use of Words in Communication-Commonly Confused Words <p>ACTIVE READING and NOTE-MAKING</p> <ul style="list-style-type: none"> • Note-Making-Definition-Purpose-Effectiveness <p>WRITING PRACTICES</p> <ul style="list-style-type: none"> • Précis Writing- Definition-Purpose-Uses-Examples and Exercises-Practice through Teamwork • Preparing Statement of Purpose (SoP) <p>LIFE SKILLS: Emotional Balance A Poison Tree: Poem by William Blake</p> <p><i>Self-Learning Topics (SLTs):</i></p> <p>Tenses (Reference book 2, Topics: 152-157))</p>
<p>Course Learning Outcomes (COs):</p> <p><i>After completion of this course, the students should be able to,</i></p> <p>CO1: apply basic grammar principles in speech and writing, read fast, form new words, make coherent paragraphs and adapt the real value of life.</p> <p>CO2: create effective letters, e-mails, reply to Memos and do the given tasks with confidence.</p> <p>CO3: analyze the given texts and write clear and unambiguous reports.</p> <p>CO4: deduct the superfluous information from lengthy text, prepare SoP (Statement of Purpose) effectively and solve critical problems in life with emotional balance.</p>
<p>Textbook(s):</p> <ol style="list-style-type: none"> 1. Sanjay Kumar & Pushp Lata, “English Language and Communication Skills for Engineers” As per the latest AICTE syllabus, Oxford University Press, 1st edition 2018 2. “Language and Life: A Skill’s Approach” Based on the latest AICTE model curriculum Orient Blackswan Private Limited 2nd Edition 2019.
<p>Reference Book(s):</p> <ol style="list-style-type: none"> 1. Thomson A.J. , Martinet A.V., “A Practical English Grammar”, Oxford University Press 3rd Edition 1997 2. Thomson A.J. , Martinet A.V, “A Practical English Grammar” Exercise 2 , Oxford University Press 3rd Edition 1997 3. Standard Allen W. , “Living English Structure”, Pearson India Education Pvt Ltd. 5th Edition 2009
<p>Web and Video link(s):</p> <ol style="list-style-type: none"> 1. https://onlinecourses.nptel.ac.in/noc20_hs56/preview Technical English for Engineers by Aisha Icbal, IIT Madars 2. https://onlinecourses.swayam2.ac.in/cec21_lg13/preview Indian Writing in English by Dr.Bindu Ann Philip, St Mary’s College Trissur

Course Articulation Matrix (CAM):		U24MH105: ENGLISH COMMUNICATION &REPORT WRITING													
		PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24MH105.1	-	-	-	-	-	1	-	2	2	2	1	2	1	1
CO2	U24MH105.2	-	-	-	-	-	1	-	2	2	2	1	2	1	1
CO3	U24MH105.3	-	-	-	-	-	1	-	2	2	2	1	2	1	1
CO4	U24MH105.4	-	-	-	-	-	1	-	2	2	2	1	2	1	1
U24MH105		-	-	-	-	-	1		2	2	2	1	2	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

SPORTS and YOGA			
Class: B.Tech. I - Semester		Branch: Common to all branches	
Course Code:	U24VA106	Credits:	0
Hours/Week(L-T-P-O-E):	0-0-2-2-4	CIE:	60%
Total Number of Teaching Hours:	24Hrs	ESE:	40%
Course Learning Objectives (LOs): <i>This course will develop students' knowledge in /on...</i>			
LO1: Yoga and its benefits			
LO2: various sports & games			
LO3: sportsman spirit			
LO4: all round development			
Sports and Games			
List of Sports and Games			
S.No.	Game	S.No.	Game
1	Badminton	7	Volleyball
2	Basketball	8	Cricket
3	Chess	9	Hand Ball
4	Carrom	10	Kabaddi
5	Foot Ball	11	Kho-Kho
6	Table Tennis	12	Yoga Aasanas
Textbook(s):			
1. B.K.Chaturvedi, <i>Rules and Skills of Games and Sports</i> , Publisher – Goodwill Publishing House, B-9, Rattan Jyoti, 18 Rajendra Place, New Delhi.			
ReferenceBook(s):			
1. Dr.Sakure Girish Madhaorao, <i>Foundation of Physical Education and Sports</i> , Sports Publication, New Delhi.			
Web and Video link(s):			
Badminton game Video Link: https://www.youtube.com/watch?v=HucIqi8Lw3E&t=22s			
Basketball game Video Link: https://www.youtube.com/watch?v=-tkE2IJoR58			
Chess Video Link: https://www.youtube.com/watch?v=mDw7lgM8ePo			
Carrom game Video Link: https://www.youtube.com/watch?v=z8vvJpNceeg			
Football game Video Link: https://www.youtube.com/watch?v=mXjW78AgGu4			
Table Tennis game Video Link: https://www.youtube.com/watch?v=bLrJGWvWI4U			
Volleyball game Video Link: https://www.youtube.com/watch?v=BjJb3-O0Q1U			
Cricket game Video Link: https://www.youtube.com/watch?v=87hO_Vs3-wQ			
Handball game Video Link: https://www.youtube.com/watch?v=VCa_0USaq8k			
Kabaddi game Video Link:			

<https://www.youtube.com/watch?v=ai1m7ARNyNI>

Kho-Kho game Video Link:

https://www.youtube.com/watch?v=P3_z3LKdLdg

Yoga Aasanas Video Link :

<https://www.youtube.com/watch?v=e0Q88DUOXjk>

<https://www.youtube.com/watch?v=JoDKbXEUrvQ>

Course Learning Outcomes (COs):

After completion of this course, the student should be able to demonstrate ...

CO1: demonstrate physical fitness by performing yoga aasanas

CO2: demonstrate physical fitness through various games & sports events with defined benchmarks

CO3: demonstrate sportsman spirit and ethics

CO4: demonstrate physical, psychological, social and emotional balance

Course Articulation Matrix (CAM):		U24VA106: Sports and Yoga													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24VA106.1	-	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	U24VA106.2	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO3	U24VA106.3	-	-	-	-	-	-	-	2	-	-	1	-	-	-
CO4	U24VA106.4	-	-	-	-	-	-	-	-	-	1	1	1	-	-
U24VA106		-	-	-	-	-	-	-	2	1	1	1	1	-	-
3 - HIGH, 2 - MEDIUM, 1 - LOW															

ENGINEERING GRAPHICS THROUGH CAD

Class: B. Tech. I -Semester		Branch: Common to all (except CE & ME)	
Course Code:	U24ME107	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-2-2-4	CIE:	100%
Total Number of Teaching Hours:	36 Hrs	ESE:	-

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on...

- LO1: AutoCAD commands, projections of points and straight line inclined to one plane
- LO2: projections of oblique planes
- LO3: projections of solids and sections of solids
- LO4: conversion of isometric, orthographic projections and simple circuits diagrams

LABORATORY COMPONENT

List of Experiments

1. Importance of Engineering Drawing, principles of engineering drawing, dimensioning; introduction to AutoCAD software-GUI, settings, standard toolbar, toolbars - draw, modify, dimension, properties, design centre and tool palettes
2. Introduction to orthographic projections-Vertical Plane, Horizontal plane; Views-Front view, Top view, and Side view and draw the Projection of points in different quadrants.
3. Draw the Projection of straight lines
4. Draw the Projection of planes
5. Draw the Projection of solids- Simple position(Axis perpendicular to HP or VP)
6. Draw the projections of solids inclined to both the planes
7. Draw the Sections of solids
8. Draw the Orthographic projections of given objects
9. Conversion of isometric view to orthographic projections
10. Draw the Isometric view from the given orthographic views
11. Draw the pictorial view (3D) from the given Isometric view
12. AutoCAD application in Electrical and Electronics circuits

Textbook(s):

1. Bhatt N.D., *Elementary Engineering Drawing*, Charotar Publishing House, Anand, India, 2017.
2. Kulkarni D. M., Rastogi A. P., and Sarkar A., *Engineering Graphics with AutoCAD*, PHI publisher, revised edition, July 2010.

Reference Book(s):

1. Dhananjay A Jolhe, *Engineering Drawing*, Tata Mc Graw- Hill, 2008.
2. Venugopal K. *Engineering Graphics with Auto CAD*, New Age International Publishers Ltd., Hyderabad, 2012.
3. Luzadder W.J and Duff J.M, *Fundamentals of Engineering Drawing*, Prentice-Hall of India, 1995.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc20_me79/preview NPTEL video link for *Engineering drawing and computer graphics* By Prof. Rajaram Lakkaraju, IIT Kharagpur.

Laboratory Manual (for laboratory component):

1. *Engineering Graphics through CAD Laboratory Manual & Record Book*, Dept. of ME, KITSW.

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

- CO1: draw projections of points and straight lines inclined to one plane with Auto CAD.
- CO2: develop the projections of planes using Auto CAD

CO3: construct the projections of solids and sections of solids using Auto CAD
 CO4: create orthographic and isometric projections and develop the simple electrical and electronic circuit using Auto CAD

Course Articulation Matrix (CAM):						U24ME107: ENGINEERING GRAPHICS THROUGH CAD									
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	U24ME107.1	2	1	1	-	2	-	-	1	1	2	1	1	1	1
CO2	U24ME107.2	2	1	1	-	2	-	-	1	1	2	1	1	1	1
CO3	U24ME107.3	2	1	1	-	2	-	-	1	1	2	1	1	1	1
CO4	U24ME107.4	2	1	1	-	2	-	-	1	1	2	1	1	1	1
U24ME107		2	1	1	-	2	-	-	1	1	1	1	1	1	1

PRACTICUM - 1

Class: B.Tech. I - Semester	Branch: Common to all branches		
Course Code:	U24EL108	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-4-4	CIE :	100%
Total Number of Teaching Hours:	-	ESE :	-

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on...

LO1: literature review and identifying research gaps

LO2: implementing a project independently by applying knowledge to practice

LO3: preparing well-documented report and informative PPT

LO4: effective technical presentation and creating video pitch

Practicum is an independent project carried out by the student during the course period, under the supervision of allotted course faculty. It helps to reinforce the students' theoretical knowledge and develop their ability to apply this knowledge to the solution of practical problems. Practicums also prepare them for their MINI and MAJOR PROJECTs and for independent work in their chosen field that promotes creative abilities. Besides they provide Higher Order Cognitive Abilities (HOCAs).

- (i). Practicum is a mandatory semester project work.
- (ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)
- (iii). Allotment of Practicum topics for students:
 - o **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	U24MH101	U24PS102	U24EC103	U24CS104	U24EE105	U24CH106
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

- o In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.
- o The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

CIRCULAR

Allotment of Practicum topics to students

Section :

S.No.	Roll number of the student	Practicum topic allotted	Practicum under the course	Course faculty

Note:

1. The students should meet immediately the allotted course faculty for practicum and start working on the practicum with the guidance of course faculty.
2. To complete the Practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and also outside the class work hours during weekdays.
3. The course faculty are advised to guide the allotted students for practicum during the semester course work.

(Signature of class teacher)

- (iv). *To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.*
- (v). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.
- (vi). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.
- (vii). The class teacher shall collect the final marks of practicum of the students allotted to each course teacher and submit them to the CoE.
- viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course
- (ix). A sample rubrics for assessment and evaluation of practicum is as follows:

Literature survey & Identification of research gaps	10 marks
Working model / process / software package / system developed	30 marks
Report writing (subjected to max of 30% plagiarism)	20 marks
Oral presentation with PPT and viva-voce	20 marks
Video pitch	20 marks
Total	100 marks

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation of Practicum.

- (a) **Practicum Topic:** Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.
- (b) **Working Model:** Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.

- (c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.
- What was the objective of the practicum assigned?
 - What are the main responsibilities and tasks for practicum?
 - What knowledge and skills from the coursework are applied in the practicum?
 - What new knowledge and skills are acquired during the practicum?
 - In what ways, can the practicum be helpful for the professional career?
 - What gaps are identified in your practicum work?
 - What improvements or changes you suggest for addressing the identified gaps for future work?
- (d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute
- (e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department
- (f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact
- (g) The student has to register for the Practicum as a supplementary examination in the following cases:
- i) he/she is absent for oral presentation and viva-voce
 - ii) he/she fails to submit the report in prescribed format
 - iii) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

Course Learning Outcomes (COs):

After completion of this course, the students should be able to...

CO1: synthesize literature survey, identify research gaps and define objective & scope of practicum problem

CO2: apply knowledge to design & conduct experiments, utilize modern tools for solution of practicum problem and develop working model/ process/ system

CO3: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through practicum

CO4: create a video pitch on practicum and make an effective oral presentation using PPTs

Course Articulation Matrix (CAM):		U24EL108: PRACTICUM - 1													
		PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24EL108.1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	U24EL108.2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

CO3	U24EL108.3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	U24EL108.4	2	2	2	2	2	2	2	2	2	2	2	2	2	2
U24EL108		2	2	2	2	2	2	2	2	2	2	2	2	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW															

SOCIAL EMPOWERMENT ACTIVITY/ SELF ACCOMPLISHMENT ACTIVITY- 1 (SEA/SAA)			
Class: B.Tech. I -Semesters	Branch: Common to all branches		
Course Code:	U24VA109(SE/SA)ZZZ	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-2-2	CIE:	100%
Total Number of Teaching Hours:	-	ESE :	-
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: holistic development through activity-based learning to gain real-life experience which effectively help individuals deal appropriately with problems/challenges			
LO2: positive mindset by actively adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity and handling rejection in life			
LO3: skills for effective fieldwork practice , which include ethics, observation, communication, interviewing, problem solving, time management, organisation and documentation			
LO4: making a well-documented report and an effective oral presentation through PPTs portraying knowledge, skills, qualities acquired and social impact of the activity			
Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building generic competencies in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the physical, emotional, cognitive, spiritual and social aspects . This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.			
It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely SEA (Social Empowerment Activities) and SAA (Self Accomplishment Activities)			
These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.			
<ul style="list-style-type: none"> (a) Each SEA/SAA activity is treated as one credit course (b) Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester. (c) Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA (d) To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc., (e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enrol in the forthcoming semesters. 			
<u>Monitoring SEA/SAA:</u>			
(a) Nodal units: The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i ² RE) shall act as nodal units for			

activities listed under SEA/SAA.

(b) During the semester period, the student has to **acquire requisite knowledge, conduct fieldwork**, acquire skills and propose unique solutions to the real-life problems

(c) **Knowledge Acquisition & Skilling:**

- i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity
- ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.
- iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

(d) **Fieldwork:** Fieldwork is an essential component of learning for gaining real-life experiences. In addition to knowledge acquisition & skilling, student has to take up fieldwork on the chosen activity, as part of SEA/SAA course.

- i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.
- ii. Fieldwork consists of three phases: preparation, the actual activity and feedback
- iii. **As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.**
- iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.
- v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more
- vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.
- vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

(a). **In case of socially relevant problems/ activities of SEA/SAA:** Eminent personalities/ achievers include district administrative officers, Eminent Social workers / NGOs, other inspiring and great personalities

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:**

Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

- viii. **For appointment to interact eminent personalities:** Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction
 - ix. On fieldwork, student is expected to demonstrate solid time management, organisational and note taking skills during fieldwork
 - x. **Ethics of fieldwork:** Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged
 - xi. Student is expected to take care of health and Safety practices for fieldwork and travel
 - xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.
 - xiii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practise sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.
 - xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.
 - During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.
- (e) **Demonstration / Presentation and Report:** Student after presentation/ demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.
- (f) **Flow process for completion of SEA/SAA course:**
- i. **Faculty counsellor approval:** In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of

supervising faculty of nodal centre. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

- ii. **Identification of goals and preparation of action plan:** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.
- iii. **Field work:** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal centre.
- iv. **Demonstration/ Presentation:** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.
- v. **Report writing:** After successful demonstration/presentation, student shall write a 2-3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

(g) **Assessment & Evaluation:** There shall be *only Continuous Internal Evaluation (CIE) for SEA/SAA*. The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centres and faculty counsellors, consolidate them, and submit the final grades to the examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

Assessment	Maximum marks	Marks to be awarded by
Goal setting, Planning & Knowledge Acquisition	20	Nodal centre
Field work	40	Nodal centre
Demonstration/Presentation	20	Nodal centre
Report submission	20	Faculty counsellor
Total	100	-

Note:

- (a) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.
- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.
- (b) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator*.
- (c) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.
- (d) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she
- a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal centre, **and**
 - b. scores a minimum of 40 marks in the CIE of the course
- (e) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Course Learning Outcomes (COs):

After completion of this course, the students should be able to...

CO1: integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility

CO2: interact effectively through written, oral and nonverbal communication with external-world in a professional, sensitive and culturally relevant manner

CO3: analyse the issues related to social empowerment / self-accomplishment, demonstrate problem-solving skills, articulate solutions and demonstrate social sensibility

CO4: demonstrate the generic competencies in making a well-documented report and an effective oral presentation with PPTs portraying knowledge, skills, qualities acquired through fieldwork/practice sessions and social impact of the course learning

Text / Reference book(s):

For knowledge acquisition, students shall refer to textbooks and web resources relevant to the course selected. Plan for fieldwork/practice sessions in coordination with SEA/SAA coordinator

Course Articulation Matrix (CAM):		U24VA109(SE/SA)ZZZ Courses listed under SEA/ SAA - 1													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	U24VA109.1	-	-	-	-	-	2	2	2	2	2	2	2	1	1

CO2	U24VA109.2	-	-	-	-	-	2	2	2	2	2	2	2	1	1
CO3	U24VA109.3	-	-	-	-	-	2	2	2	2	2	2	2	1	1
CO4	U24VA109.4	-	-	-	-	-	2	2	2	2	2	2	2	1	1
U24VA109		-	-	-	-	-	2	2	2	2	2	2	2	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

Course Code: U24VA109(SE/SA)ZZZ

X represents semester; YY represents SEA/SAA course serial number in that semester; SE- represents SEA activity or SA - represents SAA activity; ZZZ represents activity code from SEA/SAA baskets

<p>Ex: If A student selects a SEA/SAA course as below:</p> <p><i>Semester: 1</i> <i>SEA/SAA course serial number: 09</i> <i>SEA/SAA category: SEA</i> <i>course number: 302</i></p> <p>The course code will be U24VA109SE302</p>	<p>Ex: If A student selects a SEA/SAA course as below:</p> <p><i>Semester: 4</i> <i>SEA/SAA course serial number: 10</i> <i>SEA/SAA category: SAA</i> <i>course number: 206</i></p> <p>The course code will be U24VA410SA206</p>
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EXPERT TALK SERIES - I			
Class: B.Tech. I -Semester	Branch: Common to all branches		
Course Code:	U24AE110	Credits:	1
Hours / Week (L-T-P-O-E):	0-0-0-1-1	CIE :	100%
Total Number of Teaching Hours:	-	ESE:	-
<p>Course Learning Objectives (LOs): <i>This course will develop students' knowledge in /on...</i></p> <p>LO1: 21st century skills needed for industry, current industry trends, challenges and innovations</p> <p>LO2: latest technology in practice and applying knowledge to solve real-world problems</p> <p>LO3: smart work, soft skills, professional etiquette, networking abilities</p> <p>LO4: making a well-documented report portraying the knowledge, skills, qualities acquired and the impact of the learning</p>			
<p>In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.</p> <p>(a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.</p> <p>(b) Learning from industry experts with real-world examples, is important to enhance your educational experience.</p> <p>(c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximised if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.</p> <p>(d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".</p> <p>But how would you know all this without venturing into the industry?</p> <p>(e) The answer is Industry Expert Talk Series (ETS). Through ETS, we invite industry experts in different fields to deliver talks and interact with students.</p> <p>(f) Through Industry expert talks students get to know so much more that textbooks don't explain.</p> <p>(g) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.</p> <p>(h) Our competency-focussed curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses</p> <p>(i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal</p>			

development.

- (j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.
- (k) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.
- (l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.
- (m) ETS enhances your learning in many ways for global opportunities for your career.
- (n) All in all, learning from industry experts, is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.
- (o) Salient features of ETS are hereunder:
 - (i) ETS is offered from I semester to VI semester.
 - (ii) ETS, in any given semester, is treated as one credit course
 - (iii) Students are required to earn six credits (from I to VI semester)
 - (iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**
 - (v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.
 - (vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs ; *duration: 10-15 mins*), on the contents covered in the expert talk.
 - (vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators**.
 - (viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.
 - (ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.
 - (x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks
 - (xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).
- (p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

Quiz score (<i>sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks</i>)	60 marks
Attendance (<i>out of 10 quizzes</i>)	20 marks
Report in prescribed format (<i>max 30% plagiarism</i>)	20 marks
Total	100 marks

- i. **Attendance:** Maximum of 20 marks shall be awarded based on the attendance maintained by the student over a maximum of 10 lectures.

$$\text{Marks for attendance} = \frac{\text{Number of expert talks attended fully}}{10} * 20$$

ii. **Supplementary Exam:**

- Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE
- The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs ; *duration: 2Hrs*) on the content covered in ETS lectures.
- Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE
- Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

Course Learning Outcomes (COs):

After completion of this course, the students should be able to...

CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology

CO2: identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement

CO3: interact with experts, exhibit confidence, demonstrate improved communication and networking abilities potentially leading to mentorship opportunities, internships, or even future job prospects

CO4: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through ETS sessions and impact of the expert talks

Course Articulation Matrix (CAM):		U24AE110 EXPERT TALK SERIES - I													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	U24AE110.1	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO2	U24AE110.2	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO3	U24AE110.3	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO4	U24AE110.4	1	1	1	1	1	1	1	2	1	2	1	2	1	1
U24AE110		1	1	1	1	1	1	1	2	1	2	1	2	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

II SEMESTER

Stream-II

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24PY202B	Physics from Pool-I	2	1	2	5	10	4
3	PCC	U24DS203	Computer Architecture and Organization	2	1	-	4	7	3
4	ESC	U24DS204	Data Structures through C	2	1	2	5	10	4
5	ESC	U24EE205B	Basic Electrical Engineering	2	1	2	5	10	4
6	VAC	U24CY206	Environmental Studies	2	-	-	2	4	-
7	AEC	U24AE207	Idea Lab Makerspace	-	-	2	2	4	1
8	SEC	U24SE208	Programming Skill Development (PSD) Lab - 1	-	-	2	2	4	1
9	ELC	U24EL209	Practicum-2	-	-	-	4	4	1
10	VAC	U24VA210X XXXX	SEA-2/ SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
Total:				12	5	10	38	65	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				NIL					

MATRIX THEORY AND VECTOR CALCULUS			
Class: B.Tech. II -Semester		Branch: Common to all branches	
Course Code:	U24MH201	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-6-9	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: various methods of solving system of linear equations and eigen value problems			
LO2: double integral, triple integral and their applications			
LO3: vector differential calculus and applications			
LO4: integration of vector valued functions and applications			
UNIT-I			9 Hrs
Matrices:			
Rank of a Matrix, Elementary transformations of a matrix, Gauss Jordan method of finding the inverse, Normal form of a matrix, Consistency of linear system of equations, System of linear homogenous equations, Eigen values, Eigen vectors, Properties of Eigen values, Cayley Hamilton's theorem, Reduction to diagonal form, Factorization method (LU Decomposition)			
Applications of Eigen value problems: Stretching of an elastic membrane, Eigen value problems arising from Markov processes, Eigen value problems arising from population models, Leslie model			
<i>Self-Learning Topics (SLTs): Review of Matrices [Text 1: topics 2.1,2.2,2.3,2.4,2.5]</i>			
<i>PAQ –Normal form [Text 1, topic 2.7(7), Solved problems: 2.26, Practice problems: exercise 2.4 (9,10)]</i>			
<i>Additional problems on System of homogeneous and non-homogeneous equations [Text 1: topic 2.18, Solved problems: 2.52, Practice problems: exercise 2.10 (13,14)]</i>			
<i>Additional problems on Eigen values and Eigen vectors [Text 2: topic 8.1, Solved problems: 8.1(1,2), Practice problems: exercise 8.1(4,6)]</i>			
<i>Nature of Quadratic form [Text 1: topic 2.18, Solved problems: 2.52, Practice problems: exercise 2.10 (13,14)]</i>			
UNIT-II			9 Hrs
Multiple Integrals and Beta, Gamma functions:			
Double Integrals, change of order of integration, Double Integrals in polar coordinates, Area enclosed by plane curves, Triple integrals, Volumes of solids, Calculation of Mass for a plane lamina, Beta function, Gamma function, Relation between Beta and Gamma functions (without proof).			
<i>Self-Learning Topics (SLTs): Review of integrals [Text 1: topic Appendix VII (1)]</i>			
<i>Additional problems on change of order of integration [Text 1: topic 7.2, Solved problems: 7.4,7.6, Practice problems: exercise 7.1 (9,14)]</i>			
<i>Centre of gravity of a plane lamina [Text 1: topic 7.10, Solved problems 7.34,7.35, Practice problems: exercise 7.6 (9,10)]</i>			
<i>Moment of Inertia of plane lamina [Text 1: topic 7.12(1,2), Solved problems: 7.37,7.38, Practice problems: exercise 7.7 (1,4)]</i>			
<i>Additional problems on Volume of solids [Text 1: topic 7.6, Solved problem: 7.21, Practice problems: exercise 7.4 (12,25)]</i>			

UNIT-III	9 Hrs
<p>Vector Calculus and its applications: - Vector Space, Linear dependent and independent vectors, Differentiation of vectors, Curves in space, Tangent, Principal normal, Binormal, Curvature, Torsion, Velocity and acceleration, Scalar and vector point functions, Del applied to scalar point functions - Gradient, Geometrical interpretation, Directional derivative, Del applied to vector point functions -Divergence, Curl, Physical interpretation of divergence, Physical interpretation of curl, Del applied twice to point functions, Del applied to products of point functions, Decomposition of vector valued functions</p> <p><i>Self-Learning Topics (SLTs):</i> Review of vectors [Text 2: topics 9.1, 9.2, 9.3] Vector identities [Text 1: topic 8.9, Solved problems: 8.22, 8.23, Practice problems: exercise 8.4 (13,14)] Additional problems on Directional derivatives [Text 1: topic 8.5(3), Solved problems: 8.13,8.14, Practice problems: exercise 8.3 (4,6,8,9)]</p>	
UNIT-IV	9 Hrs
<p>Integration of vectors: Line integral, Surfaces-Surface integral, flux across a surface, Green's theorem in the plane (without proof), Stoke's theorem (Relation between line and surface integrals) (without proof), Volume integral, Gauss divergence theorem (Relation between surface and volume integrals) (without proof), irrotational fields, solenoidal fields</p> <p><i>Self-Learning Topics (SLTs):</i> Additional problems on Green's theorem [Text 1: topic 8.13, Solved problems: 8.33,8.35, Practice problems: exercise 8.8 (1,2,4)] Additional problems on Stoke's theorem [Text 1: topics 8.14, Solved problems: 8.39, 8.40, Practice problems: exercise 8.9 (1,2)] Additional problems on Gauss Divergence theorem [Text 1: topic 8.16, Solved problems: 8.44,8.46, Practice problems: exercise 8.10 (1,2)]</p>	
<p>Course Learning Outcomes (COs): After completion of this course, the students should be able to...</p> <p>CO1: analyze eigen value problems using matrix theory CO2: apply basic concepts of multiple integrals in evaluating physical quantities of real-life engineering problems CO3: apply differential operators on vector and scalar point functions CO4: solve line, surface, volume integrals and correlate these with applications of Green, Stoke and Gauss divergence theorems</p>	
<p>Textbook(s):</p> <ol style="list-style-type: none"> Grewal, B.S., <i>Higher Engineering Mathematics</i>, Khanna Publishers, Delhi, 44th edition, 2017 (Chapters 2,7,8) Kreyszig E, <i>Advanced Engineering Mathematics</i>, Inc, U.K, John Wiely &sons, 10th edition, 2020 (Chapter 8(8.2)) 	
<p>Reference Book(s):</p> <ol style="list-style-type: none"> Spiegel M, <i>Vector Analysis</i> -Schaum's Series, McGraw Hill, 2nd edition, 2017 S.S. Sastry, <i>Engineering Mathematics, Vol.II</i>, Prentice Hall of India, 3rd edition, 2014. Gilbert Strang, <i>Introduction to Linear Algebra</i>, Wellesley-Cambridge Press, 5th edition 	
<p>Web and Video link(s):</p> <ol style="list-style-type: none"> https://youtu.be/L4crGhtEX14?si=hyjAPgDheJOhXtYZ : NPTEL Video Lecture on Matrix Analysis 	

- with Applications/Dr.S.K.Gupta and Dr.Sanjevo Kumar/IIT Roorkee*
2. https://youtu.be/ksS_yOK1vtk?si=CNNA58OIuszubPiX : NPTEL Video Lecture on Integral and Vector Calculus./Prof.Hari Shankar Mahato / IIT Kharagpur

Course Articulation Matrix (CAM):		U24MH201 MATRIX THEORY AND VECTOR CALCULUS													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24MH201.1	2	2	1	1	-	-	-	1	1	1	1	1	1	1
CO2	U24MH201.2	2	2	1	1	-	-	-	1	1	1	1	1	1	1
CO3	U24MH201.3	2	2	1	1	-	-	-	1	1	1	1	1	1	1
CO4	U24MH201.4	2	2	1	1	-	-	-	1	1	1	1	1	1	1
U24MH201		2	2	1	1	-	-	-	1	1	1	1	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

ENGINEERING PHYSICS

(common to CSM, CSD, CSN, CSO & IT)

Class: B.Tech. II- Semester	Branch: Common to CSM, CSD, CSN, CSO & IT		
Course Code:	U24PY202B	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60%
Total Number of Teaching Hours:	60 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: basic principles, operation of lasers and optical fibers			
LO2: fundamental laws of electrostatics and magnetostatics, properties of magnetic and superconducting materials			
LO3: basic concepts of quantum mechanics and quantum computing			
LO4: semiconductor materials, semiconductor diodes and bipolar junction transistors (BJTs)			
THEORY COMPONENT			
UNIT-I		9 Hrs	
<p>Applied Optics and Lasers: Principles of interference, Diffraction phenomena and applications (qualitative), Difference between conventional light and laser, Basic principles and characteristics of lasers, Absorption, Spontaneous and stimulated emission, Population inversion, Pumping methods, Optical resonator; Types of lasers- Ruby laser, He-Ne laser, Diode laser; Applications of lasers</p> <p>Fiber Optics: Introduction, Total internal reflection, Optical fiber construction, Numerical aperture and acceptance angle, Types of optical fibers - Step index and graded index, Single and multimode, V-number; Power losses in optical fibers - Attenuation, Dispersion, Bending; Fiber optic communication system, Applications of optical fibers - Endoscopy, Fiber optic sensors (temperature and displacement)</p> <p><i>Self Learning Topics (SLTs):</i> Concept of wave and basic concepts- amplitude, wavelength, frequency, phase, phase angle and general wave equation(Text1: topic 1.9), types of waves(Text1: topic 1.10), reflection laws(Text1: topic 1.11).</p>			
UNIT-II		9 Hrs	
<p>Electrostatics and Magnetostatics: Electric charges, Coulomb's law, Electric field, Electrostatic potential, Computation of electric field and electrostatic potential due to point and line charges; Magnetic field, Magnetic flux density, Biot-Savart's law, Ampere's law, Faraday's law and Lenz's law</p> <p>Magnetic and Superconducting materials: Introduction, Permeability, Magnetization, Susceptibility, Origin of magnetism, Bohr magneton, Ferro, Antiferro and ferri magnetic materials, Hysteresis, Soft and hard magnetic materials and their applications; superconductivity, Meissner effect, Transition temperature, Isotope effect, Type-I and type-II superconductors, High T_c superconductors, Applications of superconductors</p> <p><i>Self Learning Topics (SLTs):</i> magnetisation, susceptibility & their relations (Text1: topic 41.2), London penetration depth (Text1: topics 42.4.7), Solved problems (Text1: Prob 42.9 to 42.14).</p>			
UNIT-III		9 Hrs	
<p>Elements of Quantum Mechanics: Wave-particle duality, de-Broglie wavelength, Physical significance of wave function, Schrodinger time-dependent wave equation, Schrodinger time-independent wave equation, Particle in an infinite potential well (one dimension)</p> <p>Introduction to Quantum Computing: Observables and operators, Expectation values, Expectation values in operator notation, Dirac Bra-Ket notation, Superposition principle, Concept of Quantum bits, Classical versus Quantum computing, Quantum parallelism and</p>			

Quantum entanglement, Applications of quantum computing	
<i>Self Learning Topics (SLTs): Heisenberg's uncertainty principle (Text1: topics 27.2), Observables and operators (Text1: topics 27.19), Solved problems (Text1: Prob 27.13, Prob 27.17).</i>	
UNIT-IV	9 Hrs
Semiconductor Physics: Classification of solids based on energy band theory- Conductors, Semiconductors and insulators, Intrinsic semiconductor- carrier generation and recombination; Extrinsic semiconductors - n-type and p-type (qualitative)	
Semiconductor Diodes and Bipolar Junction Transistors (BJTs): Formation of a PN junction, Forward and reverse bias, PN junction diode, Diode current equation, Zener diode, Zener diode as voltage regulator and their V-I characteristics, Light emitting diode (LED), Transistor structure, Representation of NPN and PNP transistors, Transistor action, Transistor configurations- Common base(CB), Common emitter(CE) and Common collector(CC); Corresponding α , β , γ parameters and their relations and transistor as an amplifier	
Self Learning Topics (SLTs): drift & diffusion current (Text2: topic 4.9), diode current equation (Text2: topic 4.15), Solved problems (Text2: Prob 4.17 to 4.21).	
LABORATORY COMPONENT	
List of Experiments	
<ol style="list-style-type: none"> 1. Linear Measurements using Vernier callipers and screw gauge 2. Determination of slit width using He-Ne laser 3. Determination of wavelength of He-Ne laser using reflection and transmission diffraction grating 4. Determination of dielectric constant of materials using parallel plate capacitor 5. Magnetic hysteresis- B-H curve tracing using CRO 6. Numerical aperture and acceptance angle of an optical fiber 7. Study of V-I characteristics of PN junction diode 8. Study of V-I characteristics of LED 9. Study of common emitter characteristics of NPN transistor 10. Energy band gap of a semiconductor material 11. Determination of thickness of thin sheet using air-wedge method 12. Determination of Planck's constant 	
Textbook(s):	
<ol style="list-style-type: none"> 1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, <i>A Text Book of Engineering Physics</i>, S. Chand & Company Ltd, 11th Edn., 2018 2. S Salivahanan, N Suresh Kumar, <i>Electronic devices and circuits</i>, Mc Graw Hill Edn., 2017 3. Michael Nielsen and Isaac Chuang, <i>Quantum Computation and Quantum Information</i>, Cambridge University Press, 2010 	
Reference Book(s):	
<ol style="list-style-type: none"> 1. Neil Gershenfeld, <i>Physics of Information Technology</i>, Cambridge University Press, 1st Edn., 2000 2. V. Rajendran, <i>Engineering Physics</i>, Mc Graw Hill Edn., 2013 3. Eleanor Rieffel and Wolfgang Polak, <i>Quantum Computing: A Gentle Introduction</i>, The MIT Press Cambridge, Massachusetts London, England, 2011 4. R.K. Gaur and S.L.Gupta, <i>Engineering Physics</i>, Dhanpath Rai and Sons, 2013 5. David Halliday, Robert Resnick and S Krane, <i>Physics Volume I&II</i>, Wiley India Limited, 5th Edn., 2014 	
Web and Video link(s):	
<ol style="list-style-type: none"> 1. https://onlinecourses.nptel.ac.in/noc24_ph28/preview; NPTEL video lecture on Concepts 	

- in Magnetism and Superconductivity by Prof. Arghya Taraphder IIT Kharagpur*
2. https://onlinecourses.nptel.ac.in/noc24_lw07/preview; NPTEL video lecture on Introduction to Law on Electricity by Prof. Uday Shankar, IIT Kharagpur
 3. https://onlinecourses.nptel.ac.in/noc24_ph45/preview; NPTEL Video Lecture on Introduction to LASER - Course by Prof. M. R. Shenoy, IIT Delhi
 4. https://onlinecourses.nptel.ac.in/noc20_ee77/preview; NPTEL Video Lecture on Semiconductor Devices and Circuits By Prof. Sanjiv Sambandan, IISc Bangalore
 5. <https://nptel.ac.in/courses/106106232>; NPTEL Video Lecture on Introduction to Quantum Computing: Quantum Algorithms and Qiskit by Prof. Prabha Mandayam, Prof. Anupama Ray, Prof. Sheshashayee Raghunathan, IIT Madras

Laboratory Manual (for laboratory component):

1. Engineering Physics Laboratory Manual & Record Book, Department of PS, KITSW
2. A.K.Katiyar, C.K.Pandey, Engineering Physics Theory and Practical, Wiley India Pvt. Ltd, 2nd Edn., 2017

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

(based on cognitive skills acquired from theory component)

CO1: evaluate properties of lasers and optical fibre parameters

CO2: calculate the electric field, electric potential, magnetic field and flux density; determine properties of magnetic and superconducting materials

CO3: evaluate the energy values of a particle in an infinite potential well and apply the quantum principles in quantum computing

CO4: analyze V-I characteristics of semiconductor diodes and suggest their applications; determine resistances of transistor biasing circuits

(based on psychomotor skills acquired from laboratory component)

CO5: measure diameter of wire and hollow tubes using Vernier callipers and screw gauge

CO6: determine the width of a narrow slit and wavelength of laser using diffraction phenomenon and numerical aperture of an optical fiber

CO7: calculate the dielectric constant of a material and plot the hysteresis curve of ferromagnetic material

CO8: determine forward voltage and currents from V-I characteristics of semiconductor diodes; identify cut-off, saturation and active regions of NPN transistor

Course Articulation Matrix (CAM):		U24PY202B: ENGINEERING PHYSICS (common to CSM, CSD, CSN, CSO & IT)													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	U24PY202B.1	2	1	-	-	-	1	-	1	1	1	1	1	1	1
CO2	U24PY202B.2	2	1	-	-	-	1	-	1	1	1	1	1	1	1
CO3	U24PY202B.3	2	1	-	-	-	1	-	1	1	1	1	1	1	1
CO4	U24PY202B.4	2	1	-	-	-	1	-	1	1	1	1	1	1	1
CO5	U24PY202B.5	2	1	-	-	1	1	-	1	1	2	1	1	1	1
CO6	U24PY202B.6	2	1	-	-	1	1	-	1	1	2	1	1	1	1
CO7	U24PY202B.7	2	1	-	-	1	1	-	1	1	2	1	1	1	1

CO8	U24PY202B.8	2	1	-	-	1	1	-	1	1	2	1	1	1	1
U24PY202B		2	1	-	-	1	1	-	1	1	1.5	1	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

COMPUTER ORGANIZATION AND ARCHITECTURE			
Class: B.Tech. II -Semester		Branch: CSE (Data Science)	
Course Code:	U24DS203	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-4-7	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: functional units of a computer, principle components and instruction set architecture			
LO2: processing unit and computation of arithmetic operations			
LO3: memory unit and data transfer between processor, memory and I/O			
LO4: operations of high-performance computing systems			
UNIT-I			9 Hrs
Basic Structure of Computers: Functional units, Basic operational concepts, Performance.			
Instruction Set Architecture: Memory locations and addresses, Memory operations, Instructions and instruction sequencing, Instruction formats, Addressing modes, Assembly Language-Assembler directives.			
<i>Self Learning Topics (SLTs): Importance and working of Processors (Text1: topics 1.7), RISC vs CISC processors (Text1: Chapter 2.11)</i>			
UNIT-II			9 Hrs
Basic Processing Unit: Fundamental concepts, Instruction execution, Hardware components, Instruction fetch and execution steps, Control signals, Hard-wired control, CISC-style processors.			
Arithmetic: Addition and subtraction of signed numbers, Multiplication of unsigned numbers, Multiplication of signed numbers, Fast multiplication, Integer division, Floating-point numbers and operations.			
<i>Self Learning Topics (SLTs): Fast multiplication (Text1: Chapter 9.5)</i>			
UNIT-III			9 Hrs
The Memory System: Basic concepts, Semiconductor RAM memories-Internal organization of memory chips, Static memories, Dynamic RAMs; Read-only memories, Memory hierarchy, Cache memory mapping functions, Performance considerations, Secondary storage			
Input-Output Organization: Input-output interface- I/O bus and interface modules, I/O vs. memory bus, Isolated vs. memory-mapped I/O; Asynchronous data transfer- Strobe control, Handshaking, Asynchronous serial transfer			
<i>Self Learning Topics (SLTs): Read only memories (Text1: Chapter 8.3), Secondary Storage (Text1: Chapter 8.10), I/O vs. memory bus (Text2: Chapter 12.2)</i>			
UNIT-IV			9 Hrs
Modes of Transfer: Modes of transfer, Priority interrupt, Direct memory access, Interconnection standards.			
Pipeline and Vector Processing: Parallel processing, Pipelining, Arithmetic pipeline, Instruction pipeline, Vector processing.			
Multi Processors: Characteristics of multiprocessors, Interconnection structures.			
<i>Self Learning Topics (SLTs): Interconnection standards (Text1: Chapter 7.5), Arithmetic pipeline (Text2: Chapter 10.3)</i>			

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: apply principles of computer architecture to design and analyze systems,

<p>emphasizing functional units, core components, and instruction set architecture</p> <p>CO2: design and analyze processing units and arithmetic operations, including control mechanisms and computation of various arithmetic functions</p> <p>CO3: categorize cache memory mapping techniques and examine data transfer mechanisms between the processor, memory, and I/O systems</p> <p>CO4: analyze different modes of data transfer, classify interconnection structures of multiprocessors, and evaluate concepts of pipelining and vector processing in high-performance computing systems</p>
<p>Textbook(s):</p> <ol style="list-style-type: none"> 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, <i>Computer Organization and Embedded Systems</i>, McGraw-Hill Education, 6th edition, 2012, New Delhi. (Chapters 1, 2, 5, 7-9) 2. M. Morris Mano, <i>Computer System Architecture</i>, Pearson Education, Revised 3rd edition, 2019, New Delhi. (Chapters 9, 10, 11, 12, 14)
<p>Reference Book(s):</p> <ol style="list-style-type: none"> 1. B Ram, Sanjay Kumar, <i>Computer Fundamentals: Architecture and Organization</i>, New Age International Publishers, 5th edition, 2018, New Delhi 2. W. Stallings, <i>Computer Organization and Architecture - Designing for Performance</i>, Pearson Education, 7th edition, 2009, New Delhi 3. John P. Hayes, <i>Computer Architecture and Organization</i>, McGraw-Hill Education, 3rd edition, 1998, New Delhi 4. Vincent P. Heuring, Harry F. Jordan, <i>Computer Systems Design and Architecture</i>, Pearson Education, 2nd edition, 2004, United States
<p>Web and Video link(s):</p> <ol style="list-style-type: none"> 1. https://onlinecourses.nptel.ac.in/noc22_cs88/preview, NPTEL Video Lecture on Instruction Set Architecture and Input-Output System Design by Prof. INDRANIL SENGUPTA, IIT Kharagpur. 2. https://onlinecourses.nptel.ac.in/noc23_cs67/preview, NPTEL Video Lecture on Pipelining and Cache Memory by Prof. Smruti Ranjan Sarangi, IIT Delhi.

Course Articulation Matrix (CAM):		U24DS203: COMPUTER ORGANIZATION AND ARCHITECTURE													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24DS203.1	2	2	2	1	-	-	-	1	1	1	1	1	1	1
CO2	U24DS203.2	2	2	2	1	-	-	-	1	1	1	1	1	1	1
CO3	U24DS203.3	2	2	2	1	-	-	-	1	1	1	1	1	2	1
CO4	U24DS203.4	2	2	2	1	-	-	-	1	1	1	1	1	2	1
U24DS203.1		2	2	2	1	-	-	-	1	1	1	1	1	1.5	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

DATA STRUCTURES THROUGH C			
Class: B.Tech. II -Semester		Branch: CSE (Data Science)	
Course Code:	U24DS204	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60%
Total Number of Teaching Hours:	60 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: time complexity, space complexity, array operations, and dynamic memory allocation			
LO2: stacks and various forms of queues			
LO3: various types of linked lists			
LO4: various sorting techniques and hashing techniques			
THEORY COMPONENT			
UNIT-I		9 Hrs	
Data Structures: Basic terminology, Classification of data structures, Applications and operations on data structures, Time and space complexity			
Arrays: Operations on arrays-traversing an array, Inserting an element in an array, Deleting an element from an array, Searching an element using binary search and their complexities,			
Dynamic Memory Allocation: Memory allocation functions, Dynamic memory allocation for single and two dimensional arrays			
<i>Self Learning Topics (SLTs): Three dimensional and n-dimensional arrays (Text1: topics 2.4.3), passing arrays to functions and pointers (Reference1: topics 3.6, 3.7), Practice problems (Text1: Prob 2.3, Reference1: Prob 1, Prob 2, Prob 3, Prob 4)</i>			
UNIT-II		9 Hrs	
Stacks: stacks, Array representation of stacks, Operations on a stack-push and pop; Multiple stacks, Applications of stacks- recursion, Fibonacci series, tower of Hanoi, evaluation of expressions (infix to postfix conversion, evaluation of postfix expression)			
Queues: queues, Array representation of queues, Double ended queues, Circular queues			
<i>Self Learning Topics (SLTs): Infix to prefix (Reference1: topics 7.7.3), priority Queue(Reference1: 8.4.3), Solved problems (Reference1: Prob 7.7.1, Prob 7.7.2), Practice problems (Text1: Prob 4.5, Prob 4.11, Prob 5.7, Prob 5.9)</i>			
UNIT-III		9 Hrs	
Linked Lists: Basic terminologies, Linked list versus arrays, Memory allocation and de-allocation for a linked list, Singly linked list, Circular linked list, Doubly linked list, Circular doubly linked list (linked list operations- traversing, searching, inserting, deleting), Representing stack and queue using linked list			
<i>Self Learning Topics (SLTs): Merging (Text1: topics 3.3), Skiplist (weblink: https://www.geeksforgeeks.org/skip-list/), Deallocation strategy(Text1: topic 3.9), Solved problems (Text1: Prob 3.6.1, Prob 3.6.2), Practice problems (Reference1: Prob 5.5, Prob 5.7, Prob 5.9)</i>			
UNIT-IV		9 Hrs	
Sorting Techniques: Selection sort, Insertion Sort, Shell sort and radix sort, Time complexities of sorting			
Hashing: Hashing techniques, Collision resolution techniques, Closed hashing, Open			

hashing, Comparison of collision resolution techniques

Self Learning Topics (SLTs): Two way insertion sort (*Text1: topics 10.3.4*), Comparison of sorting techniques(*Reference1: topics 14.16*) Solved problems (*Reference1: Prob 15.5, Prob 15.6, Prob 15.7*), Practice problems (*Text1: Prob 6.4*)

LABORATORY COMPONENT

List of Experiments

Experiment-I

1. Program to implement initialization of array and perform traversal operations in both the directions
2. Program to implement searching operation on array using Linear Search
3. Program to display the count of occurrences of every number in an array

Experiment-II

4. Program to implement searching operation on array using Binary Search
5. Program to implement insertion operation on array
6. Program to implement deletion operations on array

Experiment-III

7. Program to implement initialization of arrays and traversal operation with DMA
8. Program to implement matrix addition and subtraction with DMA

Experiment-IV

9. Program to implement matrix multiplication with DMA
10. Program to implement stack operations
11. Program to convert infix expression into postfix

Experiment-V

12. Program to evaluate given postfix expression
13. Program to define recursive function to solve tower of hanoi puzzle
14. Program to display the Fibonacci series with the help of recursive function
15. Program to implement MultiStack

Experiment-VI

16. Program to implement queue operations using arrays
17. Program to implement circular queue operations using arrays
18. Program to implement double ended queue operations using arrays

Experiment-VII

19. Program to create single linked list and implement its operations
- Note:- Linked list Operations: i) traversing ii) inserting iii) deleting iv) searching v) reversing vi) concatenation

Experiment-VIII

20. Program to create circular linked list and implement its operations
21. Program to create double linked list and implement its operations

Experiment-IX

22. Program to create circular double linked list and implement its operations

Experiment-X

23. Program to implement stack operations using linked list
24. Program to implement queue operations using linked list

Experiment-XI

25. Program to implement selection sort
26. Program to implement insertion sort

Experiment-XII

27. Program to implement shell sort
28. Program to implement radix sort
29. Program to implement hash table.

Textbook(s):

1. Debasis Samanta, *Classic Data Structures*, Prentice Hall India, 2nd edition, 2009

Reference Book(s):

1. Reema Thareja, *Data Structures Using C*, Oxford University Press, 2nd edition, 2014
2. Balagurusamy E, *Data Structure Using C*, McGraw Hill Education, 1st edition, 2017
3. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach with C*, Cengage Learning, 2nd Edition, 2007

Web and Video link(s):

<https://nptel.ac.in/courses/106106130>; NPTEL Video Lecture on Programming and Data Structures Dr. N. S. Narayana Swamy, CSE, IIT Madras.

Laboratory Manual (for laboratory component):

3. *Data Structures through C Laboratory Manual and Record Book*, Department of CSE (AI & ML), KITSW.

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

(based on cognitive skills acquired from theory component)

- CO1:** analyze and implement array operations by utilizing dynamic memory allocation and evaluating their time and space complexities
- CO2:** analyze and implement stack and queue data structures by utilizing array representations and evaluating their applications and operational complexities
- CO3:** analyze and implement various types of linked lists by utilizing dynamic memory allocation techniques and evaluating their operational complexities
- CO4:** develop various sorting algorithms, analyze their time complexities, and apply hashing techniques with collision resolution methods, comparing their efficiencies

(based on psychomotor skills acquired from laboratory component)

- CO5:** develop and test basic data structures and array operations, including dynamic memory allocation to evaluate their performance and complexity
- CO6:** apply the linear data structures such as stacks and queues and perform various operations using LIFO or FIFO order respectively

- CO7: solve problems using various linked list representations for efficiently storing and retrieving the data
- CO8: apply different sorting techniques on unsorted data and sort them in an order, able to store the data using hashing techniques to retrieve the data very effectively

Course Articulation Matrix (CAM):		U24DS204 DATA STRUCTURES THROUGH C													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2
CO1	U24DS204.1	2	2	2	1	-	-	-	1	1	1	1	1	2	1
CO2	U24DS204.2	2	2	2	2	-	-	-	1	1	1	1	2	2	2
CO3	U24DS204.3	2	2	2	2	-	-	-	1	1	1	1	2	2	2
CO4	U24DS204.4	2	2	2	2	-	-	-	1	1	1	1	2	2	2
CO5	U24DS204.5	2	2	2	1	-	-	-	1	1	1	1	1	2	1
CO6	U24DS204.6	2	2	2	2	-	-	-	1	1	1	1	2	2	2
CO7	U24DS204.7	2	2	2	2	-	-	-	1	1	1	1	2	2	2
CO8	U24DS204.8	2	2	2	2	-	-	-	1	1	1	1	2	2	2
U24DS204		2	2	2	1.75	-	-	-	1	1	1	1	1.75	2	1.75

BASIC ELECTRICAL ENGINEERING			
Class: B.Tech. II -Semester	Branch: Common to CSM, CSD,CSN.CSO & IT		
Course Code:	U24EE205B	Credits	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE	60 %
Total Number of Teaching Hours:	60 Hrs	ESE	40 %
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: network elements and DC circuits			
LO2: DC network theorems			
LO3: 1- Ø AC and 3-Ø AC circuits			
LO4: construction, principles and applications of DC & AC machines and concept of Lighting sources			
THEORY COMPONENT			
UNIT-I			9 Hrs
<p>DC circuits: Network elements, Linear & non-linear elements, Active & passive elements, Unilateral & bilateral elements, Ohm's law, Power, Energy, Kirchhoff's laws, Resistances connected in series and parallel, Voltage divider rule & Current divider rule.</p> <p>DC Circuit analysis: Source transformation, Star-Delta conversion, Mesh analysis & Nodal analysis (T & π networks only).</p> <p><i>Self-Learning Topics (SLTs):</i> Definitions of charge, current, & voltage (Text1: Topics1.2.), Solved problems (Text1: Prob 3.10, 3.11 & 3.12), Practice problems (Text1: Chap-3, Prob 4,5,7&8).</p>			
UNIT-II			9 Hrs
<p>DC network theorems (Independent sources only): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem (T & π networks only).</p> <p><i>Self-Learning Topics (SLTs):</i> Condition for maximum power transfer (Text1: Topics3.9), Solved problems (Text1: Prob 3.15, 3.18, 3.23 & 3.25), Practice problems (Text1: Chap-3, Prob 9,10,13 & 14).</p>			
UNIT-III			9 Hrs
<p>1-Ø AC circuits: R.M.S value, Average value, Peak factor and form factor of a sine wave, Concept of phasor, Phase and phase difference, Rectangular and polar form representation, Sinusoidal steady state analysis of R, L, C, Series RL, RC, RLC circuits, Concept of Reactance, Impedance, Complex power, Real Power, Reactive power and Power factor.</p> <p>3- Ø AC circuits: Generation of 3- Ø voltages, Advantages, Disadvantages, Applications of a three-phase system, Voltage & current relationships of line and phase values for balanced star and delta connections.</p> <p><i>Self-Learning Topics (SLTs):</i> Expression for RMS & Average value (Text1: Topic, 4.4 & 4.5) Solved problems (Text1: Prob 4.10, 4.12, 4.13 & 4.14), Practice problems (Text1: Chap-4, Prob 8,9,12&12).</p>			
UNIT-IV			9 Hrs
<p>Electrical Machines & Electrical Lighting (Qualitative treatment): Construction, Principle of operation, Characteristics & applications of 1- Ø transformer, 3- Ø induction motor, 1- Ø induction motor and DC motor and Types of DC motor.</p> <p>Electrical lighting sources and Energy calculations: Lighting sources-incandescent, Fluorescent, CFL & LED lamps, Elementary calculations for energy consumption.</p> <p><i>Self-Learning Topics (SLTs):</i> EMF equation of a Transformer (Text1: Part-II Topic, 4.4.2) Solved problems (Text1: Part-II Prob 4.5, 4.6 & 4.7), Practice problems (Text1: Part-II Prob 5.2, 5.3 &</p>			

5.4), Practice problems (Text1: Part-II Prob 6, 7 & 8)

LABORATORY COMPONENT

List of Experiments

1. Verification of voltage divider rule and current divider rule
2. Verification of Mesh Analysis
3. Verification of Nodal Analysis
4. Verification of Superposition Theorem
5. Verification of Thevenin's Theorem
6. Verification of Maximum power transfer Theorem
7. Determination of internal parameters of a choke coil
8. Impedance calculations and phasor representation of RL series circuit
9. Impedance calculations and phasor representation of RC series circuit
10. Load test on 1-phase transformer
11. Verification of Kirchoff's laws using PSPICE/MATLAB
12. **Interfacing Sensors with Arduino using TINKER CAD**
 - i. LED blinking
 - ii. IR Sensor
 - iii. Ultrasonic Sensor
 - iv. Voltage Sensor
 - v. Current Sensor
 - vi. Speed Sensor

Textbook(s):

1. K. Uma Rao, *Basic Electrical Engineering*, Pearson Education, Edition, 2011

Reference Book(s):

1. B.L. Thereja, A.K. Thereja, *Electrical Technology Vol. I & II*, S.Chand & Company Ltd, Edition, 2005.
2. Edward Hughes, *Electrical & Electronics Technology*, Pearson Education, 10th Edition., 2010.
3. D. P. Kothari and I. J. Nagrath, *Basic Electrical Engineering*, Tata McGraw Hill, Edition, 2010.
4. Chakravarthy A, Sudhipanath and Chandan Kumar, *Basic Electrical Engineering*, Tata McGraw Hill Ltd, 4th Edition, 2013

Web and Video link(s):

<https://nptel.ac.in/courses/108/105/108105112//>; NPTEL Video Lecture on Fundamentals of Electrical Engineering by Prof. Debapriya Das, Professor of EED, IITK Kharagpur.

Laboratory Manual (for laboratory component):

1. *Basic Electrical Engineering Laboratory Manual and Record Book*, Department of EEE, KITSW.

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

(based on cognitive skills acquired from theory component)

CO1: determine voltage, current & power in electrical circuits using network reduction techniques, mesh & nodal analysis

CO2: apply suitable network theorems to analyze DC circuits

CO3: determine impedance, voltage, current, and power in 1- Ø AC circuits & determine line and phase quantities in 3- Ø AC circuits

CO4 : select a suitable electrical machine for given applications and determine the energy consumed by a lighting load.

(based on psychomotor skills acquired from laboratory component)

CO5: validate mesh and nodal analysis

CO6: validate network theorems

CO7: determine the impedance of series RL & RC circuits at various operating frequencies

CO8: determine the efficiency of a transformer by conducting a load test

Course Articulation Matrix (CAM):		U24EE205B: BASIC ELECTRICAL ENGINEERING													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24EE205B.1	2	1	-	-	-	-	-	1	1	1	1	1	1	1
CO2	U24EE205B.2	2	2	-	-	-	-	-	1	1	1	1	1	1	1
CO3	U24EE205B.3	3	3	1	1	1		1	1	1	1	1	1	1	1
CO4	U24EE205B.4	3	3	1	1	1	1	1	1	1	1	1	1	1	1
CO5	U24EE205B.5	2	1	-	-	-	-	-	1	1	1	1	1	1	1
CO6	U24EE205B.6	2	2	-	-	-	-	-	1	1	1	1	1	1	1
CO7	U24EE205B.7	3	3	1	1	1		1	1	1	1	1	1	1	1
CO8	U24EE205B.8	3	3	1	1	1	1	1	1	1	1	1	1	1	1
U24EE205B		2.5	2.25	1	1	1	1	1	1	1	1	1	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

ENVIRONMENTAL STUDIES			
Class: B.Tech. II Semester	Branch: Common to ME, CSM, CSD, IT, CSN & CSO		
Course Code:	U24CY206	Credits:	0
Hours/Week (L-T-P-O-E):	2-0-0-5-7	CIE:	60%
Total Number of Teaching Hours:	24 Hrs	ESE:	40%
Course Learning Objectives (LOs): <i>This course will develop students' knowledge in /on...</i> LO1: natural resources and their usage more equitably LO2: ecosystem and the importance of biodiversity conservation LO3: environmental pollution and it's control measures LO4: environmental legislation and green methodology			
UNIT-I		6 Hrs	
The Multidisciplinary Nature of Environmental Studies: Definition, Scope and importance Natural Resources: Forest Resources-Use and over exploitation of forests, Deforestation, Timber extraction, Mining, Dams and their effects on forests and tribal people; Water Resources-Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water; Mineral Resources-Environmental effects of extracting and using mineral resources; Energy Resources-Renewable and non-renewable energy sources, Use of alternate energy sources Self Learning Topics (SLTs): <i>Use and over-utilization of surface and ground water (Text1: unit 2, topic: 2.2.2) world food problems (Text1: unit 2, topic 2.2.2)</i>			
UNIT-II		6 Hrs	
Ecosystem and Biodiversity: Ecosystem: Concepts of an ecosystem, Food chain, Food webs, Ecological pyramids, Energy flow in the ecosystem and ecological succession Biodiversity and its Conservation: Introduction, Definition, Genetic, Species and ecosystem diversity, Value of biodiversity, Biodiversity in India, Hot spots of biodiversity, Man-wildlife conflicts, Endangered and endemic species of India; In-situ and Ex-situ conservation Self Learning Topics (SLTs): <i>Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)</i>			
UNIT-III		6 Hrs	
Environmental Pollution: Global issues-Global climatic change, Greenhouse gases, Effects of global warming, Ozone layer depletion International Conventions/Protocols: Earth summit, Kyoto protocol, Montreal protocol Environmental Pollution- Causes and effects of air, Water, Soil, Marine and noise pollution with case studies Solid and Hazardous Waste Management: Introduction, Types, Effects of urban industrial and nuclear waste Natural Disaster Management: Introduction to disaster, Management of disaster, Disaster management of flood, earthquake, cyclone and landslides Role of information technology in environment and human health Self Learning Topics (SLTs): <i>Role of individual in prevention of pollution (Text1: unit 5, topic 5.10)</i>			
UNIT-IV		6 Hrs	

Social Issues and the Environment: Role of Individual and Society, Water conservation, Rain water harvesting

Environmental Protection/Control Acts: Air (prevention and control of pollution) act 1981, Forest conservation act (1980 and 1992), Wildlife protection act 1972, Environment protection act 1986, Issues involved in enforcement of environmental legislations

Green Methodology: Principles of green chemistry, Green methods in electronic production, Impact of electronic waste on public health and environment; United nations goals of sustainable development

Self Learning Topics (SLTs): Water (prevention and control of pollution) act 1974 (Text1: unit 6, topics 6.10), Water pollution cess act 1977 (Text1: unit 6, topics 6.11)

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: identify the natural resources and practice their usage more equitably

CO2: develop an action plan for sustainable alternatives and conserving biodiversity

CO3: examine and perceive the solutions for the environmental pollution

CO4: adapt issues involved in enforcement of environmental legislation and green methodology

Textbook(s):

1. Erach Bharucha, *Text Book of Environmental Studies for Under Graduate Courses*, 2nd Edn., Universities Press (India) Pvt. Ltd, 2013

Reference Book(s):

1. Y. Anjaneyulu, *Introduction to Environmental Science*, B.S. Publications, 2004.
2. Gilbert M. Masters, *Introduction to Environmental Engineering & Science*, 3rd Edn., Prentice Hall of India, 1991
3. Anubha Kaushik, C.P. Kaushik, *Environmental Studies*, 4th Edn., New Age International Publishers, 2014
4. R. Rajagopalan, *Environmental Studies from crisis to cure*, Oxford University Press, 2nd Edn., 2011

Web and Video link(s):

1. <https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ch27/> video lecture on renewable energy resources by Prof. Vaibhav. V. Goud and Dr. R. Anandalakshmi, Dept. Of Chemical Engineering, Guwahati.

Course Articulation Matrix (CAM):		U24CY206 ENVIRONMENTAL STUDIES													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24CY206.1	2	1	2	1	-	2	1	-	1	1	1	1	-	-
CO2	U24CY206.2	-	-	2	-	-	1	2	-	1	1	1	1	-	-
CO3	U24CY206.3	1	2	1	-	-	1	1	1	1	1	1	1	-	-
CO4	U24CY206.4	-	-	1	-	-	1	2	-	1	1	1	1	-	-
U24CY206		1.50	1.50	1.50	1	-	1.25	1.50	1.00	1.00	1.00	1.00	1.00	-	-
3 - HIGH, 2 - MEDIUM, 1 - LOW															

IDEA Lab Makerspace			
Class: B.Tech. II -Semester		Branch: Common to all branches	
Course Code:	U24AE207	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-2-2-4	CIE :	100%
Total Number of Lab Hours:	36 Hrs	ESE :	-
Course Learning Objectives (LOs): <i>This course will develop students' knowledge in /on...</i> LO1: carpentry and CNC wood router LO2: mould for sand casting and arc welding joints LO3: laser engraving, 3D printing and robots in manufacturing LO4: Printed Circuit Board (PCB) and Internet of Things (IoT)			
LABORATORY COMPONENT			
S. No.	Creative Fabrication Technology	List of Experiments	
1.	Carpentry	Prepare a half lap dovetail joint	
2.	CNC Wood Router	Perform wood carving using CNC Wood Router	
3.	Foundry	Prepare a sand mould using single piece pattern	
4.	Welding	Prepare a single V-butt joint on mild steel plates using AC arc welding machine	
5.	Injection Moulding	Prepare a plastic product using Injection moulding machine	
6.	Laser Engraving	Perform key chain by using CO ₂ laser cutting machine	
7.	3D Printing	Prepare a key chain on 3D printer with the given dimensions	
8.		Prepare a Spur Gear on 3D printer with the given dimensions	
9.	Robotics	Perform basic pick-and-place operation using robot	
10.	Printed Circuit Board (PCB)	Design and fabricate a PCB for a given application	
11.	Internet of Things (IoT)	Measure the temperature and humidity by using DHT11 sensor and Arduino UNO	
12.		Create a smart plant watering system using IoT	
Course Project		<ul style="list-style-type: none"> Students are required to create an affordable prototype as their course project, based on the knowledge and skills acquired during the course. Students have to present and submit their prototypes to demonstrate their ability to apply classroom learning practically, showcasing their creativity and technical aptitude. 	
Laboratory Manual: <ul style="list-style-type: none"> IDEA Lab Makerspace Laboratory Manual & Record Book (LMRB) prepared by the faculty of department of Mechanical Engineering, KITSW, Revised version 4, August-2024. 			
Text/ Reference Book(s):			
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy., "Elements of Workshop			

Technology”, Media Promoters and publishers Pvt. Ltd, India, Vol-I-2008 &Vol-II-2010.

3. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, “Additive Manufacturing Technologies-3D Printing, Rapid Prototyping, and Direct Digital Manufacturing” Springer Nature, 2nd Edition 2021.
4. R.S. Khandpur, “Printed Circuit Boards: Design, Fabrication, Assembly and Testing”, New Delhi Tata Mc Graw Hill-2008.
5. Sudeep Mishra, Anandarupmukherjee and Arijit Roy, “Introduction to IoT”, New Delhi: University Cambridge Press, 2021.

Course Learning Outcomes (COs):

After completion of this course, the students should be able to ...

(based on psychomotor skills acquired from laboratory component)

CO1: produce wooden joints and intricate articles using carpentry and CNC wood router respectively

CO2: implement procedures to prepare the mould cavity for sand casting and arc welding joints

CO3: produce innovative prototypes using laser engraving and 3D printing

CO4: design and develop systems based on PCB and IoT for given applications

Course Articulation Matrix (CAM):		IDEA Lab Makerspace													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24AE207.1	2	2	1	1	2	1	-	1	2	2	1	1	-	-
CO2	U24AE207.2	2	2	1	1	2	1	-	1	2	2	1	1	-	-
CO3	U24AE207.3	2	2	1	1	2	1	-	1	2	2	1	1	-	-
CO4	U24AE207.4	2	2	1	1	2	1	-	1	2	2	1	1	-	-
U24AE207		2	2	1	1	2	1	-	1	2	2	1	1	-	-
3 - HIGH, 2 - MEDIUM, 1 - LOW															

Programming Skill Development Lab -1

Class: B.Tech. II -Semester		Branch: CSE (AI & ML)	
Course Code:	U24SE208	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-2-2-4	CIE :	100%
Total Number of Lab Hours:	36 Hrs	ESE :	-

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on...

- LO1:** a solid foundation in C programming, focusing on fundamental concepts such as variables, data types, control structures, loops, and functions to solve computational problems
- LO2:** apply logical and analytical thinking to devise solutions for moderate to complex problems by writing efficient and optimized C programs
- LO3:** identify, analyze, and fix errors in C programs by mastering debugging techniques and utilizing testing strategies to ensure code reliability and performance
- LO4:** developing real-world applications by designing, coding, and implementing projects that simulate industry-standard challenges, thereby preparing for placements and professional careers

LABORATORY COMPONENT

S. No.	List of Experiments
13.	Programs using input output functions, operators
14.	Programs using conditional control structures: if, if-else, nested if
15.	Programs using else if ladder, switch and goto statements
16.	Programs using iterative statements
17.	Programs using iterative statements
18.	Programs on one dimensional array and two-dimensional arrays
19.	Programs on one dimensional array and two-dimensional arrays
20.	Programs on String operations and string handling functions
21.	Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
22.	Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
23.	Programs using structures, unions, pointers to arrays and pointers to strings
24.	Programs using array of pointers and pointers to structures

Text/ Reference Book(s):

6. Balagurusamy.E, *Programming in ANSI C*, McGraw Hill, 8th edition, 2022
7. Paul Deitel, Harvey Deitel, *C How to Program: With Case Studies Introducing Applications Programming and Systems Programming*, Pearson Education Limited, 9th edition, 2022
8. Brian W. Kernighan and Dennis Ritchie, *The C Programming Language*, Pearson Education India, 2nd edition, 2015
9. Reema Thareja, *Programming in C*, Oxford University Press, 3rd edition, 2023
10. Yashavant Kanetkar, *Let Us C*, BPB Publications, 19th edition, 2022
11. A.K.Sharma, *Computer Fundamentals and Programming in C*, Universities Press, 2nd edition, 2018

Course Learning Outcomes (COs):

After completion of this course, the students should be able to ...

(based on psychomotor skills acquired from laboratory component)

CO1: develop efficient and optimized C programs to solve a range of moderate to complex problems, demonstrating a strong understanding of programming fundamentals and algorithm design

CO2: analyze and debug C programs to identify errors and optimize code performance, employing appropriate debugging techniques and tools

CO3: apply advanced programming concepts such as dynamic memory allocation, data structures, and file handling in C to create robust and scalable solutions

CO4: design, implement, and test real-world applications in C, simulating industry scenarios and preparing for technical roles in software development and problem-solving

Course Articulation Matrix (CAM):		Programming Skill Development Lab -1													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24SE208.1	2	2	1	1	1	-	-	1	1	1	1	1	2	2
CO2	U24SE208.2	2	2	1	1	1	-	-	1	1	1	1	1	2	2
CO3	U24SE208.3	2	2	1	1	1	-	-	1	1	1	1	1	2	2
CO4	U24SE208.4	2	2	1	1	1	-	-	1	1	1	1	1	2	2
U24SE208		2	2	1	1	1	-	-	1	1	1	1	1	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW															

PRACTICUM - 2

Class: B.Tech. II - Semester	Branch: Common to all branches		
Course Code:	U24EL209	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-4-4	CIE:	100%
Total Number of Teaching Hours:	-	ESE :	-

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on...

LO1: literature review and identifying research gaps

LO2: implementing a project independently by applying knowledge to practice

LO3: preparing well-documented report and informative PPT

LO4: effective technical presentation and creating video pitch

Practicum is an independent project carried out by the student during the course period, under the supervision of allotted course faculty. It helps to reinforce the students' theoretical knowledge and develop their ability to apply this knowledge to the solution of practical problems. Practicums also prepare them for their MINI and MAJOR PROJECTs and for independent work in their chosen field that promotes creative abilities. Besides they provide Higher Order Cognitive Abilities (HOCAs).

- (i). Practicum is a mandatory semester project work.
- (ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)
- (iii). Allotment of Practicum topics for students:
 - o **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	U24MH101	U24PS102	U24EC103	U24CS104	U24EE105	U24CH106
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

- o In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.
- o The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

CIRCULAR

Allotment of Practicum topics to students

Section :

S.No.	Roll number	Practicum topic allotted	Practicum under the	Course
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	of the student		course	faculty

Note:

4. The students should meet immediately the allotted course faculty for practicum and start working on the practicum with the guidance of course faculty.
5. To complete the Practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and also outside the class work hours during weekdays.
6. The course faculty are advised to guide the allotted students for practicum during the semester course work.

(Signature of class teacher)

- (iv). *To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.*
- (v). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.
- (vi). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.
- (vii). The class teacher shall collect the final marks of practicum of the students allotted to each course teacher and submit them to the CoE.
- viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course
- (ix). A sample rubrics for assessment and evaluation of practicum is as follows:

Literature survey & Identification of research gaps	10 marks
Working model / process / software package / system developed	30 marks
Report writing (subjected to max of 30% plagiarism)	20 marks
Oral presentation with PPT and viva-voce	20 marks
Video pitch	20 marks
Total	100 marks

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation of Practicum.

- (h) **Practicum Topic:** Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.
- (i) **Working Model:** Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.
- (j) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt

presentation.

- What was the objective of the practicum assigned?
 - What are the main responsibilities and tasks for practicum?
 - What knowledge and skills from the coursework are applied in the practicum?
 - What new knowledge and skills are acquired during the practicum?
 - In what ways, can the practicum be helpful for the professional career?
 - What gaps are identified in your practicum work?
 - What improvements or changes you suggest for addressing the identified gaps for future work?
- (k) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute
- (l) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department
- (m) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact
- (n) The student has to register for the Practicum as a supplementary examination in the following cases:
- iv) he/she is absent for oral presentation and viva-voce
 - v) he/she fails to submit the report in prescribed format
 - vi) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

Course Learning Outcomes (COs):

After completion of this course, the students should be able to...

CO1:synthesize literature survey, identify research gaps and define objective & scope of practicum problem

CO2:apply knowledge to design & conduct experiments, utilize modern tools for solution of practicum problem and develop working model/ process/ system

CO3:demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through practicum

CO4:create a video pitch on practicum and make an effective oral presentation using PPTs

Course Articulation Matrix (CAM):		U24EL209 PRACTICUM - 2													
		PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24EL209.1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	U24EL209.2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	U24EL209.3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	U24EL209.4	2	2	2	2	2	2	2	2	2	2	2	2	2	2
U24EL209		2	2	2	2	2	2	2	2	2	2	2	2	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW															

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY - 2 (SEA/SAA)			
Class: B.Tech. II - Semesters	Branch: Common to all branches		
Course Code:	U24VA210(SE/SA)ZZZ	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-2-2	CIE:	100%
Total Number of Teaching Hours:	-	ESE :	-
<p>Course Learning Objectives (LOs): <i>This course will develop students' knowledge in /on...</i></p> <p>LO1: holistic development through activity-based learning to gain real-life experience which effectively help individuals deal appropriately with problems/challenges</p> <p>LO2: positive mindset by actively adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity and handling rejection in life</p> <p>LO3:skills for effective fieldwork practice, which include ethics, observation, communication, interviewing, problem solving, time management, organisation and documentation</p> <p>LO4: making a well-documented report and an effective oral presentation through PPTs portraying knowledge, skills, qualities acquired and social impact of the activity</p>			
<p>Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building generic competencies in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the physical, emotional, cognitive, spiritual and social aspects. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.</p> <p>It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely SEA (Social Empowerment Activities) and SAA (Self Accomplishment Activities)</p> <p>These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.</p> <ol style="list-style-type: none"> (a) Each SEA/SAA activity is treated as one credit course (b) Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester. (c) Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA (d) To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc., (e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enrol in the forthcoming semesters. <p><u>Monitoring SEA/SAA:</u></p> <ol style="list-style-type: none"> (a) Nodal units: The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA. 			

(b) During the semester period, the student has to **acquire requisite knowledge, conduct fieldwork**, acquire skills and propose unique solutions to the real-life problems

(c) **Knowledge Acquisition & Skilling:**

- i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity
- ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.
- iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

(d) **Fieldwork:** Fieldwork is an essential component of learning for gaining real-life experiences. In addition to knowledge acquisition & skilling, student has to take up fieldwork on the chosen activity, as part of SEA/SAA course.

- i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.
- ii. Fieldwork consists of three phases: preparation, the actual activity and feedback
- iii. **As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.**
- iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.
- v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more
- vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.
- vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

(a). **In case of socially relevant problems/ activities of SEA/SAA:** Eminent personalities/ achievers include district administrative officers, Eminent Social workers / NGOs, other inspiring and great personalities

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state

- level/national level /international level competitions, other inspiring and great personalities.
- viii. **For appointment to interact eminent personalities:** Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction
 - ix. On fieldwork, student is expected to demonstrate solid time management, organisational and note taking skills during fieldwork
 - x. **Ethics of fieldwork:** Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged
 - xi. Student is expected to take care of health and Safety practices for fieldwork and travel
 - xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.
 - xiii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practise sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.
 - xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.
 - During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.
- (e) **Demonstration / Presentation and Report:** Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.
- (f) **Flow process for completion of SEA/SAA course:**
- i. **Faculty counsellor approval:** In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal centre. The allotment details shall be shared to

the SEA/SAA coordinator and the student through domain mail id of the student

- ii. **Identification of goals and preparation of action plan:** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.
- iii. **Field work:** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal centre.
- iv. **Demonstration/ Presentation:** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.
- v. **Report writing:** After successful demonstration/presentation, student shall write a 2-3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

(g) **Assessment & Evaluation:** There shall be *only Continuous Internal Evaluation (CIE) for SEA/SAA*. The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centres and faculty counsellors, consolidate them, and submit the final grades to the examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

Assessment	Maximum marks	Marks to be awarded by
Goal setting, Planning & Knowledge Acquisition	20	Nodal centre
Field work	40	Nodal centre
Demonstration/Presentation	20	Nodal centre
Report submission	20	Faculty counsellor
Total	100	-

Note:

- (f) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.
- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.
- (g) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator*.
- (h) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.
- (i) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she
- a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal centre, **and**
 - b. scores a minimum of 40 marks in the CIE of the course
- (j) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Course Learning Outcomes (COs):

After completion of this course, the students should be able to...

CO1: integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility

CO2: interact effectively through written, oral and nonverbal communication with external-world in a professional, sensitive and culturally relevant manner

CO3: analyse the issues related to social empowerment / self-accomplishment, demonstrate problem-solving skills, articulate solutions and demonstrate social sensibility

CO4: demonstrate the generic competencies in making a well-documented report and an effective oral presentation with PPTs portraying knowledge, skills, qualities acquired through fieldwork/practice sessions and social impact of the course learning

Text / Reference book(s):

For knowledge acquisition, students shall refer to textbooks and web resources relevant to the course selected. Plan for fieldwork/practice sessions in coordination with SEA/SAA coordinator

Course Articulation Matrix (CAM):		U24VA210(SE/SA)ZZZ- Courses listed under SEA/ SAA - 2													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	U24VA210.1	-	-	-	-	-	2	2	2	2	2	2	2	1	1
CO2	U24VA210.2	-	-	-	-	-	2	2	2	2	2	2	2	1	1

CO3	U24VA210.3	-	-	-	-	-	2	2	2	2	2	2	2	1	1
CO4	U24VA210.4	-	-	-	-	-	2	2	2	2	2	2	2	1	1
U24VA210		-	-	-	-	-	2	2	2	2	2	2	2	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

Course Code: U24VA XYY(SE/SA)ZZZ

X represents semester; YY represents SEA/SAA course serial number in that semester; SE- represents SEA activity or SA - represents SAA activity; ZZZ represents activity code from SEA/SAA baskets

Ex: If A student selects a SEA/SAA course as below:	Ex: If A student selects a SEA/SAA course as below:
<p><i>Semester: 1</i> <i>SEA/SAA course serial number: 09</i> <i>SEA/SAA category: SEA</i> <i>course number: 302</i></p> <p>The course code will be U24VA109SE302</p>	<p><i>Semester: 4</i> <i>SEA/SAA course serial number: 10</i> <i>SEA/SAA category: SAA</i> <i>course number: 206</i></p> <p>The course code will be U24VA410SA206</p>

EXPERT TALK SERIES - II			
Class: B.Tech.II -Semester	Branch: Common to all branches		
Course Code:	U24AE211	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-1-1	CIE:	100%
Total Number of Teaching Hours:	-	ESE:	-
<p>Course Learning Objectives (LOs): <i>This course will develop students' knowledge in /on...</i></p> <p>LO1: 21st century skills needed for industry, current industry trends, challenges and innovations</p> <p>LO2: latest technology in practice and applying knowledge to solve real-world problems</p> <p>LO3: smart work, soft skills, professional etiquette, networking abilities</p> <p>LO4: making a well-documented report portraying the knowledge, skills, qualities acquired and the impact of the learning</p>			
<p>In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.</p> <p>(a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.</p> <p>(b) Learning from industry experts with real-world examples, is important to enhance your educational experience.</p> <p>(c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximised if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.</p> <p>(d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".</p> <p>But how would you know all this without venturing into the industry?</p> <p>(a) The answer is Industry Expert Talk Series (ETS). Through ETS, we invite industry experts in different fields to deliver talks and interact with students.</p> <p>(b) Through Industry expert talks students get to know so much more that textbooks don't explain.</p> <p>(c) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.</p> <p>(d) Our competency-focussed curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses</p> <p>(e) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal</p>			

development.

- (f) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.
- (g) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.
- (h) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.
- (i) ETS enhances your learning in many ways for global opportunities for your career.
- (j) All in all, learning from industry experts, is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.
- (k) Salient features of ETS are hereunder:
 - (i) ETS is offered from I semester to VI semester.
 - (ii) ETS, in any given semester, is treated as one credit course
 - (iii) Students are required to earn six credits (from I to VI semester)
 - (iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**
 - (v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.
 - (vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs ; *duration: 10-15 mins*), on the contents covered in the expert talk.
 - (vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators**.
 - (viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.
 - (ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.
 - (x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks
 - (xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).
- (l) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

Quiz score (<i>sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks</i>)	60 marks
Attendance (<i>out of 10 quizzes</i>)	20 marks
Report in prescribed format (<i>max 30% plagiarism</i>)	20 marks
Total	100 marks

- ii. **Attendance:** Maximum of 20 marks shall be awarded based on the attendance maintained by the student over a maximum of 10 lectures.

$$\text{Marks for attendance} = \frac{\text{Number of expert talks attended fully}}{10} * 20$$

iii. **Supplementary Exam:**

- (e) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE
- (f) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs ; *duration: 2Hrs*) on the content covered in ETS lectures.
- (g) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE
- (h) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

Course Learning Outcomes (COs):

After completion of this course, the students should be able to...

CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology

CO2: identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement

CO3: interact with experts, exhibit confidence, demonstrate improved communication and networking abilities potentially leading to mentorship opportunities, internships, or even future job prospects

CO4: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through ETS sessions and impact of the expert talks

Course Articulation Matrix (CAM):		U24AE211 EXPERT TALK SERIES - 2													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	U24AE211.1	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO2	U24AE211.2	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO3	U24AE211.3	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO4	U24AE211.4	1	1	1	1	1	1	1	2	1	2	1	2	1	1
U24AE211		1	1	1	1	1	1	1	2	1	2	1	2	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW															

After First Year: (UG Certificate in CSE(Data Science))

(i) The candidate should pass any two of the following additional courses (ITI Level) during the 2-Months internship at institute

Exit Option to Qualify UG Certificate in CSE(Data Science): Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
12	PCC	U24DS212X	Introduction to Python Programming	2	-	2	-	4	3
13	PCC	U24 DS213X	Programming with Java	2	-	2	-	4	3
14	PCC	U24 DS214X	Introduction to Databases	2	-	2	-	4	3
15	PCC	U24 DS215X	Fundamentals of Computer Networks	2	-	2	-	4	3
16	PCC	U24 DS216X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

INTRODUCTION TO PYTHON PROGRAMMING			
Class: B.Tech. II – Semester (Exit Course)		Branch: CSE (Data Science)	
Course Code:	U24DS212X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE :	60%
Total Number of Teaching Hours:	32 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: python syntax, operators, and control statements			
LO2: creating functions, utilizing modules, and understanding namespaces in Python			
LO3: manipulate strings and understanding data structures such as lists, tuples, and dictionaries			
LO4: file operations and learning to implement exception handling in Python			
THEORY COMPONENT			
UNIT-I			4 Hrs
Python Programming: Features of Python, The future of Python, Writing and executing Python programs			
Python Preliminaries: Literal constants, Variables and identifiers, Data types, Input operation, Comments, Reserved words, Indentation, Operators, Expressions in Python, Type conversion			
Decision Control Statements: Selection/Conditional branching statements, Loop structures/iterative statements, Nested loop, the break statement, the continue statement, the pass statement, the else statement used with loops			
UNIT-II			4 Hrs
Functions: Function definition, Function call, Variable scope and lifetime, the return statement, Advances in defining in functions, Lambda functions, Recursive functions			
Modules and Name Spaces: The from ... import statement, Naming module, Making your own modules, the dir() function, Standard library modules, globals(), locals(), and reload(), Function redefinition			
UNIT-III			4 Hrs
Python Strings: String operations, String formatting operator, Built-in string methods and functions, slice operation, ord() and chr() Functions, in and not in operators, Comparing strings, Regular expressions and meta characters			
Data Structures: Lists, Tuple, Dictionaries			
UNIT-IV			4 Hrs
Files: Opening and closing files, Reading and writing files, File positions, Renaming and deleting files			
Error and Exception Handling: Handling Exceptions, Multiple Except Blocks, Multiple exceptions in a single block, Except block without exception, The else clause, Raising exceptions, Handling exceptions in invoked functions, Built-in exceptions, The finally block			
LABORATORY COMPONENT			
List of Experiments			

Unit-1:

1. Develop a Python program that uses decision control statements to determine if a given number is positive, negative, or zero.
2. Develop a python program to implement and compare different loop structures (for loop, while loop) to solve a problem, such as generating a sequence of numbers or performing a series of calculations.
3. Develop a Python program to validate user input and provide appropriate feedback based on various conditional checks, such as checking if an input string meets certain criteria (e.g., length, content).
4. Develop a Python program that utilizes the break, continue, and pass statements within loops to control the flow of execution based on specific conditions.

Unit-2:

5. Develop a Python function that performs a specific task, such as calculating the factorial of a number, and demonstrates how to call this function from different parts of a program.
6. Develop a Python program that defines and uses a lambda function to perform a simple operation, such as filtering or mapping a list of values.
7. Develop a Python program that demonstrates the use of modules and imports by creating a custom module with multiple functions and importing it into a main script.
8. Develop a Python program that illustrates variable scope and lifetime by defining functions with local and global variables and observing how these variables are accessed and modified.

Unit-3:

9. Develop a Python program to perform basic string operations, including slicing, concatenation, and formatting, and demonstrate their use in processing and displaying text data.
10. Develop a Python program that uses lists, tuples, and dictionaries to store and manipulate data. For example, develop a simple contact management system that adds, updates, and retrieves contact information.
11. Develop a Python script to perform various operations on strings, such as counting occurrences of specific characters, reversing a string, and finding substrings.

Unit-4:

12. Develop a Python script that reads data from a file, processes the data (e.g., counting lines or words), and writes the results to a new file. Include error handling for file access errors.
13. Develop a Python program that demonstrates exception handling by intentionally causing errors (e.g., dividing by zero, accessing an invalid dictionary key) and using try-except blocks to manage these exceptions.

Textbook(s):

1. Reema Thareja, *Python Programming using problem solving approach*, Oxford University Press, 1st edition, 2017, New Delhi. (Chapters 3 to 8, 12)

Reference Book(S):

1. William Punch and Richard Enbody, *Practice of Computing Using Python*, Pearson, 3rd edition, 2015, Noida
2. Dr.Charles R. Severance, *Python for Everybody-Exploring Data Using Python*, Shroff Publishers, 1st edition, 2017, Mumbai
3. David Beazley, *Python Cookbook*, O'Reilly Media, 3rd edition, 2013, Sabastopol, CA

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc21_cs32/preview; NPTEL Video Lecture on Python Programming by Prof. Sudarshan Iyengar, Professor of E&ECE, IIT Ropar.

Laboratory Manual (for laboratory component):

1. *Python Programming Laboratory Manual and Record Book*, Department of CSE (AI & ML), KITSW

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

(based on cognitive skills acquired from theory component)

CO1 : develop python programs using python syntax, operators and control statements

CO2 : develop and utilize functions, import and manage modules, and understand the use of namespaces to organize code efficiently

CO3 : manipulate strings and utilize data structures such as lists, tuples, and dictionaries to solve complex problems

CO4 : develop programs using file read/write operations and implement robust exception handling mechanisms to manage errors and ensure program reliability

(based on psychomotor skills acquired from laboratory component)

CO5 : develop and execute Python programs that utilize fundamental syntax, operators, and control statements

CO6 : develop python functions, organize code using modules, and manage namespaces to create modular and reusable Python programs

CO7 : apply techniques to manipulate strings and utilize data structures such as lists, tuples, and dictionaries to solve real-world problems

CO8 : develop python programs involved in file read/write operations and implement exception handling to manage errors and ensure the robustness of Python programs

Course Articulation Matrix (CAM):			U24DS212X INTRODUCTION TO PYTHON PROGRAMMING												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24DS212X.1	1	2	2	1	-	-	-	1	-	1	-	-	2	2
CO2	U24DS212X.2	2	2	3	2	-	-	-	1	-	1	-	2	2	2
CO3	U24DS212X.3	2	2	3	2	-	-	-	1	-	1	-	2	2	2
CO4	U24DS212X.4	2	2	3	3	-	-	-	1	-	1	-	2	2	2
CO5	U24DS212X.5	1	2	2	2	-	-	-	1	2	1	2	-	2	2
CO6	U24DS212X.6	2	2	3	2	-	-	-	1	2	1	2	2	2	2
CO7	U24DS212X.7	2	2	3	2	-	-	-	1	2	1	2	2	2	2
CO8	U24DS212X.8	2	2	3	2	-	-	-	1	2	1	2	2	2	2
U24DS212X		1.75	2	2.75	1.75	-	-	-	1	1.5	1	2	2	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW															

PROGRAMMING WITH JAVA			
Class: B.Tech. II -Semester (Exit Course)		Branch: CSE (Data Science)	
Course Code:	U24DS213X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE :	60%
Total Number of Teaching Hours:	32 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: data types, operators, control statements, and arrays			
LO2: classes, methods, and strings			
LO3: types of inheritance, dynamic method dispatch, and interfaces			
LO4: streams (I/O) and exception handling			
THEORY COMPONENT			
UNIT-I		4 Hrs	
Programming Paradigms: Object oriented programming (OOP) concepts			
Java Basics: An overview of java, Data types, Variables and arrays, Operators, Control statements			
Introducing classes: Class fundamentals, Objects, Methods, Object reference variables			
UNIT-II		4 Hrs	
Classes and Methods: Overloading methods, this keyword, Passing and returning objects, Recursion, Constructors, Overloading constructors, static variables, static blocks and static methods, Nested and inner classes, Command line arguments			
Strings: Exploring String, StringBuffer			
UNIT-III		4 Hrs	
Inheritance: Inheritance basics, Types of inheritance, super keyword, Method overriding, Order of constructors calling, Dynamic method dispatch, Abstract classes, final with inheritance, Object class			
Interfaces: Defining an interface, Implementing interfaces, Nested interfaces			
UNIT-IV		4 Hrs	
Using I/O: I/O basics, Reading, Writing and copying files			
Exception Handling: Exception types, Uncaught exceptions, Using try and catch, Multiple catch clauses, Nested try statements, throw, throws, finally			
LABORATORY COMPONENT			
List of Experiments			
Experiment-I			
1. Develop a java program to demonstrate different operators supported by java.			
2. Develop a java program to demonstrate control structures.			
3. Develop a java program to demonstrate switch statement.			
Experiment-II			
4. Develop a java program to read an array and display them using for-each control.			
5. Develop a java program to read a matrix and display whether it is an identity matrix or not. Use civilized form of break statement.			
6. Develop a java program to define a two-dimensional (2D) array where each row contains different number of columns. Display the 2D-array using for-each.			
Experiment-III			

7. Develop a java program to demonstrate class concept.
8. Develop a java program to demonstrate this keyword.
9. Develop a java program to demonstrate overloading of methods.

Experiment-IV

10. Develop a java program to demonstrate constructors.
11. Develop a java program to demonstrate nested and inner classes.
12. Develop a java program to demonstrate static variables, static methods, and static blocks.

Experiment-V

13. Develop a java program to read at least five strings from command line argument and display them in sorted order.

Experiment-VI

14. Develop a java program to accept a string, count number of vowels and remove all vowels.
15. Develop a java program to accept a string, count number of vowels and remove all vowels using StringBuffer class.

Experiment-VII

16. Develop a java program to demonstrate single level-inheritance.
17. Develop a java program to demonstrate multilevel-inheritance using super.
18. Develop a java program to demonstrate method overriding.

Experiment-VIII

19. Develop a java program to demonstrate dynamic method dispatch.
20. Develop a java program to demonstrate use of abstract class.

Experiment-IX

21. Develop a java program to implement interfaces.
22. Develop a java program to extend the interfaces.

Experiment-X

23. Develop a java program to demonstrate implementation of nested interfaces.

Experiment-XI

24. Develop a java program to demonstrate try-catch block.
25. Develop a java program to demonstrate throw clause.
26. Develop a java program to demonstrate throws clause.

Experiment-XII

27. Develop a java program to demonstrate read/write/copy a file.

Textbook(s):

1. Herbert Schildt, *Java The Complete Reference*, McGraw-Hill Education, 11th edition, 2019, New Delhi

Reference Book(s):

1. Kathy Sierra, Bert Bates, *Head First Java*, O'Reilly Publications, 2nd edition, 2013
2. Uttam K. Roy, *Advanced JAVA Programming*, Oxford Publications, 1st edition, 2013
3. Balaguruswamy, *Programming with Java: A Primer*, McGraw-Hill Education India Pvt. Ltd, 6th edition, 2019, New Delhi
4. Tanweer Alam, *Internet and Java Programming*, Khanna Publishing House, 1st edition, 2010, New Delhi

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc20_cs58/preview; NPTEL Video Lecture on *Programming in Java* by Prof. Debasis Samanta, Professor of CSE, IIT Kharagpur.

Laboratory Manual (for laboratory component):

2. *Programming in Java laboratory manual and Record Book*, Department of CSE(AI&ML), KITSW

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

(based on cognitive skills acquired from theory component)

CO1: apply fundamental java concepts, including data types, variables, arrays, operators, and control statements, to develop and debug basic java programs

CO2: design and implement java programs using classes including overloading, recursion, and string manipulation techniques to solve complex problems

CO3: apply inheritance and interface concepts to develop robust java applications

CO4: develop java programs that incorporate file handling and implement effective exception handling strategies to ensure program reliability and error management

(based on psychomotor skills acquired from laboratory component)

CO5: develop and debug java programs demonstrating basic syntax, data types, operators, and control statements, including the use of classes and methods

CO6: design and develop java applications using object-oriented principles and recursion

CO7: apply file operations and exception handling techniques to manage file reading, writing, and error handling in java programs

CO8: utilize string manipulation and advanced class features to solve complex programming problems

Course Articulation Matrix (CAM):		U24DS213X PROGRAMMING WITH JAVA													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24DS213X.1	2	1	1	1	-	-	-	1	-	1	-	2	2	1
CO2	U24DS213X.2	2	2	2	2	-	-	-	1	-	1	-	2	2	1
CO3	U24DS213X.3	2	2	2	2	-	-	-	1	-	1	-	2	2	2
CO4	U24DS213X.4	2	3	2	2	-	-	-	1	-	1	-	2	2	2
CO5	U24DS213X.5	2	1	1	1	-	-	-	1	2	1	-	2	2	1
CO6	U24DS213X.6	2	2	2	2	-	-	-	1	2	1	-	2	2	1
CO7	U24DS213X.7	2	2	2	2	-	-	-	1	2	1	-	2	2	2
CO8	U24DS213X.8	2	3	2	2	-	-	-	1	2	1	-	2	2	2
U24DS213X		2	2	1.75	1.75	-	-	-	1	1.5	1	-	2	2	1.5
3 - HIGH, 2 - MEDIUM, 1 - LOW															

INTRODUCTION TO DATABASES			
Class: B.Tech. II – Semester (Exit Course)		Branch: CSE (Data Science)	
Course Code:	U24DS214X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE:	60%
Total Number of Teaching Hours:	32 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO1: database system concepts, architecture, relational data models and constraints			
LO2: Entity-Relationship database model and SQL			
LO3: normalization techniques for designing a database			
LO4: transaction in a database and concurrency control			
THEORY COMPONENT			
UNIT-I			4 Hrs
<p>Databases and Database Users: Characteristics of database approach, Advantages of using DBMS, When not to use DBMS</p> <p>Database System Concepts and Architecture: Data models, Schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, The database system environment, Classification of database management systems.</p> <p>The Relational Data Model and its constraints: Relational model concepts, Relational constraints and the relational database schemas, Update operations and dealing with constraint violations</p>			
UNIT-II			4 Hrs
<p>Data Modeling using the Entity-Relationship Model: Using high-level conceptual data models for database design, Entity types, Entity sets, Attributes and keys, Relationships types, Relationship sets, Roles and structural constraints, Weak entity types, ER diagrams</p> <p>Basic SQL: SQL Data definition and data types, Specifying constraints in SQL, Basic retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL</p>			
UNIT-III			4 Hrs
<p>Database Design Theory and Normalization: Informal design guidelines for relation schemas, Functional dependencies, Normal forms on Primary keys, General definitions of second and third normal form, Boyce-Codd normal form</p>			
UNIT-IV			4 Hrs
<p>Introduction to Transaction Processing: Introduction to transaction processing, Transaction and system concepts, Desirable properties of a transactions, Characterizing schedules based on recoverability and serializability</p> <p>Concurrency Control Techniques: Two-Phase locking techniques for concurrency control, Concurrency control based on timestamp ordering</p>			
LABORATORY COMPONENT			
List of Experiments			
<ol style="list-style-type: none"> 1. Design and implement DDL,DML, TCL and DCL. 2. Design and implement Queries on types of constraints. 3. Design and implement Queries using built-in functions of NUMBER, CHARACTER and DATE Data types. 			

4. Design and implement Queries on Data type conversion functions.
5. Design and implement Queries on single row functions and operators.
6. Design and implement Queries on aggregate functions.
7. Design and implement Queries on joins and nested queries.
8. Construct SQL statements to create simple, composite indexes, user-defined data types, views, sequences.
9. Implementation of sample PL/SQL programs using conditional and iterative statements.
10. Implementation of PL/SQL programs using cursors.
11. Implementation of PL/SQL programs using parameterized cursors.
12. Create PL/SQL programs to handle exceptions.

Textbook(s):

1. Ramez Elmasri, Shamakanth B. Navathe, *Fundamentals of Database Systems*, 7th edition, 2017, New Delhi

Reference Book(s):

1. Raghu RamaKrishnan, Johannes Gehrke, *Database Management Systems*, 4th edition, McGraw Hill, 2014, New Delhi
2. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, *Database System Concepts*, 6th edition, McGraw-Hill, 2011, New Delhi

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc24_cs75/preview, NPTEL Video Lecture on Database Management Systems by Prof. Partha Prathim Das, Professor of CSE, IIT Kharagpur.

Laboratory Manual (for laboratory component):

2. *Database Management Systems Laboratory Manual and Record Book*, Department of CSE (AI & ML), KITSW.

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

(based on cognitive skills acquired from theory component)

CO1 : analyze and evaluate the characteristics, architecture, and relational constraints of database management systems to design robust database solutions

CO2 : design and optimize complex database schemas using the Entity-Relationship model and implement robust data definitions, constraints, and manipulations using SQL

CO3 : analyze and apply normalization principles and functional dependencies to design efficient and well-structured relational database schemas

CO4 : evaluate and implement advanced transaction processing techniques and concurrency control methods to ensure data integrity and optimal database performance

(based on psychomotor skills acquired from laboratory component)

CO5 : develop and test advanced SQL queries using built-in functions, data type conversion functions, and aggregate functions to manipulate and analyze data effectively

CO6 : design and test complex SQL queries for creating and managing constraints, indexes, user-defined data types, views, and sequences to enhance database

performance and maintainability

CO7 : develop and execute PL/SQL programs incorporating conditional and iterative statements, cursors, and parameterized cursors to create dynamic and efficient database applications

CO8 : develop and test robust PL/SQL programs to handle exceptions, ensuring reliable and error-free database operations

Course Articulation Matrix (CAM):		U24DS214X INTRODUCTION TO DATABASES													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24DS214X.1	1	2	2	1	1	-	-	1	-	1	-	-	2	2
CO2	U24DS214X.2	2	2	3	2	2	-	-	1	-	1	-	2	2	2
CO3	U24DS214X.3	2	2	3	2	2	-	-	1	-	1	-	2	2	2
CO4	U24DS214X.4	2	2	3	3	2	-	-	1	-	1	-	2	2	2
CO5	U24DS214X.5	1	2	2	2	1	-	-	1	2	1	2	2	2	2
CO6	U24DS214X.6	2	2	3	2	2	-	-	1	2	1	2	2	2	2
CO7	U24DS214X.7	2	2	3	2	2	-	-	1	2	1	2	2	2	2
CO8	U24DS214X.8	2	2	3	2	2	-	-	1	2	1	2	2	2	2
U24DS214X		1.75	2	2.75	1.75	1.75	-	-	1	2	1	2	2	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW															

FUNDAMENTALS OF COMPUTER NETWORKS			
Class: B.Tech. II -Semester (Exit Course)		Branch: CSE (Data Science)	
Course Code:	U24DS215X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE:	60%
Total Number of Teaching Hours:	32 Hrs	ESE:	40%
Course Learning Objectives (LOs):			
<i>This course will develop students' knowledge in /on...</i>			
LO5: computer networks reference models, physical layer components & network switching			
LO6: data link and medium access control protocols			
LO7: routing algorithms & internetworking			
LO8: transport and application layer protocols used in the networks			
THEORY COMPONENT			
UNIT-I		4 Hrs	
<p>Fundamentals of Computer Networks: Uses of computer networks, Network hardware, Network software Reference Models: OSI reference model, TCP /IP reference model, Comparison of OSI and TCP/IP reference model</p> <p>Physical Layer: Transmission media - Guided transmission media, Wireless transmission; Digital modulation and multiplexing Switching: Circuit and Packet switching</p>			
UNIT-II		4 Hrs	
<p>Data Link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols</p> <p>Medium Access Control Sub Layer: IEEE standard 802.3, Token bus, Token ring, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, Data link layer switching</p>			
UNIT-III		4 Hrs	
<p>Network Layer: Network layer design issues, Routing algorithms - Optimality principle, Shortest path algorithm, Flooding, broadcast routing, Multicast routing</p> <p>Internetworking: How networks differ, how networks can be connected, Tunneling, Internetwork routing, Packet fragmentation</p>			
UNIT-IV		4 Hrs	
<p>Network Layer In The Internet: IP version 4 protocols, IP addresses, IP version 6 protocol, Internet control protocols, Internet multicasting</p> <p>Transport Layer: Transport services, Elements of transport protocols - Connection establishment and release, Error control and flow control, Crash recovery, Multiplexing congestion control</p> <p>Internet transport protocols - UDP, TCP</p> <p>Application Layer: Domain name system (DNS), Electronic mail, World Wide Web</p>			
LABORATORY COMPONENT			
List of Experiments			
<ol style="list-style-type: none"> 1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool, Study of Network Devices. 2. Setting up LAN, checking for connectivity, basic network commands and Network configuration, Interpreting Ping and Traceroute Output. 			

3. Configure of TCP/IP protocols in Window/LINUX with Subnet masking.
4. Examine Network Address Translation (NAT)
5. Configure Static and Dynamic Routing with Static and Default Routes.
6. Configure Ethernet and Serial Interfaces.
7. Configure RIP.
8. Configure Network Firewalls for securing the network.
9. Configure a Cisco Router as a DHCP Server.
10. Capture Packets Using Wireshark tool.
11. Analysing the packet traffic for Statistics with Filters.

Textbook(s):

1. Andrew S. Tannenbaum, David J. Wetherall, *Computer Networks*, 5th edition, Pearson Education, 2011, London

Reference Book(S):

1. William Stallings, *Data and Computer Communications*, 10th edition, Pearson Education, 2014, London
2. Behrouz Forouzan, *Data Communication and Networking*, 5th edition, Tata McGraw Hill, 2012, New York
3. Larry Peterson, Bruce S Davie, *Computer Networks*, 5th edition, Elsevier Inc., 2011, New York
4. James F. Kurose and Keith W. Ross, *Computer Networking A Top-Down Approach*, 6th edition, Pearson Education, 2013, London

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc24_cs69/preview; NPTEL Video Lecture on *Demystifying Networking*, by Prof. Sridhar Iyer, Prof. Ashutosh Raina, IIT Bombay

Laboratory Manual (for laboratory component):

1. *Computer Networks laboratory manual and Record Book*, Department of CSE (AI & ML), KITSW

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

(based on cognitive skills acquired from theory component)

- CO1:** evaluate and compare network hardware, software, reference models, and transmission techniques to design optimized network solutions
- CO2:** analyze and design robust data link layer protocols and medium access control techniques to ensure efficient and reliable network communication
- CO3:** analyze and implement advanced routing algorithms and internetworking techniques to design efficient and scalable network infrastructures
- CO4:** evaluate and implement IP protocols, transport protocols, and application layer services to design and optimize comprehensive network communication systems

(based on psychomotor skills acquired from laboratory component)

- CO5:** develop and configure TCP/IP protocols and sub-netting on Windows/Linux systems to ensure efficient network communication and address management
- CO6:** analyze and implement network security measures by configuring firewalls and examining Network Address Translation (NAT) to protect and manage network

traffic

CO7: design and implement dynamic and static routing protocols, including RIP, to optimize network routing and ensure reliable data transmission

CO8: utilize network analysis tools such as Wireshark to capture and analyze packet traffic, applying filters to interpret network performance and troubleshoot issues

Course Articulation Matrix (CAM):		U24DS215X FUNDAMENTALS OF COMPUTER NETWORKS													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24DS215X.1	1	2	2	2	-	-	-	1	-	1	-	1	2	2
CO2	U24DS215X.2	2	2	2	2	-	-	-	1	-	1	-	1	2	2
CO3	U24DS215X.3	2	2	2	2	-	-	-	1	-	1	-	1	2	2
CO4	U24DS215X.4	2	2	2	2	-	-	-	1	-	1	-	1	2	2
CO5	U24DS215X.5	2	2	2	2	2	-	-	1	2	1	2	1	2	2
CO6	U24DS215X.6	2	2	2	2	2	-	-	1	2	1	2	1	2	2
CO7	U24DS215X.7	2	2	2	2	2	-	-	1	2	1	2	1	2	2
CO8	U24DS215X.8	2	2	2	2	2	-	-	1	2	1	2	1	2	2
U24DS215X		1.875	2	2	2	2	-	-	1	2	1	2	1	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW															