ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2020 Rank Band: 201-250

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)

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B.TECH. CURRICULUM

ACADEMIC YEAR: 2024–25

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

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
Competancy-Focused Outcome Based Curriculum (CF-OBC)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI & ML)
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 506 015 TELANGANA
(UGC Autonomous Institute Under Kakatiya University, Warangal)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AI & ML)

History:

PROGRAM	DESCRIPTION	
	INTAKE	NBA ACCREDITATION
UG in B.Tech. Computer Science and Engineering (AI & ML)	• Started with an intake of 60 in the year 2020. • Intake increased to 120 in the year 2022.	• Will appear in: 2025-26

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 (AI & ML): VISION AND MISSION

VISION

Attain Center of Excellence in Artificial Intelligence and Machine Learning 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 Artificial Intelligence and Machine Learning 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 Artificial Intelligence and Machine Learning. Empower them to address global socio-economic, political, and environmental issues through innovative solutions and impactful contributions.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: **Technical Expertise**
Apply the fundamental knowledge of the core courses of computer science and Artificial Intelligence and Machine Learning for developing the effective and transformational software solutions

PEO2: **Successful Career**
Excel in profession, higher education and entrepreneurship with updated technologies in software, artificial intelligence and machine learning 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 adaptable, which is crucial for thriving in a dynamic and evolving field.

PEO Statements	Mission Statements	Mapping Level	Justification
	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)	Apply the fundamentals of computer science and engineering along with artificial intelligence and machine learning knowledge to develop and maintain high-quality sustainable software solutions that address real-world complex engineering problems.
PSO2: (Societal Impact through AI and ML)	Design, configure, and implement AI and machine learning applications that benefit society and promote development by continuously 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	Conductinvestigationofcomplexproblems	3	2	2
PO5	Engineering tool usage	3	2	2
PO6	The Engineer and The World	1	1	2
PO7	Ethics	1	3	3
PO8	Individual and Teamwork	3	3	2
PO9	Communication	2	3	3
PO10	Project management and finance	2	2	2
PO11	Life long Learning	2	2	3
PSO1	Sustainable Software Solutions: Apply the fundamentals of computer science and engineering along with artificial intelligence and machine learning knowledge to develop and maintain high-quality sustainable software solutions that address real-world complex engineering problems	3	3	2
PSO2	Societal Impact through AI and ML: Design, configure, and implement AI and machine learning applications that benefit society and promote development by continuously adapting to the latest advancements and updates in the field	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.
- Mulitple Entry Multiple Exit (MEME) option.
- Multidisciplinary four year UG progrmme 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 though 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 experiancial 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 imart important skills like problem solving, critical thinking and communication. Under experiential learingthe 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 expertial 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 Adopter*
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 accorss 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 21stcentury require, that liberal broad-based multidisciplinary education become the basis for all higher education. This will help develop well-rounded individuals that possess critical 21stcentury 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. The approach across all undergraduate programs, including those in professional, technical, and vocational disciplineswould be leading to holistic education, in the long run.*

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 21stcentury."

To ensure holistic development of the learner, an attempt has been made in this curriculum to blend engineering education appropriately with arts, humanities, crafts, ethics of personal and social engagement. 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 holistic education as envisaged in NEP 2020.

(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:**

   URR24 Regulations governing the Choice Based Credit System (CBCS) with Multiple Entry and Multiple Exit (MEME) options with Competancy-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 exist (MEME) options. The maximum duration for a student for complining 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(AI & ML); UG Diploma in CSE (AI & ML) after the study of two academic years (four semesters); and B. Voc in CSE (AI & ML) 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 (AI & ML) 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, Post graduate 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 undergraduate programme)	36-40
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 HEUIs 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 Padegogy:

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 padagogocal approches:

(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 othere-learning platforms, approved by the BoS chair and Dean AA, towards obtaining required credits wherever 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 (AI & ML)	The student should be employable as Technical Assistant CSE (AI & ML) in any industry/organization.
2.	Second Exit	After completion of Second year.	UG Diploma in CSE (AI & ML)	The student should be employable as Technician (CSE (AI & ML)) in any industry/organization.
3.	Third Exit	After completion of Third year.	B. Voc. in CSE (AI & ML)	The student should be employable as Technical Supervisor (CSE (AI & ML)) in any industry/organization.
4.	Normal Exit	After completion of Fourth year.	B.Tech. in CSE (AI & ML)	The student should be employable as an Engineer (CSE (AI & ML)) 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 (AI & ML) from our institute.
3.	Third Entry	V-Sem. of the program	The successful completion of UG Diploma in CSE (AI & ML) from our institute.
4.	Fourth Entry	VII -Sem. of the program	The successful completion of B. Voc. in CSE (AI & ML) from our institute.

(i) **No. of maximum exits:** as per NEP 2020/UGC/AICTE guidelines on MEME

(ii) **No. of maximum entry:** as per NEP 2020/UGC/AICTE guidelines on MEME

(iii) **Maximum gap between exit and entry:** as per NEP 2020/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 offered by other departments / in identified cutting-edge technologies /external recognized organizations, can start the programme in either 3rd semester or in 5th semester as per their interest. The requirement for completion of Minor degree programme is that the students are,

(i) **3rd to 6th semeseters**: allowed to take maximum one theory and one lab course in each semester, starting from 3rd to 6th semesters

(ii) **7th & 8th semesters**: allowed to take only one theory course per semester in 7th and 8th semesters

Students should complete 4 theory and two lab courses by the end of 8th semester. However, All four theory courses have to be completed through MOOCS and lab courses have to be completed in the department which offers the Minor degree programme.

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

Students opting for Honours degree offred by their own department / external recognized organizations, can start in eith 3rd or 5th semester aas per their interest. The requirement for completion of Minor degree programme is that the students are,

(i) **3rd to 6th semeseters**: allowed to take maximum one theory and one lab course in each semester, starting from 3rd to 6th semesters

(ii) **7th & 8th semesters**: allowed to take only one theory course per semester in 7th and 8th semesters

Students should complete 4 theory and two lab courses by the end of 8th semester. However, All four theory courses have to be completed through MOOCS and lab courses have to be completed in the department which offers the Minor degree programme.

c) ***B.Tech–"Honours with Research" degree (with additional 18 credits by research): 170+18 credits***

Students opting for Honours with Research degree, can start in 4th semester. They are expected to complete one course on "Research Methodology" through MOOCS or can complete one week FDP on "Research Methodology" during 4th

semester (4 credits). They have to complete two research internships each of 2-month duration, one in summer after 2nd year (5 credits) and other in summer after 3rd year (5 credits). They have to work on **individual research based project**, starting from 5th semester onwards. They have to present a Seminar on the individual research project in 5th semester, carryout a Mini-Project during 6th semester and continue the same as Major Project during 7th & 8th semesters. Finally, publish a research paper as outcome of their research project, in a journal indexed by SCI/SCOPUS/WEB OF SCIENCE (4 credits), by the end of 8th semesetr. ***(The individual research project itself shall be considered for regular B. Tech degree programme under Seminar, Mini-Project and Major Project work courses)***.

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	1 theory (4 credits) + 1 lab (1 credit)	1 theory (4 credits) + 1 lab (1 credit)	-
IV	1 theory (4 credits) + 1 lab (1 credit)	1 theory (4 credits) + 1 lab (1 credit)	"Research Methodology" Theory Course (4 Credits)
Summer break after 2nd 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 3rd year	-	-	2-Months Research Internship -II (5 credits)
VII	1 theory (4 credits)	1 theory (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	**Overall 18 credits (through 4 theory and 2 lab courses)**	**Overall 18 credits (through 4 theory and 2 lab courses)**	**18 credits (through Research Methodology, 2 Research Internships and a Research Publication out of Individual Research Project)**

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

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

<table>
<tr><th>S. No.</th><th>Activity</th><th>Points earned</th><th>Maximum Limit</th></tr>
<tr><td>1</td><td>Success in the GATE Exam</td><td><table><tr><td>Percentile</td><td>Points</td></tr><tr><td>Above 98</td><td>8</td></tr><tr><td>Above 95</td><td>6</td></tr><tr><td>Above 90</td><td>4</td></tr><tr><td>Qualified</td><td>2</td></tr></table></td><td>8 Points</td></tr>
<tr><td>2</td><td>Research Publication indexed by SCI / SCOPUS / Web of Science*</td><td>SCI Journal: 8 Points
SCOPUS / Web of Science Journal: 4 Points
Patent: 4 Points</td><td>8 Points</td></tr>
<tr><td>3</td><td>Winning Prestigious Technical Competition at National Level</td><td><table><tr><td>Rank</td><td>Points</td></tr><tr><td>1</td><td>4</td></tr><tr><td>2</td><td>3</td></tr><tr><td>3</td><td>2</td></tr></table></td><td>6 Points</td></tr>
<tr><td>4</td><td>Completion of PG level MOOCS</td><td><table><tr><td>Percentile</td><td>Points</td></tr><tr><td>Above 95</td><td>6</td></tr><tr><td>Above 90</td><td>5</td></tr><tr><td>Above 80</td><td>4</td></tr></table></td><td>6 Points</td></tr>
<tr><td colspan="3">Total Points Restricted to a maximum of</td><td>8 Points</td></tr>
</table>

Note: As the activities mentioned in the above Table of 11.3 are aimed at an additional professional dimention 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.

***In journals only. Journal to be approved by the BoS chair and Dean AA.**

#In events approved by the BoS chair and Dean AA.

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 *(for CSM)*	I	4
3.	BSC 03	U24MH201	Matrix Theory and Vector Calculus	II	3
4.	BSC 04	U24PY202B	Engineering Physics *(for CSM)*	II	4
5.	BSC 05	U24MH301E	Essential Mathematics and Statistics for Machine Learning	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	U24AI104	Programming for Problem Solving with C	I	4
3.	ESC 03	U24ME107	Engineering Graphics through CAD	I	1
3.	ESC 04	U24AI204	Data Structures through C	II	4
4.	ESC 05	U24EE205B	Basic Electrical Engineering *(for CSM)*	II	4
				Total	16

(iv) Program Core Courses (PCC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	PCC 01	U24AI203	Computer Architecture and Organization	II	3
2.	PCC 02	U24AI302	Advanced Data Structures	III	4
3.	PCC 03	U24AI303	Operating Systems	III	3
4.	PCC 04	U24AI304	Automata Theory and Compiler Design	III	3
5.	PCC 05	U24AI305	Object Oriented Programming through Java	III	4
6.	PCC 06	U24AI401	Database Management Systems	IV	4
7.	PCC 07	U24AI402	Artificial Intelligence	IV	3
8.	PCC 8	U24AI403	Software Engineering	IV	3
9.	PCC 9	U24AI404	Computer Networks	IV	3
10.	PCC 10	U24AI405	Python Programming	IV	4
11.	PCC 11	U24AI502	Web Programming	V	4
12.	PCC 12	U24AI503	Design and Analysis of Algorithms	V	3
13.	PCC 13	U24AI504	Machine Learning	V	4
14.	PCC 14	U24AI602	Computer Vision and Image Processing	VI	3
15.	PCC 15	U24AI603	Deep Learning	VI	4
16.	PCC 16	U24AI604	DevOps	VI	4
17.	PCC 17	U24AI703	Big Data Analytics	VII	4
18.	PCC 18	U24AI704	Cloud Computing	VII	3
19.	PCC 19	U24AI705	Ethical Hacking	VII	3
				Total	66

(v) Program Elective Courses (PEC)

S. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	PEC 01	U24AI601A	Natural Language Processing with Transformers	VI	3
		U24AI601B	Advanced Computer Networks		
		U24AI601C	Fundamentals of IoT		
		U24AI601D	Predictive Analytics and Data Mining		
		U24AI601E	Mobile Application Development		
2.	PEC 02	U24AI702A	Robotic Process Automation	VII	3
		U24AI702B	Cryptography and Network Security		
		U24AI702C	IoT Architectures and Protocols		
		U24AI702D	Exploratory Data Analysis with Python		
		U24AI702E	UNIX Shell Programming		
3.	PEC 03	U24AI802A	Prompt Engineering for Generative AI	VIII	3
		U24AI802B	Block Chain Technologies		
		U24AI802C	Industrial IoT		

S. No.	Course Type	Course Code	Course Name	Semester	Credits
		U24AI802D	Social and Information Network Analysis		
		U24AI802E	Introduction to NoSQL		
4.	PEC 04	U24AI803A	MLOps Architecture for LLMs	VIII	3
		U24AI803B	Cyber Security and Digital Forensic		
		U24AI803C	Privacy and Security in IoT		
		U24AI803D	Web Scraping with Python		
		U24AI803E	Matlab		
				Total	12

(vi) Experiential Learning Courses(ELC)

S. 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)

S. 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	1
2.	VAC 02	U24VA109XXXXX	SEA-I / SAA-I	I	1
3.	VAC 03	U24CY206	Environmental Studies	II	-
4.	VAC 04	U24VA210XXXXX	SEA-2 / SAA-2	II	1
5.	VAC 05	U24VA306	Soft & Interpersonal Skills	III	1
6.	VAC 06	U24VA309XXXXX	SEA-3 / SAA-3	III	1
7.	VAC 07	U24VA406A	Quantitative Aptitude and Logical Reasoning	IV	2
8.	VAC 08	U24VA409XXXXX	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 Development (PSD) Lab –3	IV	1
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 Maker space	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 & EntrepreneurshipBasket**	VI	3
				Total	3

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

- Students are required to earn 4 credits through first four semesters.
- If student is not able to attend/ fulfill performance requirements, he/she will be dropped from the course and will have to repeat by enrolling in the forthcoming semesters.

Table: SEA

SEA (Social Empowerment Activities)			
Module	**Title**	**Course Code**	**Courses Title**
SEA-I	**Socho Bharat**	U24VAYYYSE101	Study of Green & White Revolutions in India
		U24VAYYYSE102	Government Missions (Study of any 2)
		U24VAYYYSE103	Study of India's top 2 problems
		U24VAYYYSE104	Study of World's top 2problems
		U24VAYYYSE105	How Government Works? (Study of one department of the Central/ State Government)
		U24VAYYYSE106	Study of one of the identified Books
		U24VAYYYSE107	Study of two National policies
		U24VAYYYSE120	Any other activity approved by Dean Academic Affairs
SEA-II	**Swacch Bharat**	U24VAYYYSE201	River/Beach/Mohalla/School/Campus/Govt offices Cleaning
		U24VAYYYSE202	Waste Segregation Surveys
		U24VAYYYSE203	NSS camp in village for a week
		U24VAYYYSE204	Medical camps in schools
		U24VAYYYSE205	First Aid training for a week
		U24VAYYYSE206	Surveys and Estimation for roof top s
		U24VAYYYSE207	NCC participation
		U24VAYYYSE220	Any other activity approved by Dean Academic Affairs
SEA-III	**Shikshit Bharat**	U24VAYYYSE301	Mentoring of School Children
		U24VAYYYSE302	Digital Literacy for yielders
		U24VAYYYSE303	Value addition for deprived schools
		U24VAYYYSE304	Mentoring junior (first year) students at KITSW
		U24VAYYYSE305	Teaching Assistantship at KITSW
		U24VAYYYSE306	Development of learning material for schools/ITIs
		U24VAYYYSE307	Participation in "Teach-for-India" movement
		U24VAYYYSE320	Any other activity approved by Dean Academic Affairs

SEA (Social Empowerment Activities)			
Module	**Title**	**Course Code**	**Courses Title**
SEA-IV	**Samruddha Bharat**	U24VAYYYSE401	Great Grass Root Innovations
		U24VAYYYSE402	Innovation and Creativity
		U24VAYYYSE403	Critical Thinking and Problem solving
		U24VAYYYSE404	Team work and collaboration
		U24VAYYYSE405	Leadership & Entrepreneurship
		U24VAYYYSE406	Design Thinking
		U24VAYYYSE407	Study of one of the identified books
		U24VAYYYSE408	Work with START-UP at KITSW
		U24VAYYYSE409	Basics of fire safety
		U24VAYYYSE420	Any other activity approved by Dean Academic Affairs

Table : SAA

SAA (Self-Accomplishment Activities)			
Module	**Title**	**Course Code**	**Courses Title**
SAA-I	**Sanskarit Bharat**	U24VAYYYSA101	Values and Ethos of Bhavan
		U24VAYYYSA102	Philosophy of religion (any)
		U24VAYYYSA103	Study of Life Management / Kindle Life / Life Empowerment and Enriching Program or any other book cited.
		U24VAYYYSA104	Study of any of GREAT sons of INDIA (Ex. Gandhi, Ambedkar, Phule, Savarkar, Sardar Patel, Nehru, Shivaji, JRD Tata etc)
		U24VAYYYSA120	Any other activity approved by Dean Academic Affairs
SAA-II	**Saksham Bharat**	U24VAYYYSA201	Physical Fitness, Self-difence 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
		U24VAYYYSA202	Sports – Representation of Institute at University level/Inter college level and above in ANY sport
		U24VAYYYSA203	Participation in National Tech Fest, AICTE-Hackathon, Industry floated global and national competitions, Robocon, BAHA etc
		U24VAYYYSA204	Pran-vidya (Yoga & Pranayaam), Jeevan-vidya (work-life balance)
		U24VAYYYSA220	Any other activity approved by Dean Academic Affairs
SAA-III	**Sunder Bharat**	U24VAYYYSA301	Institute representation in prestigious cultural fests/competitions
		U24VAYYYSA302	Dance (Bharatanatyam /Kathak /Lavani /Western Dance). Only for beginners

SAA (Self-Accomplishment Activities)			
Module	**Title**	**Course Code**	**Courses Title**
		U24VAYYYSA303	Music composition / Learning musical instrument (Any type). Only for beginners.
		U24VAYYYSA304	Film Appreciation/Dramatics/Seeing through Painting
		U24VAYYYSA305	Making short film/Photography
		U24VAYYYSA306	Yogvidya-II
		U24VAYYYSA320	Any other activity approved by Dean Academic Affairs
SAA-IV	**Surakshit Bharat**	U24VAYYYSA401	Food that Heals
		U24VAYYYSA402	Personal and Social Hygiene
		U24VAYYYSA403	Intellectual Property Rights
		U24VAYYYSA404	Etiquette and Conversational skills
		U24VAYYYSA405	Basics of Ayurveda
		U24VAYYYSA406	Study of one of the identified Books
		U24VAYYYSA420	Any other activity approved by Dean Academic Affairs

(i) Mandatory Internship (Six to Eight Weeks)
(ii) Mini Project Work
(iii) Major Project Phase-I
(iv) Major Project Phase-II

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	Experiantial Learning Courses	9	17	10
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 (*Course Category wise*)												
	BSC	**ESC**	**HSMC**	**PCC**	**MOPEC**	**PEC**	**SEC**	**VAC**	**ELC**	**AEC**	**IKSC**	**STE**	**TOTAL**
I	2/7	3/8	1/2	-				2/2	1/1	1/1	1/-		11/21
II	2/7	2/8		1/3			1/1	2/1	1/1	2/2			11/23
III	1/3			4/14			1/1	2/2	1/1	1/1			10/22
IV				5/17			1/1	2/3	1/1	1/1			10/23
V			2/4	3/11	1/3		1/1		1/1	1/1	1/2		10/23
VI				3/11		1/3	1/1		1/1	1/1	1/2	1/3	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)	7.06% (12/170)	2.94% (5/170)	4.71% (8/170)	10% (17/170)	4.12% (7/170)	2.35% (4/170)	1.76% (3/170)	100 % (72/170)

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

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
కాకతీయ ప్రౌద్యోగికీ ఎవం విజ్ఞాన సంస్థాన, వరంగల - ५०६ ०१५ తెలంగాన, భారత
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
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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	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	Engineering Chemistry *(for CSM)*	2	1	2	5	10	4
3	ESC	U24EC111	Switching Theory and Logic Design	2	1	-	4	7	3
4	ESC	U24AI104	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	1
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	21
Summer/ Inter-semBridge 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	Engineering Physics *(for CSM)*	2	1	2	5	10	4
3	PCC	U24AI203	Computer Architecture and Organization	2	1	-	4	7	3
4	ESC	U24AI204	Data Structures through C	2	1	2	5	10	4
5	ESC	U24EE205B	Basic Electrical Engineering *(for CSM)*	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-semBridge 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 & Electronics 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 twosubjects (6-Credits)during 2-months internship at the institute

OR

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

A. After First Year: (UG Certificate in CSE(AI & ML))

(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(AI & ML): Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24AI212X	Introduction to Python Programming	2	-	2	-	4	3
2	PCC	U24AI213X	Programming with Java	2	-	2	-	4	3
3	PCC	U24AI214X	Introduction to Databases	2	-	2	-	4	3
4	PCC	U24AI215X	Fundamentals of Computer Networks	2	-	2	-	4	3
5	PCC	U24AI216X	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(AI & ML): Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE217X	Core Python Programming Reference: https://www.netacad.com/courses/programming/pcap-programming-essentials-python	-	-	6	-	6	3
2	SEC	U24SE218X	Java Fundamentals Reference: https://learn.oracle.com/ols/learning-path/java-fundamentals/55593/55578	-	-	6	-	6	3
3	SEC	U24SE219X	Database Foundations Reference: https://academy.oracle.com/en/solutions-curriculum-database.html	-	-	6	-	6	3
4	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
5	SEC	U24SE221X	Networking Fundamentals Reference: https://www.netacad.com/courses/networking/ccna-introduction-networks	-	-	6	-	6	3
6	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	C
1	BSC*	U24MH301E*	Essential Mathematics and Statistics for Machine Learning*	2	1	-	6	9	3
2	PCC	U24AI302	Advanced Data Structures	2	1	2	5	10	4
3	PCC	U24AI303	Operating Systems	2	1	-	5	8	3
4	PCC	U24AI304	Automata Theory and Compiler Design	2	1	-	4	7	3
5	PCC	U24AI305	Object Oriented Programming through Java	2	1	2	5	10	4
6	VAC*	U24VA306B*	Soft & Interpersonal Skills*	2	-	-	2	4	1
7	SEC	U24SE307	Programming Skill Development (PSD) Lab - 2	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309XXXXX	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
			Total:	12	5	6	36	59	22
Summer/ Inter-semBridge 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.	U24MH301E	Essential Mathematics and Statistics for Machine learning *(for CSM)*
6.	U24MH301F	Essential Mathematics and Statistics for Data Science *(for CSD)*

*** VAC (Value Added Course):**

T&P Basket		
S. No.	**Course Code**	**Course Title**
1.	U24VA306A	Qunatitative Aptitude and Logical Reasoning
2.	U24VA306B	Soft & Interpersonal Skills

*** 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	C
1	PCC	U24AI401	Database Management Systems	2	1	2	5	10	4
2	PCC	U24AI402	Artificial Intelligence	2	1	-	5	8	3
3	PCC	U24AI403	Software Engineering	2	1	-	4	7	3
4	PCC	U24AI404	Computer Networks	2	1	-	4	7	3
5	PCC	U24AI405	Python Programming	2	1	2	5	10	4
6	VAC*	U24VA406A*	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	62	23
Summer/ Inter-semBridge 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*

*** VAC (Value Added Course):**

T&P Basket		
S. No.	Course Code	Course Title
1.	U24VA406A	Qunatitative Aptitude and Logical Reasoning
2.	U24VA406B	Soft & Interpersonal

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

Bridge Courses for exit:

Successful completion of twosubjects (6-Credits)during 2-months internship at the institute

OR

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

B. After Second Year: (UG Diploma in CSE (AI & ML))

(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 (AI & ML): Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24AI412X	Machine Learning	2	-	2	-	4	3
2	PCC	U24AI413X	Computer Vision and Image Processing	2	-	2	-	4	3
3	PCC	U24AI414X	Data Warehousing and Data Mining	2	-	2	-	4	3
4	PCC	U24AI415X	Web Technologies	2	-	2	-	4	3
5	PCC	U24AI416X	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 (AI & ML): 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/noc19_cs58/preview	-	-	6	-	6	3
3	SEC	U24SE419X	R Programming for Data Analytics Reference: https://onlinecourses.nptel.ac.in/noc19_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/noc22_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	U24AI502	Web Programming	2	1	2	5	10	4
3	PCC	U24AI503	Design and Analysis of Algorithms	2	1	-	4	7	3
4	PCC	U24AI504	Machine Learning	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	U24AI507	Programming Skill Development (PSD) Lab - 4	-	-	2	2	4	1
8	HSMC	U24MH508	Technical English	-	-	2	2	4	1
9	ELC	U24AI509	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-semBridge 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 (MOPEC): 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-Commerce 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	U24AI601X	Program Elective –I / MOOCs-I	2	1	-	3	6	3
2	PCC	U24AI602	Computer Vision & Image Processing	2	1	-	4	7	3
3	PCC	U24AI603	Deep Learning	2	1	2	4	9	4
4	PCC	U24AI604	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	U24AI607	Programming Skill Development (PSD) Lab - 5	-	-	2	2	4	1
8	ELC	U24AI608	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-semBridge 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 twosubjects (6-Credits)during 2-months internship at the institute

OR

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

C. After Third Year:(B.Tech Voc.in CSE (AI & ML):

(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 (AI & ML):Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24AI610X	Natural Language Processing with Transformers	2	-	2	-	4	3
2	PCC	U24AI611X	Big Data Analytics	2	-	2	-	4	3
3	PCC	U24AI612X	Prompt Engineering for Generative AI	2	-	2	-	4	3
4	PCC	U24AI613X	Ethical Hacking	2	-	2	-	4	3
5	PCC	U24AI614X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify forB. Voc. in CSE (AI & ML)Degree.

Exit Option to Qualify B. Voc in CSE (AI & ML): 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/noc20_cs92/preview	-	-	6	-	6	3
3	SEC	U24SE617X	Introduction to Robotic Process Automation Reference: https://onlinecourses.nptel.ac.in/noc20_de11/preview	-	-	6	-	6	3
4	SEC	U24SE618X	Amazon Web Services Reference: https://www.coursera.org/specializations/aws-fundamentals	-	-	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	U24AI702X	Program Elective - II/ MOOCs-II	2	1	-	4	7	3
3	PCC	U24AI703	Big Data Analytics	2	1	2	4	7	4
4	PCC	U24AI704	Cloud Computing	2	1	-	4	7	3
5	PCC	U24AI705	Ethical Hacking	2	1	-	4	7	3
6	ELC	U24AI706	Internship Evaluation*	-	-	2	-	2	1
7	ELC	U24AI707	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	U24AI802X	Program Elective - III / MOOCs-III	2	1	-	4	7	3
3	PEC	U24AI803X	Program Elective - IV / MOOCs-IV	2	1	-	4	7	3
4	ELC	U24AI804	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	21	23	22	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..

(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 DepartmentSunder 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 Aprreciation
7	**U24OEX01LIG**	Drama Appreciation
8	**U24OEX01LIH**	Cultural Studies
9	**U24OEX01LII**	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**	Administritative 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

Department of Computer Science and Engineering (Artificial Intelligence and Machine Learning)

PROGRAM ELECTIVE COURSES (PEC)

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

VERTICAL/ PE	PE1	PE2	PE3	PE4
VERTICAL 1: Visual Computing	U24AI601A: Natural Language Processing with Transformers	U24AI702A: Robotic Process Automation	U24AI802A: Prompt Engineering for Generative AI	U24AI803A: MLOps Architecture for LLMs
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 2: Computer Communications and Cyber Security	U24AI601B: Advanced Computer Networks	U24AI702B: Cryptography and Network Security	U24AI802B: Block Chain Technologies	U24AI803B: Cyber Security and Digital Forensic
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 3: Internet of Things	U24AI601C: Fundamentals of IoT	U24AI702C: IoT Architectures and Protocols	U24AI802C: Industrial IoT	U24AI803C: Privacy and Security in IoT
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 4: Data Analytics	U24AI601D: Predictive Analytics and Data Mining	U24AI702D: Exploratory Data Analysis with Python	U24AI802D: Social and Information Network Analysis	U24AI803D: Web Scraping with Python
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 5: Programming	U24AI601E: Mobile Application Development	U24AI702E: UNIX Shell Programming	U24AI802E: Introduction to NoSQL	U24AI803E: Matlab
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			

ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2020 Rank Band: 201-250

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ – ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
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Semester -I Syllabi

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	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	U24AI104	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	1
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	21
Summer/ Inter-semBridge 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)*

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):

This course will develop students' knowledge in /on…

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)

Self-Learning Topics (SLTs): *Review of basic concepts of limit, continuity and differentiability [Reference 1: topic (3.1,3.2,3.5,4.1)]*

Alternating series [(Text 1: topic 9.12, Solved problems: 9.16,9.17, Practice problems: exercise 9.7(1, 7)]

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))]

Additional problems on Maclaurin's series [(Text 1: topic 4.4, Solved problems: 4.20, Practice problems: exercise 4.5 (3, 5)]

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

Self-Learning Topics (SLTs):

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)]

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))].

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))]

UNIT-III	9 Hrs

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,

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

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)]

UNIT-IV	9 Hrs

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

Applications of linear differential equations: Simple harmonic motion, Simple pendulum, Oscillations of spring, Oscillatory electrical circuit-LCR circuit, Electro-mechanical analog

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)]

Course Learning Outcomes (COs):

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

CO1: examine the convergence of a series and interpret mean value theorems.

CO2: apply partial differentiation to functions of several variables in solving various engineering problems.

CO3: apply appropriate methods of differential equations of first order and first degree to solve real life engineering problems.

CO4: analyze the solutions of higher order linear differential equation with constant coefficients

Text Book(s):

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

Reference Book(s):

1. Shanti Narayan, Dr. Mittal P.K, *Differential Calculus*, S. Chand & Co., 1st ed., New Delhi, Reprint 2014.
2. Kreyszig E, *Advanced Engineering Mathematics*, Inc, U.K, John wiely & sons, 10th ed., 2020.
3. S.S. Sastry, *Engineering Mathematics, Vol.II*, Prentice Hall of India, 3rd ed., 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-iUkdlV; *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/btOCUmJkrrg?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**	**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**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENGINEERING CHEMISTRY

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):

This course will develop students' knowledge in /on…

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**

Electrochemical Technology and Engineering: Introduction, Specificconductance, Equivalent conductance,Effect of dilution;Conductometrictitrations-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, Electrodepotential, Electrochemical series, Nernst equation;Potentiometric titrations-Acidbase titrations and advantages of potentiometric titrations

Batteries: Classification,Lead-acid battery, Li-ion battery

Fuel cells: Hydrogen-oxygen fuel cell

Self Learning Topics (SLTs): *Types of conductors (Text 1: Jain &Jain: chapter 5 topic 1), Ohms law (Text 1: Jain & Jain: chapter 5 topic 5)*

UNIT-II **9 Hrs**

Applied Chemistry:

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-Ionexchange method,Desalinationprocesses, Reverse osmosis;Quality parameters of potable water (BIS and WHO)

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-Cathodicprotection-Impressed current cathodic protection, Sacrificial anodic protection

Self Learning Topics (SLTs): *Units of hardness(Text1: Jain &Jain chapter 1 topic 5), Introduction to corrosion (Text 1: Jain & Jain: chapter 7 topic 1)*

UNIT-III **9 Hrs**

Engineering Materials: Nanomaterials-Introduction,Synthesis of nanomaterials-Top down and bottom-up approaches, Synthesis by sol-gel method;Nanoscalematerials-Fullerenes, Carbon nanotubes and Graphene,Properties and applications, Biosensors

Spectroscopy: Introduction to spectroscopy, Microwavespectroscopy-Principle, Selection rules, Applications;Infra-red spectroscopy-Principle, Selection rules, Applications; UV Spectroscopy-Lambert-Beer's law and itsapplications

Self Learning Topics (SLTs): *Introduction to nanotechnology (Text 1: Jain & Jain:chapter 37 topic 1), Electromagnetic spectrum (Text 1: Jain & Jain; chapter 35 topic 1)*

UNIT-IV	9 Hrs

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

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

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)*

LABORATORY COMPONENT

List of Experiments

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 (CH_3COOH) 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 (Fe^{2+}) 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):

1. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Company, 17th ed., 2019 (*chapters 1 ,3 ,5 ,6 ,7 ,35 ,36 ,37)*
2. Dornfeld, D.A., *Green manufacturing: fundamentals and applications,* Springer Science & Business Media, 2012 (*chapters 5, 8, 9)*

Reference Book(s):

1. J.C.Kuriacose and J.Rajaram, *Chemistry in Engineering and Technology*(vol.I), Tata Mc. Graw-Hills Education Pvt. Ltd., 2010
2. Shashi Chawla, *Text book of Engineering Chemistry*, 3rd ed.,Dhanpat Rai Publishers, 2003
3. S.S. Dara, S.S. Umare, *A Text book of Engineering Chemistry*, 12th ed., S.Chand & Company Ltd.,2010

Web and Video link(s):

1. 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*

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):		**U24CY102 : ENGINEERING CHEMISTRY**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24CY102B.1**	2	-	-	-	1	1	1	1	1	-	1	-	-
CO2	**U24CY102B.2**	2	-	-	-	1	1	1	1	1	-	1	-	-
CO3	**U24CY102B.3**	2	-	-	-	1	1	1	1	1	-	1	-	-
CO4	**U24CY102B.4**	2	-	-	-	1	2	1	1	1	-	1	-	-
CO5	**U24CY102B.5**	2	1	-	-	-	1	1	1	1	-	1	-	-
CO6	**U24CY102B.6**	2	1	-	-	2	1	1	1	1	-	1	-	-
CO7	**U24CY102B.7**	2	1	-	-	-	1	1	1	1	-	1	-	-
CO8	**U24CY102B.8**	2	1	-	-	-	1	1	1	1	-	1	-	-
U24CY102B		**2.00**	**1.00**	**-**	**-**	**1.20**	**1.12**	**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):

This course will develop students' knowledge in /on…

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.

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).*

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.

Self Learning Topics (SLTs): *decimal adder (Text1: topic 4.6), Priority encoders (Text2: topic 4.22).*

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).

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)*

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.

Self Learning Topics (SLTs): *capabilities and limitations of finite state machine (Ref Text3:10.2) simplification of incompletely specified machines (Ref Text3:10.4).*

Course Learning Outcomes (COs):

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

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

Text Book(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=BPBiyzc0OBw *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**	**PSO 1**	**PSO 2**
CO1	**U24EC111.1**	3	2	1	-	-	1	1	1	1	1	1	1	1
CO2	**U24EC111.2**	3	2	1	-	-	1	1	1	1	1	1	2	1
CO3	**U24EC111.3**	3	2	2	1	-	2	1	1	1	1	1	2	1
CO4	**U24EC111.4**	3	2	3	3	-	3	1	1	1	1	1	3	1
U24EC111		**3**	**2**	**1.75**	**2**	**-**	**1.75**	**1**	**1**	**1**	**1**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

PROGRAMMING FOR PROBLEM SOLVING WITH C

Class: B.Tech. I -Semester		**Branch:** common to all branches	
Course Code:	**U24AI104**	**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):

This course will develop students' knowledge in /on…

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

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)*

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

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)*

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

Text Book(s):

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

Reference Book(s):

1. Paul Deitel, Harvey Deitel, *C How to Program: With Case Studies Introducing Applications Programming and Systems Programming*, 9th ed., Pearson Education Limited, 2022
2. Brian W. Kernighan and Dennis Ritchie, *The C Programming Language*, 2nd ed., Pearson Education India, 2015
3. Reema Thareja, *Programming in C*, 3rd ed., Oxford University Press, 2023
4. Yashavant Kanetkar, *Let Us C*, 19th ed., BPB Publications, 2022

5. A.K.Sharma, *Computer Fundamentals and Programming in C,* 2nd ed., Universities Press, 2018

Web and Video link(s):

1. 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.*
2. 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):		**U24AI104: 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**	**PSO 1**	**PSO 2**
CO1	**U24AI104.1**	2	1	1	1	-	-	1	1	1	1	2	1	2
CO2	**U24AI104.2**	2	2	2	1	-	-	1	1	1	1	2	2	2
CO3	**U24AI104.3**	2	2	3	1	-	-	1	1	1	1	2	2	2
CO4	**U24AI104.4**	2	2	3	2	-	-	1	1	1	1	2	2	2
CO5	**U24AI104.5**	1	1	1	1	1	-	1	1	1	1	2	1	2
CO6	**U24AI104.6**	1	2	2	2	1	-	1	1	1	1	2	2	2
CO7	**U24AI104.7**	1	2	3	2	1	-	1	1	1	1	2	2	2
CO8	**U24AI104.8**	1	2	3	2	1	-	1	1	1	1	2	2	2
U24AI104		**1.5**	**1.75**	**2.25**	**1.5**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**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):

This course will develop students' knowledge in /on…

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

- Tenses-Structures-usage-examples-exercises for practice
- Sentence Correction-Correct use of Tenses, Verb forms, Punctuation.

VOCABULARY

- Word formation: Prefixes-Suffixes-Sentence Formation with newly formed words

READING SKILL

- Definition-Sub skills of Reading-Emphasis on Skimming-Purpose- How to skim through the text-Examples, Exercises for practice

WRITING PRACTICES

- 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

Self Learning Topics (SLTs):

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**

GRAMMAR

- Tenses-Revision-Exercises for practice
- Subject-Verb Agreement
- Reported Speech-Transformation
- Sentence Correction -Emphasis Concord ,Report Speech, Sentence Structures

VOCABULARY

- Synonyms-Antonyms-Single Word Substitutes-Popular Abbreviations

READING STRATEGY

- Emphasis on Scanning the Text-Purpose-Advantages-Examples, Exercises and Practice through Teamwork

WRITING PRACTICES

- Letter Writing- Effective Letter Writing Techniques-Information Seeking Letters-Job Application Letters- Apology Letters-Explanation to Memos- E-mails-Cover Letters-Resume

LIFE SKILLS: Determination

- How I Became a Public Speaker: An essay by George Bernard Shaw

Self Learning Topics (SLTs): *English Vocabulary (Text 2,Unit-I,Unit-II,Unit-III),Tenses (Reference book 3,Topic-30, Exercises,30.1,30.2,30.3)*

UNIT-III	**9 Hrs**

GRAMMAR

- Tenses-Revision- Exercises for Practice
- Nouns- Prepositions-Adverbs-Adjectives
- Sentence Correction: Correct Use of tenses, nouns, prepositions, adverbs and adjectives

VOCABULARY

- Phrasal Verbs-Technical Words-Latin Words

READING STRATEGY

- Intensive Reading-purpose-Types of Comprehension Questions-Examples, Exercises and Practice through Teamwork

WRITING PRACTICES

- Report Writing-Definition-Purpose-Qualities of a Good Report- Formal and Informal Reports-Report Format-Sample Reports-Exercises
- Emphasis on Technical Reports

LIFE SKILLS: Positive Attitude

- Be the Best of Whatever You Are: A Poem by Douglas Malloch

Self Learning Topics (SLTs):

- *Parts of Speech (Text book 1,Unit-I),Tenses (Reference book 1, Topics-16,17,18,19) Phrasal Verbs (Reference book 3)*

UNIT-IV	**9 Hrs**

GRAMMAR

- Tenses-Revision-Exercises for Practice
- Clauses- Conjunctions-Transformation of Sentences
- Sentence Correction (Based on Parts of Speech)- Clauses- Tenses

VOCABULARY

- Appropriate Use of Words in Communication-Commonly Confused Words

ACTIVE READING and NOTE-MAKING

- Note-Making-Definition-Purpose-Effectiveness

WRITING PRACTICES

- Précis Writing- Definition-Purpose-Uses-Examples and Exercises-Practice through Teamwork
- Preparing Statement of Purpose (SoP)

LIFE SKILLS: Emotional Balance A Poison Tree: Poem by William Blake

Self-Learning Topics (SLTs):

Tenses (Reference book 2, Topics: 152-157))

Course Learning Outcomes (COs):

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

CO1: apply basic grammar principles in speech and writing, read fast, form new words, make coherent paragraphs and adapt the real value of life.

CO2: create effective letters, e-mails, reply to Memos and do the given tasks with confidence.

CO3: analyze the given texts and write clear and unambiguous reports.

CO4: deduct the superfluous information from lengthy text, prepare SoP (Statement of Purpose) effectively and solve critical problems in life with emotional balance.

Text Book(s):

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.

Reference Book(s):

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

Web and Video link(s):

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**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24MH105.1**	-	-	-	-	-	1	2	2	2	-	2	-	-
CO2	**U24MH105.2**	-	-	-	-	-	1	2	2	2	-	2	-	-
CO3	**U24MH105.3**	-	-	-	-	-	1	2	2	2	-	2	-	-
CO4	**U24MH105.4**	-	-	-	-	-	1	2	2	2	-	2	-	-
U24MH105		**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**2**	**-**	**2**	**-**	**-**
3–HIGH,2–MEDIUM,1 –LOW														

SPORTS /YOGA

Class: B.Tech. I -Semester		**Branch:** Common to all branches	
Course Code:	**U24VA106**	**Credits:**	**1**
Hours/Week(L-T-P-O-E):	**0-0-2-2-4**	**CIE :**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE :**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: Yoga and its Benefits

LO2: various Sports &Games.

LO3: sportsman spirit.

LO4: all round development

Sports and Games

List of Sports and Games

Sl.No.	Game	Sl.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

Text Book(s):

1. B.K.Chaturvedi,*Rules and Skills of Games and Sports,* Publisher – Goodwill Publishing House, B-9, Rattan Jyoti, 18 Rajendra Place, New Delhi.

Reference Book(s):

1. Dr.Sakure Girish Madhaorao,*Foundation of Physical Education and Sports*, Sports Publication,New Delhi

Web and Video link(s):

Badminton game Video Link :
https://www.youtube.com/watch?v=HucIqi8Lw3E&t=22s
Basket Ball game Video Link :
https://www.youtube.com/watch?v=-tkE2lJoR58
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 asanas.

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 / Yoga**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VA106.1**	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	**U24VA106.2**	-	-	-	-	-	-	-	1	-	-	-	-	-
CO3	**U24VA106.3**	-	-	-	-	-	-	2	-	-	-	-	-	-
CO4	**U24VA106.4**	-	-	-	-	-	-	-	-	1	-	1	-	-
U24VA106		**-**	**-**	**-**	**-**	**-**	**-**	**2**	**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 :**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE :**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: AutoCAD commands, projections of points and straight lines
LO2: projection of oblique planes
LO3: projection of solids and sections of solids
LO4: isometric, orthographic projections, simple circuit diagrams and 3D modelling

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

Text Book(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):

1. 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 projection of planes using Auto CAD
CO3: construct the projection of solids and sections of solids using Auto CAD
CO4: create orthographic, isometric projections and develop the simple electrical, electronic circuit & 3D modelling using Auto CAD

Course Articulation Matrix (CAM): U24ME107 ENGINEERING GRAPHICS THROUGH CAD													
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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**	**2**	**1**	**1**	**1**	**1**

PRACTICUM-I

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 Marks (%):**	**100**
Total Number of Teaching Hours:	**-**	**ESE Marks (%):**	**-**

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: preparingwell-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:

- **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	U24CY102	U24EC111	U24AI104	U24MH105	U24VA106
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

- 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.
- 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 timetableand alsooutside 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 suggestfor addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicumreport 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 teacheras 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 anddefine 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-I**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24EL108.1**	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
CO3	**U24EL108.3**	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
U24EL108		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

SOCIAL EMPOWERMENT ACTIVITY-1 / SELF ACCOMPLISHMENT ACTIVITY-1 (SEA-1 /SAA-1)

Class: B.Tech. I Semester	**Branch:** Common to all branches		
Course Code:	**U24VAXYY(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):

This course will develop students' knowledge in /on…

LO1: holistic development through activity-based learning to gain real-life experiencewhicheffectively help individualsdeal 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 presentationthrough PPTs portraying knowledge, skills,qualitiesacquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) isintroduced 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 andsocial 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** (SelfAccomplishment 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.

(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.

Monitoring SEA/SAA:

(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: E**minent 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 interacteminent 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/presentationand 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 studentshall, identifiesminimum of4 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 makinga well-documented report and an effective oral presentationwith 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):		**U24VAXYY(SE/SA)ZZZ - Courses listed under SEA/ SAA**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VAXYY.1**	-	-	-	-	-	2	2	2	2	2	-	-	-
CO2	**U24VAXYY.2**	-	-	-	-	-	2	2	2	2	2	-	-	-
CO3	**U24VAXYY.3**	-	-	-	-	-	2	2	2	2	2	-	-	-
CO4	**U24VAXYY.4**	-	-	-	-	-	2	2	2	2	2	-	-	-
U24VAXYY		-	-	-	-	-	2	2	2	2	2	2	-	-
3 – HIGH, 2 – MEDIUM, 1 – LOW														

Course Code: **U24VA XYY(SE/SA)ZZZ**

X represents semester; YYrepresents 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:
Semester: 1 *SEA/SAA course serial number: 09* *SEA/SAA category: SEA* *course number: 302* The **course code** will be U24VA109SE302	*Semester: 4* *SEA/SAA course serial number: 10* *SEA/SAA category: SAA* *course number: 206* The **course code** will be U24VA410SA206

EXPERT TALK SERIES - 1

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 Marks (%):**	**100**
Total Number of Teaching Hours:	**-**	**ESE Marks (%):**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: 21st century skills needed for industry, current industry trends, challenges and innovations

LO2: latest technology in practice andapplying knowledge to solve real-world problems

LO3: smart work, soft skills, professional etiquette, networking abilities

LO4: making a well-documented reportportraying the knowledge, skills, qualities acquired and the impact of the learning

In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.

(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.

(b) Learning from industry experts with real-world examples,is important to enhance your educational experience.

(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.

(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".

But how would you know all this without venturing into the industry?

(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.

(b) Through Industry expert talks students get to know so much more that textbooks don't explain.

(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.

(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

(e) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal 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 (*sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks*)	60 marks
Attendance (*out of 10 quizzes*)	20 marks
Report in prescribed format (*max 30% plagiarism*)	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.

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

ii. **Supplementary Exam:**

(i) Student has to register for ETS supplementary examination if he/she scores less than 40 marksin CIE

(ii) 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.

(iii) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE

(iv) 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…

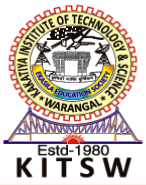
CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology

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 - 1**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AE110**.1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO2	**U24AE110**.2	1	1	1	1	1	1	2	1	2	1	2	1	1
CO3	**U24AE110**.3	1	1	1	1	1	1	2	1	2	1	2	1	1
CO4	**U24AE110**.4	1	1	1	1	1	1	2	1	2	1	2	1	1
U24AE110		**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														



KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
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Semester -II Syllabi

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

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	Engineering Physics	2	1	2	5	10	4
3	PCC	U24AI203	Computer Architecture and Organization	2	1	-	4	7	3
4	ESC	U24AI204	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-semBridge 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 & Electronics 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)*

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):

This course will develop students' knowledge in /on…

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

Self-Learning Topics (SLTs): *Review of Matrices [Text 1: topics 2.1,2.2,2.3,2.4,2.5]*

PAQ –Normal form [Text 1, topic 2.7(7), Solved problems: 2.26, Practice problems: exercise 2.4 (9,10)]

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)]

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)]

Nature of Quadratic form [Text 1: topic 2.18, Solved problems: 2.52, Practice problems: exercise 2.10 (13,14))

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).

Self-Learning Topics (SLTs): *Review of integrals [Text 1: topic Appendix VII (1)*

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))

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)]

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)]

Additional problems on Volume of solids [Text 1: topic 7.6, Solved problem: 7.21, Practice problems: exercise 7.4 (12,25)]

UNIT-III	9 Hrs

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

Self-Learning Topics (SLTs): *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)]

UNIT-IV	9 Hrs

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

Self-Learning Topics (SLTs): *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)]

Course Learning Outcomes (COs):
After completion of this course, the students should be able to…

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

Text Book(s):

1. Grewal, B.S., *Higher Engineering Mathematics*, 44th ed., Khanna Publishers, Delhi, 2017 (Chapters 2,7,8)
2. Kreyszig E, *Advanced Engineering Mathematics*, Inc, 10th ed., U.K: John Wiely &sons, 2020 (Chapter 8(8.2))

Reference Book(s):

1. Spiegel M, *Vector Analysis* -Schaum's Series, 2nd ed., McGraw Hill, 2017
2. S.S. Sastry, *Engineering Mathematics, Vol.II,* 3rd ed., Prentice Hall of India, 2014
3. Gilbert Strang, *Introduction to Linear Algebra*, 5th ed., Wellesley-Cambridge Press

Web and Video link(s):

1. https://youtu.be/L4crGhtEX14?si=hyjAPgDheJOhXtYZ : *NPTEL Video Lecture on Matrix Analysis with Applications/Dr.S.K.Gupta and Dr.Sanjeev 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**	**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

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):

This course will develop students' knowledge in /on…

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**

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

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)

Self Learning Topics (SLTs): *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).*

UNIT-II **9 Hrs**

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

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

Self Learning Topics (SLTs): *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).*

UNIT-III **9 Hrs**

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)

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 Quantum entanglement, Applications of quantum computing

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).*

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

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

Text Book(s):

1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, *A Text Book of Engineering Physics,* 11th ed., S. Chand & Company Ltd, 2018
2. S Salivahanan, N Suresh Kumar, *Electronic devices and circuits,* Mc Graw Hill , 2017
3. Michael Nielsen and Isaac Chuang, *Quantum Computation and Quantum Information,* Cambridge University Press, 2010

Reference Book(s):

1. Neil Gershenfeld, *Physics of Information Technology*, Cambridge Univ. Press, 1st Edn., 2000
2. V. Rajendran, *Engineering Physics*, Mc Graw Hill Edn., 2013
3. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction,* The MIT Press Cambridge, Massachusetts London, England, 2011
4. R.K. Gaur and S.L.Gupta, *Engineering Physics*, Dhanpath Rai and Sons, 2013
5. David Halliday, Robert Resnick and S Krane, *Physics Volume I&II*, Wiley India Ltd., 5th ed., 2014

Web and Video link(s):

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												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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 ARCHITECTURE AND ORGANIZATION

Class: B.Tech. II -Semester		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI203**	**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):

This course will develop students' knowledge in /on…

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.

Self Learning Topics (SLTs): *Importance and working of Processors (Text1: topics 1.7), RISC vs CISC processors (Text1: Chapter 2.11)*

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.

Self Learning Topics (SLTs): *Fast multiplication (Text1: Chapter 9.5)*

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

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)*

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.

Self Learning Topics (SLTs): *Interconnection standards (Text1: Chapter 7.5), Arithmetic pipeline (Text2: Chapter 10.3)*

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, emphasizing functional units, core components, and instruction set architecture

CO2: design and analyze processing units and arithmetic operations, including control mechanisms and computation of various arithmetic functions

CO3: categorize cache memory mapping techniques and examine data transfer mechanisms between the processor, memory, and I/O systems

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

Text Book(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, *Computer Organization and Embedded Systems*, 6th ed., New Delhi: McGraw-Hill Education, 2012,. *(Chapters 1, 2, 5, 7-9)*
2. M. Morris Mano, *Computer System Architecture*, Revised 3rd ed., New Delhi: Pearson Education, 2019 (Chapters 9, 10, 11, 12, 14)

Reference Book(s):

1. B Ram, Sanjay Kumar, *Computer Fundamentals: Architecture and Organization*, New Age International Publishers, 5th ed., 2018, New Delhi
2. W. Stallings, *Computer Organization and Architecture - Designing for Performance*, 7th ed., New Delhi: Pearson Education, 2009
3. John P. Hayes, *Computer Architecture and Organization,* 3rd ed., New Delhi: McGraw-Hill Education, 1998
4. Vincent P. Heuring, Harry F. Jordan, *Computer Systems Design and Architecture*, 2nd ed., United States: Pearson Education, 2004

Web and Video link(s):

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)		**U24AI203 : COMPUTER ARCHITECTURE AND ORGANIZATION**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AI203.1**	2	2	2	1	-	-	1	1	1	1	1	1	1
CO2	**U24AI203.2**	2	2	2	1	-	-	1	1	1	1	1	1	1
CO3	**U24AI203.3**	2	2	2	1	-	-	1	1	1	1	1	2	1
CO4	**U24AI203.4**	2	2	2	1	-	-	1	1	1	1	1	2	1
U24AI203		**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 (AI & ML)	
Course Code:	**U24AI204**	**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):

This course will develop students' knowledge in /on…

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

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)*

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

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)*

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

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)*

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.

Text Book(s):

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

Reference Book(s):

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

Web and Video link(s):

1. 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):

1. *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):		**U24AI204 : 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**	**PSO 1**	**PSO 2**
CO1	**U24AI204.1**	2	2	2	1	-	-	1	1	1	1	1	2	1
CO2	**U24AI204.2**	2	2	2	2	-	-	1	1	1	1	2	2	2
CO3	**U24AI204.3**	2	2	2	2	-	-	1	1	1	1	2	2	2
CO4	**U24AI204.4**	2	2	2	2	-	-	1	1	1	1	2	2	2
CO5	**U24AI204.5**	2	2	2	1	-	-	1	1	1	1	1	2	1
CO6	**U24AI204.6**	2	2	2	2	-	-	1	1	1	1	2	2	2
CO7	**U24AI204.7**	2	2	2	2	-	-	1	1	1	1	2	2	2
CO8	**U24AI204.8**	2	2	2	2	-	-	1	1	1	1	2	2	2
U24AI204		**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):

This course will develop students' knowledge in /on…

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**

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.

DC Circuit analysis: Source transformation, Star-Delta conversion, Mesh analysis & Nodal analysis (T & π networks only).

Self-Learning Topics (SLTs)*: 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).*

UNIT-II **9 Hrs**

DC network theorems (Independent sources only): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem (T & π networks only).

Self-Learning Topics (SLTs): *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).*

UNIT-III **9 Hrs**

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.

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.

Self-Learning Topics (SLTs): *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).*

UNIT-IV **9 Hrs**

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.

Electrical lighting sources and Energy calculations:

Lighting sources-incandescent, Fluorescent, CFL & LED lamps, Elementary calculations for energy consumption.

Self-Learning Topics (SLTs): *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 & 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

Text Book(s):

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

Reference Book(s):

1. B.L.Thereja, A.K.Thereja, *Electrical Technology Vol. I & II* ,S.Chand& Company Ltd, edn , 2005.
2. Edward Hughes, *Electrical & Electronics Technology* , Pearson Education, 10/e., 2010.
3. D. P. Kothari and I. J. Nagrath, *Basic Electrical Engineering* , Tata McGraw Hill, edn , 2010.
4. Chakravarthy A, Sudhipanath and Chandan Kumar, *Basic Electrical Engineering* , Tata McGraw Hill Ltd, edn, 2009.

Web and Video link(s):

1. 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 & Electronics 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**	**PSO 1**	**PSO 1**	**PSO 2**
CO1	**U24EE205A.1**	2	1	-	-	-	-	1	1	1	1	**1**	1	1	1
CO2	**U24EE205A.2**	2	2	-	-	-	-	1	1	1	1	**1**	1	1	1
CO3	**U24EE205A.3**	3	3	1	1	1	1	1	1	1	1	**1**	1	1	1
CO4	**U24EE205A.4**	3	3	1	1	1	1	1	1	1	1	**1**	1	1	1
CO5	**U24EE205A.5**	2	1	-	-	-	-	1	1	1	1	**1**	1	1	1
CO6	**U24EE205A.6**	2	2	-	-	-	-	1	1	1	1	**1**	1	1	1
CO7	**U24EE205A.7**	3	3	1	1	1	1	1	1	1	1	**1**	1	1	1
CO8	**U24EE205A.8**	3	3	1	1	1	1	1	1	1	1	**1**	1	1	1
U24EE205A		**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	
CourseCode:	**U24CY206**	**Credits:**	**0**
Hours/Week(L-T-P-O-E):	**2-0-0-5-7**	**CIE:**	**60%**
Total Number of Teaching Hours:	**24Hrs**	**ESE:**	**40%**

CourseLearningObjectives(LOs):

This course will develop students' knowledge in/on…

LO1: natural resources and their usage more equitably

LO2: ecosystem and the importance of biodiversity conservation

LO3: environmental pollution and it'scontrol measures

LO4: environmental legislation and green methodology

UNIT-I	**6Hrs**

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and importance

Natural Resources: Forest Resources-Use and overexploitation 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): *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)*

UNIT-II	**6Hrs**

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): *Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)*

UNIT-III	**6Hrs**

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): *Role of individual in prevention of pollution (Text1: unit 5, topic 5.10)*

UNIT-IV	6Hrs

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

SelfLearningTopics(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 legislationand green methodology

Text Book(s):

1. Erach Bharucha,*TextBook of Environmental Studies for Under Graduate Courses,* 2nd ed., 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 ed., Prentice Hall of India,1991
3. Anubha Kaushik, C.P. Kaushik, *Environmental Studies*, 4th ed., New Age International Publishers,2014
4. R.Rajagopalan, *Environmental Studies from crisis to cure*, 2nd ed. Oxford University Press, 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.*

CourseArticulationMatrix(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	PSO 1	PSO 2
CO1	U24CY206.1	2	1	2	1	-	2	1	1	1	1	1	1	1
CO2	U24CY206.2	-	-	2	-	-	2	1	1	1	1	1	1	1
CO3	U24CY206.3	1	2	1	-	-	1	1	1	1	1	1	1	1
CO4	U24CY206.4	-	-	1	-	-	2	1	1	1	1	1	1	1
U24CY206		1.50	1.50	1.50	1	-	1.75	1.00	1.00	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):

This course will develop students' knowledge in /on…

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		• 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:

- ***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):

1. 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.
2. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, "*Additive Manufacturing Technologies-3D Printing, Rapid Prototyping, and Direct Digital Manufacturing*", 2nd ed., Springer Nature, 2021.
3. R.S. Khandpur, "*Printed Circuit Boards: Design, Fabrication, Assembly and Testing*", New Delhi Tata Mc Graw Hill-2008.
4. 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):		**U24AE207 : 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**	**PSO 1**	**PSO 2**
CO1	**U24AE207.1**	2	2	1	1	2	1	1	2	2	1	1	1	1
CO2	**U24AE207.2**	2	2	1	1	2	1	1	2	2	1	1	1	1
CO3	**U24AE207.3**	2	2	1	1	2	1	1	2	2	1	1	1	1
CO4	**U24AE207.4**	2	2	1	1	2	1	1	2	2	1	1	1	1
U24AE207		**2**	**2**	**1**	**1**	**2**	**1**	**-**	**2**	**2**	**1**	**1**	**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
1.	Programs using input output functions, operators
2.	Programs using conditional control structures: if, if-else, nested if
3.	Programs using else if ladder, switch and goto statements
4.	Programs using iterative statements
5.	Programs using iterative statements
6.	Programs on one dimensional array and two-dimensional arrays
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 on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
11.	Programs using structures, unions, pointers to arrays and pointers to strings
12.	Programs using array of pointers and pointers to structures

Text/ Reference Book(s):

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

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 Marks (%):**	**100**
Total Number of Teaching Hours:	**-**	**ESE Marks (%):**	**-**

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: preparingwell-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:

- **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	U24MH201	U24PY202B	U24AI203	U24AI204	U24EE205	U24CY206
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

- 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.
- 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.	ll 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 timetableand alsooutside 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)

****

(i). ***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.***

(ii). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.

(iii). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.

(iv). The class teacher shall collect the final marks of practicum of the students allotted to each course teacher and submit them to the CoE.

(v). 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

(vi). 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 suggestfor addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicumreport 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 teacheras 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 anddefine 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**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24EL209.1**	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
CO3	**U24EL209.3**	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
U24EL209		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

SOCIAL EMPOWERMENT ACTIVITY-2 / SELF ACCOMPLISHMENT ACTIVITY-2 (SEA-2 /SAA-2)

Class: B.Tech. II Semester	**Branch:** Common to all branches		
Course Code:	**U24VAXYY(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):

This course will develop students' knowledge in /on…

LO1: holistic development through activity-based learning to gain real-life experiencewhicheffectively help individualsdeal 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 presentationthrough PPTs portraying knowledge, skills,qualitiesacquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) isintroduced 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 andsocial 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** (SelfAccomplishment 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.

(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.

Monitoring SEA/SAA:

(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: E**minent 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 interacteminent 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/presentationand 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 studentshall, identifiesminimum of4 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 makinga well-documented report and an effective oral presentationwith 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):		**U24VAXYY(SE/SA)ZZZ - Courses listed under SEA-2/ 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**	**PS O1**	**PS O2**
CO1	**U24VAXYY.1**	-	-	-	-	-	2	2	2	2	2	2	1	1
CO2	**U24VAXYY.2**	-	-	-	-	-	2	2	2	2	2	2	1	1
CO3	**U24VAXYY.3**	-	-	-	-	-	2	2	2	2	2	2	1	1
CO4	**U24VAXYY.4**	-	-	-	-	-	2	2	2	2	2	2	1	1
U24VAXYY		-	-	-	-	-	2	2	2	2	2	2	1	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

Course Code: **U24VA XYY(SE/SA)ZZZ**

X represents semester; YYrepresents 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:
Semester: 1 *SEA/SAA course serial number: 09* *SEA/SAA category: SEA* *course number: 302* The **course code** will be U24VA109SE302	*Semester: 4* *SEA/SAA course serial number: 10* *SEA/SAA category: SAA* *course number: 206* The **course code** will be U24VA410SA206

EXPERT TALK SERIES – 2

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 Marks (%):**	**100**
Total Number of Teaching Hours:	**-**	**ESE Marks (%):**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: 21st century skills needed for industry, current industry trends, challenges and innovations

LO2: latest technology in practice andapplying knowledge to solve real-world problems

LO3: smart work, soft skills, professional etiquette, networking abilities

LO4: making a well-documented reportportraying the knowledge, skills, qualities acquired and the impact of the learning

In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.

(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.

(b) Learning from industry experts with real-world examples,is important to enhance your educational experience.

(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.

(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".

But how would you know all this without venturing into the industry?

(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.

(b) Through Industry expert talks students get to know so much more that textbooks don't explain.

(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.

(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

(e) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal 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 (*sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks*)	60 marks
Attendance (*out of 10 quizzes*)	20 marks
Report in prescribed format (*max 30% plagiarism*)	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.

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

ii. Supplementary Exam:

(i) Student has to register for ETS supplementary examination if he/she scores less than 40 marksin CIE

(ii) 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.

(iii) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE

(iv) 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

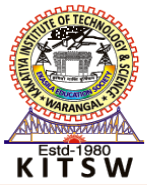
CO2: identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement

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**	**PSO 1**	**PSO 2**
CO1	**U24AE211**.1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO2	**U24AE211**.2	1	1	1	1	1	1	2	1	2	1	2	1	1
CO3	**U24AE211**.3	1	1	1	1	1	1	2	1	2	1	2	1	1
CO4	**U24AE211**.4	1	1	1	1	1	1	2	1	2	1	2	1	1
U24AE211		**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2020 Rank Band: 201-250



KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
website: www.kitsw.ac.in | E-mail: principal@kitsw.ac.in | ✆ : +91 9392055211, +91 7382564888

Semester -II Exit Option Syllabi

Bridge Courses for exit:

Successful completion of twosubjects (6-Credits)during 2-months internship at the institute

OR

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

A. After First Year: (UG Certificate in CSE(AI & ML))

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

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

Exit Option to Qualify UG Certificate in CSE(AI & ML): Any Two (02) Courses during the 2 - Months internship									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	PCC	U24AI212X	Introduction to Python Programming	2	-	2	-	4	3
2	PCC	U24AI213X	Programming with Java	2	-	2	-	4	3
3	PCC	U24AI214X	Introduction to Databases	2	-	2	-	4	3
4	PCC	U24AI215X	Fundamentals of Computer Networks	2	-	2	-	4	3
5	PCC	U24AI216X	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(AI & ML): Any Two (02) Skill based Courses -:									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	SEC	U24SE217X	Core Python Programming Reference: https://www.netacad.com/courses/programming/pcap-programming-essentials-python	-	-	6	-	6	3
2	SEC	U24SE218X	Java Fundamentals Reference: https://learn.oracle.com/ols/learning-path/java-fundamentals/55593/55578	-	-	6	-	6	3
3	SEC	U24SE219X	Database Foundations Reference: https://academy.oracle.com/en/solutions-curriculum-database.html	-	-	6	-	6	3

Exit Option to Qualify UG Certificate in CSE(AI & ML): Any Two (02) Skill based Courses -:									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
4	**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**
5	**SEC**	**U24SE221X**	**Networking Fundamentals** **Reference:** https://www.netacad.com/courses/networking/ccna-introduction-networks	**-**	**-**	**6**	**-**	**6**	**3**
6	**SEC**	**U24SE222X**	Any other skill based course approved by BoS Chair and Dean AA	**-**	**-**	**6**	**-**	**6**	**3**

INTRODUCTION TO PYTHON PROGRAMMING

Class: B.Tech. II – Semester (Exit Course)		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI212X**	**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):

This course will develop students' knowledge in /on…

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.

Text Book(s):

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

Reference Book(s):

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

Web and Video link(s):

1. 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):		**U24AI212X : 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**	**PSO 1**	**PSO 2**
CO1	**U24AI212X.1**	1	2	2	1	-	-	1	1	1	-	1	2	2
CO2	**U24AI212X.2**	2	2	3	2	-	-	1	1	1	-	2	2	2
CO3	**U24AI212X.3**	2	2	3	2	-	-	1	1	1	-	2	2	2
CO4	**U24AI212X.4**	2	2	3	3	-	-	1	1	1	-	2	2	2
CO5	**U24AI212X.5**	1	2	2	2	-	-	1	2	1	2	1	2	2
CO6	**U24AI212X.6**	2	2	3	2	-	-	1	2	1	2	2	2	2
CO7	**U24AI212X.7**	2	2	3	2	-	-	1	2	1	2	2	2	2
CO8	**U24AI212X.8**	2	2	3	2	-	-	1	2	1	2	2	2	2
U24AI212X		**1.75**	**2**	**2.75**	**1.75**	**-**	**-**	**1**	**1.5**	**1**	**2**	**1.75**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

PROGRAMMING WITH JAVA

Class: B.Tech. II -Semester (Exit Course)		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI213X**	**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):

This course will develop students' knowledge in /on…

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.

Text Book(s):

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

Reference Book(s):

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

Web and Video link(s):

1. 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):

1. *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):		**U24AI213X 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**	**PSO 1**	**PSO 2**
CO1	**U24AI213X.1**	2	1	1	1	-	-	1	1	1	-	2	2	1
CO2	**U24AI213X.2**	2	2	2	2	-	-	1	1	1	-	2	2	1
CO3	**U24AI213X.3**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO4	**U24AI213X.4**	2	3	2	2	-	-	1	1	1	-	2	2	2
CO5	**U24AI213X.5**	2	1	1	1	-	-	1	2	1	-	2	2	1
CO6	**U24AI213X.6**	2	2	2	2	-	-	1	2	1	-	2	2	1
CO7	**U24AI213X.7**	2	2	2	2	-	-	1	2	1	-	2	2	2
CO8	**U24AI213X.8**	2	3	2	2	-	-	1	2	1	-	2	2	2
U24AI213X		**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 (AI & ML)	
Course Code:	**U24AI214X**	**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):

This course will develop students' knowledge in /on…

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**

Databases and Database Users: Characteristics of database approach, Advantages of using DBMS, When not to use DBMS

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.

The Relational Data Model and its constraints: Relational model concepts, Relational constraints and the relational database schemas, Update operations and dealing with constraint violations

UNIT-II	**4 Hrs**

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

Basic SQL: SQL Data definition and data types, Specifying constraints in SQL, Basic retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL

UNIT-III	**4 Hrs**

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

UNIT-IV	**4 Hrs**

Introduction to Transaction Processing: Introduction to transaction processing, Transaction and system concepts, Desirable properties of a transactions, Characterizing schedules based on recoverability and serializability

Concurrency Control Techniques: Two-Phase locking techniques for concurrency control, Concurrency control based on timestamp ordering

LABORATORY COMPONENT

List of Experiments

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.

Text Book(s):

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

Reference Book(s):

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

Web and Video link(s):

1. 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):

1. *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):		**U24AI214X : 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**	**PSO 1**	**PSO 2**
CO1	**U24AI214X.1**	1	2	2	1	1	-	1	1	1	-	1	2	2
CO2	**U24AI214X.2**	2	2	3	2	2	-	1	1	1	-	2	2	2
CO3	**U24AI214X.3**	2	2	3	2	2	-	1	1	1	-	2	2	2
CO4	**U24AI214X.4**	2	2	3	3	2	-	1	1	1	-	2	2	2
CO5	**U24AI214X.5**	1	2	2	2	1	-	1	2	1	2	2	2	2
CO6	**U24AI214X.6**	2	2	3	2	2	-	1	2	1	2	2	2	2
CO7	**U24AI214X.7**	2	2	3	2	2	-	1	2	1	2	2	2	2
CO8	**U24AI214X.8**	2	2	3	2	2	-	1	2	1	2	2	2	2
U24AI214X		**1.75**	**2**	**2.75**	**2**	**1.75**	**-**	**1**	**1.5**	**1**	**2**	**1.875**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

FUNDAMENTALS OF COMPUTER NETWORKS

Class: B.Tech. II –Semester (Exit Course)		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI215X**	**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):

This course will develop students' knowledge in /on…

LO1: computer networks reference models, physical layer components & network switching
LO2: data link and medium access control protocols
LO3: routing algorithms & internetworking
LO4: transport and application layer protocols used in the networks

THEORY COMPONENT

UNIT-I	**4 Hrs**

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

Physical Layer: Transmission media - Guided transmission media, Wireless transmission; Digital modulation and multiplexing Switching: Circuit and Packet switching

UNIT-II	**4 Hrs**

Data Link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols

Medium Access Control Sub Layer: IEEE standard 802.3, Token bus, Token ring, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, Data link layer switching

UNIT-III	**4 Hrs**

Network Layer: Network layer design issues, Routing algorithms - Optimality principle, Shortest path algorithm, Flooding, broadcast routing, Multicast routing

Internetworking: How networks differ, how networks can be connected, Tunneling, Internetwork routing, Packet fragmentation

UNIT-IV	**4 Hrs**

Network Layer In The Internet: IP version 4 protocols, IP addresses, IP version 6 protocol, Internet control protocols, Internet multicasting

Transport Layer: Transport services, Elements of transport protocols – Connection establishment and release, Error control and flow control, Crash recovery, Multiplexing congestion control

Internet transport protocols - UDP, TCP

Application Layer: Domain name system (DNS), Electronic mail, World Wide Web

LABORATORY COMPONENT

List of Experiments

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.

Text Book(s):

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

Reference Book(s):

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

Web and Video link(s):

1. 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)

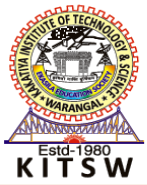
CO5: develop and configure TCP/IP protocols and sub-netting on Windows/Linux systems to ensure efficient network communication and address management

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):		**U24AI215X : 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**	**PSO 1**	**PSO 2**
CO1	**U24AI215X.1**	1	2	2	2	-	-	1	1	1	-	1	2	2
CO2	**U24AI215X.2**	2	2	2	2	-	-	1	1	1	-	1	2	2
CO3	**U24AI215X.3**	2	2	2	2	-	-	1	1	1	-	1	2	2
CO4	**U24AI215X.4**	2	2	2	2	-	-	1	1	1	-	1	2	2
CO5	**U24AI215X.5**	2	2	2	2	2	-	1	2	1	2	1	2	2
CO6	**U24AI215X.6**	2	2	2	2	2	-	1	2	1	2	1	2	2
CO7	**U24AI215X.7**	2	2	2	2	2	-	1	2	1	2	1	2	2
CO8	**U24AI215X.8**	2	2	2	2	2	-	1	2	1	2	1	2	2
U24AI215X		**1.875**	**2**	**2**	**2**	**2**	**-**	**1**	**1.5**	**1**	**2**	**1**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														



KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
website: www.kitsw.ac.in E-mail: principal@kitsw.ac.in ✆ : +91 9392055211, +91 7382564888

Semester -III Syllabi

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

III SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC*	U24MH301E*	Essential Mathematics and Statistics for Machine Learning*	2	1	-	6	9	3
2	PCC	U24AI302	Advanced Data Structures	2	1	2	5	10	4
3	PCC	U24AI303	Operating Systems	2	1	-	5	8	3
4	PCC	U24AI304	Automata Theory and Compiler Design	2	1	-	4	7	3
5	PCC	U24AI305	Object Oriented Programming through Java	2	1	2	5	10	4
6	VAC*	U24VA306B*	Soft & Interpersonal Skills*	2	-	-	2	4	1
7	SEC	U24SE307	Programming Skill Development (PSD) Lab - 2	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309XXXXX	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
			Total:	12	5	6	36	59	22
Summer/ Inter-semBridge 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.	U24MH301E	Essential Mathematics and Statistics for Machine learning *(for CSM)*
6.	U24MH301F	Essential Mathematics and Statistics for Data science *(for CSD)*

*** VAC (Value Added Course):**

T&P Basket		
S. No.	**Course Code**	**Course Title**
1.	U24VA306A	Qunatitative Aptitude and Logical Reasoning
2.	U24VA306B	Soft & Interpersonal Skills

ESSENTIAL MATHEMATICS AND STATISTICS FOR MACHINE LEARNING

Class: B.Tech.- III-Semester		**Branch:** CSE (AI&ML)	
CourseCode:	**U24MH301E**	**Credits:**	**3**
Hours/Week(L-T-P-O-E):	**2-1-0-6-9**	**CIE:**	**60 %**
TotalNumberofTeachingHours:	**36 Hrs**	**ESE:**	**40 %**

CourseLearningObjectives(LOs):

This course will develop students 'knowledge in/on…

LO1: vector space, linear dependence, matrix decompositions, multivariate calculus and its applications

LO2: Baye's theorem, random variables and theoretical probability distributions

LO3: correlation, regression, curve fitting and applications of sampling distributions in testing of hypothesis

LO4: dimensionality reduction with principal component analysis (PCA) and optimization techniques

UNIT-I	**9 Hrs**

Linear algebra: Introduction to vectors, Vector space and subspace, Linear combination and span, Linear independence and dependence, Basis vectors, Linear transformations, Null space and range of linear map and Rank-nullity theorem

Matrix decompositions:LU decomposition, Gram Schmidt process, QR decomposition, Singular value decomposition and properties, Norms and Matrix approximations

Multivariate calculus: Partial differentiation and gradient, Jacobian matrix, Gradients of matrices, Hessian matrix, Convex sets, Convex functions and multivariate Taylor series

Self-LearningTopics(SLTs):*Additional problems on linear independence and dependence[Text 3: topic 6.3; Exercises 8, 9],Additional problems on LU decomposition [Text 3: topic1.8; Exercises 3, 4],Additional problems on Gram Schmidt Process[Text 3: topic 6.8; Exercises 7, 12, 13],Additional problems on Singular value decomposition[Text 2: topic4; Exercises 4.8, 4.9], Additional problems on QR decomposition[Text 3: topic 7.1; Exercises 1, 3, 4],AdditionalproblemsonNorms [Text 3:topic 4.2,Exercises:10, 12], Additional problems on convex functions[Text 2:topic 7.3, Example 7.3, 7.4]*

UNIT-II	**9 Hrs**

Probability: Basic rules and axioms, Dependent and independent events,Conditional probability, Baye's theorem

Random variables: Discrete and continuous random variables, Expectation and variance

Distributions: Binomial, Poisson and Normal distributions

Joint probability distributions: Joint probability mass and density function, Marginal probability
mass and density functions and Covariance

Self-Learning Topics (SLTs): *Additional problems on Baye's theorem [Text 1: topic 4.9, Solved problem: 4.30,4.31 Practice problems: exercise 4(d) (2)], Additional problems on Binomial distribution [Text 1: topic 7.2, Solved problem: 7.4, 7.6, Practice problems: exercise 7(a); 7, 9], Additional problems on Poisson distribution [Text 1: topic 7.3, Solved problem: 7.27, 7.30, 7.44 Practice problems: Exercise 7(b); 11, 15(c)], Additionalproblems on Normal distribution [Text 1: topic 8.2, Solved problem: 8.12, 8.13, 8.20(b), Practice problems: exercise8(b); (7)], Additional problems onJoint probability distributionsdistribution [Text 1: topic 5.5, Solved problem: 5.21, 5.23, 5.26, 5.32, Practice problems: Exercise 5(e); 3, 4, 8(a), 9(b)]*

UNIT-III	9 Hrs

Statistics: Measures of Central tendency, Measures of dispersion, Skewness, Kurtosis, Correlation-Coefficient of correlation, Linear Regression,Curve fitting and Method of least squares

Sampling:Types of Sampling, Population, Sample, Parameter, Statistics, Sampling distribution of means (σ-known)and **E**stimation

Testof hypothesis: Procedure for testing of hypothesis, Test of significance of a single mean and difference of means-Large samples, Test of significance of a single Mean and difference of means-Small samples,Paired Sample t-test, F-test, F-test for equality of populationvariances, Chi square test, Chi-square test for goodness of fit and One-way ANOVA.

Self-Learning Topics (SLTs): **:***Additional problems on Measures of Central tendency[Text1:topic 2.5, Example 2.1:topic 2.6: Example 2.5, topic 2.7, Example 2.9], Additional problems on Measures ofdispersion[Text 1:topic 3.3, Example 3.1, 3.7, 3.9, Additional problems onSkewness [Text 1:topic 3.13, Additional problems onSkewness and Kurtosis [Text 1:topic 3.13, Exercise 3.9, 3(a), 6(a), Additional problems on coefficient of correlation [Text 1: topic 10.1, Exercise 10(a): 3, 5], Additional problems on lines of regression [Text 1: topic 10.7.1, Exercise 10(d): 8(a),(b),(c)], Additional problems on Fitting of a straight line and second degree parabola [Text 1: topic 9.1.1, 9.1.2: Exercise 1(b), 5(b)],Additional problems on chi square test for goodness of fit[Text 1: topic 13.7.2, Solved problem: 13.14 Practice problems: exercise 13(b) (3.a)], Additional problems on Paired t-test for single mean [Text 1: topic 14.2.9, Solved problem: 14.3 Practice problems: exercise 14(b) (4.b)],Additional problems on t-test for difference of means [Text 1: topic 14.2.10, Solved problem: 14.8 Practiceproblems: exercise 14(c) (2)], Additional problems on F-test[Text 1: topic 14.5.5, Solved problem: 14.20 and 14.22].*

UNIT-IV	9 Hrs

Dimensionality Reduction with Principal Component Analysis: Problem setting, Maximum Variance Perspective, Projection Perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice and Latent Variable Perspective.

Optimization: Optimization problem, Unconstrained optimization and constrained optimization.
Unconstrained optimization: Gradient Descent method, Conjugate gradient method and Newton's
method,Penalty function method

Constrained optimization: Lagrange's method and Kuhn-Tucker conditions
Self-Learning Topics (SLTs): *Additional problems on PCA [Text 3: topic 10, Example 10.4], Additional problems on Gradient Descent method[Text 4: topic 6.9,Practice problems: exercise-6.23], Additional problems on Conjugate gradientmethod [Text 4: topic 6.10, Practice problems: exercise-6.24], Additional problems on Newton's method [Text 4: topic 6.11, Practice problems: exercise-6.20], Additional problems on onLagrange's method[Text 4: topic 2.4.3, Solved problem: 2.9, 2.11, Practice problems: exercise-2.48, 2.49], Additional problems on Kuhn-Tucker conditions[Text 4: topic 2.5.1, Solved problem: 2.13, Practice problems: exercise-2.61, 2.62, 2.63],*

CourseLearningOutcomes (COs):
After completion of this course, the students should be able to…
CO1: apply linearalgebra and multivariate calculus conceptsto solve real-worldsituations.
CO2: analyze the data using various statistical measures andprobabilitydistributions
CO3: applyexactsamplingdistributionsintestingofhypothesis.
CO4: analyze dimensionality reduction with PCA and optimize the function using various methods of optimization

Text Book(s):

1. S.C. Gupta V.K. Kapoor, *Fundamentals of Mathematical Statistics*, 10th ed., New Delhi: Sultan Chand &Sons Educational Publishers, 2010.
2. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong., *Mathematics for Machine Learning*, 1st ed., UK: Cambridge University Press, 2020.
3. Bernard KolmanandDavid R.Hill.,*Introductory linear algebra an applied first course*, London, UK: Pearsoneducation
4. S.S.Rao, *Engineering Optimization theory and practice*, 4th ed., Hoboken, New Jersey John Wiley & Sons, Inc., 2009

Reference Book(s):

1. G. Strang, *Introduction to Linear Algebra,* 6th ed., MA, USA: Wellesley-Cambridge Press, 2023
2. B.L.S. Prakasa Rao., *A first course in Probability and statistics*, 1st ed., Singapore: World Scientific Publishing Co. Pvt. Ltd., 2009
3. S. P. Gupta, *Statistical Methods*, 46th ed., New Delhi: Sultan Chand& Sons, 2021
4. J.C.Pant, *Introduction to Optimization (OperationsResearch*), 7th ed., New Delhi: JainBrothers, 2008

Web and Video link(s):

1. https://www.youtube.com/watch?v=JO9jNe6BemE&list=PLLy_2iUCG87D1CXFxE-SxCFZUiJzQ3IvE:

   NPTEL Video Lecture on ESSENTIAL MATHEMATICS FOR MACHINE LEARNING/ Prof.S.K.Gupta and Prof. Sanjeev kumar /IIT Roorkee.
2. https://www.youtube.com/watch?v=r1sLCDA-kNY&list=PL46B9EA2CFEB51241:

   NPTEL Video Lecture on Introduction to the Theory of Probability/Prof.M.Chakraborty /IIT Kharagpur.

Course Articulation Matrix (CAM):		U24MH301E: ESSENTIAL MATHEMATICS AND STATISTICS FOR MACHINE LEARNING											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24MH301E.1	2	2	1	1	-	-	-	1	1	-	1	2	1
CO2	U24MH301E.2	2	2	1	1	-	-	-	1	1	-	1	2	1
CO3	U24MH301E.3	2	2	1	1	-	-	-	1	1	-	1	2	1
CO4	U24MH301E.4	2	2	1	1	-	-	-	1	1	-	1	2	1
U24MH301E		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

ADVANCED DATA STRUCTURES

Class: B.Tech. III – Semester		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI302**	**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):

This course will develop students' knowledge in /on…

LO1: organizing and retrieving the data using binary tree, binary search trees
LO2: organizing and retrieving the data using AVL trees, B-Trees, red black trees and splay trees
LO3: organizing and retrieving the data using interval tree, hash tree, tries, sorting and searching
LO4: organizing and retrieving the data using graphs and spanning trees

THEORY COMPONENT

UNIT-I	**9 Hrs**

Trees: Introduction, Types of trees

Binary Tree: Creating a binary tree, Traversing a binary tree: Preorder, Inorder, Postorder and Spiral order recursive traversals

Binary Search Tree: Operations - Insertion, Deletion, Search, Recursive and non-recursive traversal, Threaded binary trees

Self Learning Topics (SLTs): *Linear representation of a Binary Tree, Threaded binary trees applications (Text1: Chapter 7), Review questions, Debugging exercises, Programming exercises, Interview questions (Text1: Chapter 7, Text2: Chapter 9-10)*

UNIT-II	**9 Hrs**

AVL Trees: AVL trees operations - Insertion, Deletion and Traversal

Red-Black Trees: Properties, Operations, Applications, Splay trees

Multiway Search Trees: Introduction to m-way search trees, Operations on B-Trees-Insertion, Deletion, Search, B+-Trees

Self Learning Topics (SLTs): *AVL Tree search operation, B+-Tree deletion, Applications of AVL Tree, Red black tree, B-Tree and B+-Tree (Text1: Chapter 7), Applications of AVL Tree, (Text2: Chapter 10) , Review questions, Programming exercises, Interview questions (Text1: Chapter 7, Text2: Chapter 10)*

UNIT-III	**9 Hrs**

Interval Tree, Hash tree

Tries: Trie structure, Operations on Tries, Applications of Trie indexing

Searching and Internal Sorting: Fibonacci search, Quick sort, Merge sort, Heap sort, Bitonic generator sort, Time complexities of above searching and sorting techniques

Self Learning Topics (SLTs): *Heap tree, Applications of Heap (Text1: Chapter7), Review questions, Debugging exercises, Programming exercises, Interview questions (Text1: Chapter 7, chapter 10, Text2: Chapter 14)*

UNIT-IV	9 Hrs

Graphs: Introduction, Graph terminology, Representation of graphs

Application of Graph Structures: Topological sorting, Minimum spanning trees: Prim's algorithm, Kruskal's algorithm, Graphs traversal methods - Breadth first search, Depth first search, Kosaraju's algorithm

String manipulations, String compression - Run length encoding

String Matching Algorithms: Naive algorithm, Knuth Morris Pratt Algorithm, Boyer Moore algorithm, Rabin Karp algorithm

Self Learning Topics (SLTs): *Applications of graphs (Text1: Chapter 9), String manipulations (Text2: Chapter 4), Review questions, Debugging exercises, Programming exercises, Interview questions (Text1: Chapter 9, Text2: Chapter 4)*

LABORATORY COMPONENT

List of Experiments

1. Develop a program to perform creation, insertion, traversal operations on binary trees.
2. Develop a program to perform creation, deletion, traversal (recursion) operations on binary search tree.
3. Develop a program to perform inorder, preorder and postorder operations on binary search tree traversal without recursion.
4. Develop a program to implement AVL tree construction.
5. Develop a program to implement B-tree construction.
6. Develop programs on Trie and Fibonacci search.
7. Develop programs on Quick sort and Merge sort.
8. Develop programs on Heap sort and Bitonic generator sort.
9. Develop programs on Topological sort, Prim's algorithm and Kruskal's algorithm.
10. Develop programs on Depth first search, Breadth first search and Kosaraju's algorithm.
11. Develop programs on Naive and Knuth - Morris - Pratt (KMP) algorithms.
12. Develop programs on Boyer Moore and Rabin Karp algorithms.

Text Book(s):

1. Debasis Samanta, *Classic Data Structures*, 2nd ed., New Delhi: Prentice Hall India, 2009. *(Chapters 7, 8 & 9)*
2. Reema Thareja, *Data Structures Using C,* 3rd ed., New Delhi: Oxford University Press, 2023. *(Chapters 4, 9-14)*

Reference Book(s):

1. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach with C*, 2nd ed., Noida: Cengage Learning, 2007.
2. Adam Drozdeck, *Data Structures and Algorithms in C++*, 4th ed., Boston: Cengage Learning, 2013.
3. Samir Kumar Bandyopadhyay and Kashi Nath Dey, *Data Structures Using C*, 1st ed., Noida: Pearson, 2009.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, *Introduction to Algorithms,* 4th ed., London: The MIT Press Cambridge, 2022.

Web and Video link(s):

1. https://onlinecourses.swayam2.ac.in/cec25_ma15 *NPTEL Video Lecture on Data Structures by Dr. M. Deivamani, Assistant Professor of IT, Anna University.*
2. https://onlinecourses.swayam2.ac.in/nou23_cs13 *NPTEL Video Lecture on Data Structure using C Programming by Dr. Dipti Verma, Professor of CSE, Chhattisgarh Swami Vivekanand Technical University, Chhattisgarh.*

Laboratory Manual (for laboratory component):

1. *Advanced Data Structures 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 binary tree and binary search tree operations to construct, traverse and manage hierarchical data structures efficiently

CO2 : utilize AVL, Red-Black, Splay and B-Trees to efficiently perform insertion, deletion and search operations in multi-level indexed data structures

CO3 : apply Interval Trees, Hash Trees and Tries for efficient indexing, evaluate the time complexities of various searching and sorting algorithms

CO4 : make use of graph algorithms and string matching techniques for efficient data processing and compression

(based on psychomotor skills acquired from laboratory component)

CO5 : develop and test programs for creation, insertion, deletion, and traversal operations on binary and binary search trees to efficiently manage and process hierarchical data

CO6 : develop and test programs to implement AVL tree and B-tree for efficient data retrieval and multi-level indexing in optimized management

CO7 : develop and test programs on Trie, Fibonacci search, Quick sort, Merge sort, Heap sort and Bitonic generator sort to efficiently handle data searching and sorting operations

CO8 : develop and test programs on graph algorithms like topological sort, Prim's algorithm, Kruskal's algorithm, DFS, BFS and Kosaraju's algorithm, string matching algorithms like Naive, KMP, Boyer-Moore and Rabin-Karp for efficient problem solving

Course Articulation Matrix (CAM):		U24AI302 : ADVANCED DATA STRUCTURES												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24AI302.1	2	2	2	2	-	-	1	1	1	-	1	2	2
CO2	U24AI302.2	2	2	2	2	-	-	1	1	1	-	1	2	2
CO3	U24AI302.3	2	2	2	2	-	-	1	1	1	-	2	2	2
CO4	U24AI302.4	2	2	2	2	-	-	1	1	1	-	2	2	2
CO5	U24AI302.5	1	1	2	2	1	-	1	1	1	2	2	1	1
CO6	U24AI302.6	1	1	2	2	1	-	1	1	1	2	2	1	1
CO7	U24AI302.7	1	1	2	2	1	-	1	1	1	2	2	1	1
CO8	U24AI302.8	1	1	2	2	1	-	1	1	1	2	2	1	1
U24AI302		1.5	1.5	2	2	1	-	1	1	1	2	1.75	1.5	1.5
3 – HIGH, 2 – MEDIUM, 1 - LOW														

OPERATING SYSTEMS

Class: B.Tech. III - Semester		**Branch:** CSE (AIML)	
Course Code:	**U24AI303**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-5-8**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: basics of operating system, system structure and process
LO2: cpu scheduling, process synchronization and deadlocks
LO3: main memory, virtual memory and mass-storages
LO4: protection techniques and advantages of distributed system

UNIT-I	**9 Hrs**

Introduction: What operating systems do, Computer system architecture, Operating system operations, Process management, Memory management, Storage management, Protection and security, Computing environments

Operating System Structures: Operating system services, System calls, Types of system calls, System programs, Operating system structure, System boot

Processes: Process concept, Process scheduling, Inter process communication

Case study: The Linux System – Overview of its architecture, Process management, Memory management, File system, and System calls

Self Learning Topics (SLTs): *Virtualization (Text1: topics 1.7), Multithreading models (Text1: Chapter 4.3)*

UNIT-II	**9 Hrs**

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms– First come first served, Shortest job first, Priority, Round robin, Multilevel queue, Multilevel feedback queue

Process Synchronization: Background, The critical section problem, Petersons' solution, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Monitors

Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock

Self Learning Topics (SLTs): *Modern CPU scheduling techniques including advanced multi-core and real-time scheduling algorithms (Text1: Chapter 5.5), Practice exercises on resource-allocation graphs and deadlock avoidance using banker's algorithm. (Text1: Practice exercise 8.12 – 8.18)*

UNIT-III	**9 Hrs**

Main Memory: Background, Swapping, Contiguous memory allocation, Segmentation, Paging

Virtual Memory: Background, Demand paging, Page replacement, Allocation of frames, Thrashing

Mass-Storage Structure: Overview of mass storage structure, Disk structure, Disk scheduling

Self L***earning Topics (SLTs):*** *Structure of the page table (Text1: Chapter 9.4),* *RAID* structure *(Text1: Chapter 11.8), Practice exercises on page replacement algorithms (Text1: Practice exercise 10.1 – 10.9).*

UNIT-IV	**9 Hrs**

File-System Interface: File concept, Access methods, Directory and disk structure

File-System Implementation: Allocation methods, Free-space management

Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix

Distributed Systems: Advantages of distributed systems, Types of network-based operating systems, Communication structure, Robustness

Self Learning Topics (SLTs): *File-system structure (Text1: Chapter 14.1)*

Course Learning Outcomes (COs):

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

CO1: A apply the fundamental concepts of operating system and processes to solve the essential problems related to operating systems

CO2: analyze CPU scheduling based on throughput, turnaround time, waiting time, and CPU utilization, evaluate process synchronization using mutual exclusion, progress, and bounded waiting, along with deadlock conditions and prevention

CO3: analyze page replacement algorithms based on page fault rate and hit ratio, evaluate disk scheduling algorithms based on seek time, rotational latency and transfer time for effective memory and storage management

CO4: design the secured distributed systems using the concepts of protection methods and distributed systems

Text Book(s):

1. Abraham Silberschatz, Peter B Galvin, Gerg Gagne, *Operating System Concepts*, Global ed., USA: Wiley, 2024. (*Chapters 1 to 11, 13 to 14 ,17 ,19*)

Reference Book(s):

1. EktaWalia, *Operating Systems*, 2nd ed., New Delhi: Khanna Publishing House, 2019.
2. William Stalling, *Operating Systems*, 9th ed., USA: Pearson, 2018.
3. Dhananjay M. Dhamdhere, *Operating Systems A Concept-Based Approach*, 3rd ed., New Delhi: McGraw Hill, 2017.
4. Andrew S. Tanenbaum, Herbert BOS, *Modern Operating Systems*, 4th ed., USA: Pearson, 2016.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_cs108/preview, *NPTEL Video Lecture on Operating System Fundamentals by Prof. Santanu Chattopadhyay, IIT Kharagpur.*
2. https://onlinecourses.nptel.ac.in/noc23_cs101/preview, NPTEL *Video Lecture on Introduction to Operating Systems by Prof. Chester Rebeiro IIT Madaras.*

Course Articulation Matrix (CAM):		**U24AI303 : OPERATING SYSTEMS**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AI303.1**	2	2	2	2	-	1	1	1	1	2	2	2	2
CO2	**U24AI303.2**	2	2	2	2	-	1	1	1	1	2	2	2	2
CO3	**U24AI303.3**	2	2	2	2	-	1	1	1	1	2	2	2	2
CO4	**U24AI303.4**	2	2	2	2	-	1	1	1	1	2	2	2	2
U24AI303		**2**	**2**	**2**	**2**	**-**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

AUTOMATA THEORY AND COMPILER DESIGN

Class: B.Tech. III -Semester		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI304**	**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):

This course will develop students' knowledge in /on…

LO1: basics concepts of formal languages, grammars and automata theory
LO2: design and analysis of regular expressions and context-free grammars
LO3: computational models, including pushdown automata and Turing machine
LO4: phases of a compiler, apply parsing techniques and translation schemes

UNIT-I	**9 Hrs**

Introduction to Finite Automata: Structural representations, Automata and complexity, The central concepts of automata theory – Alphabets, Strings, Languages, Problems

Nondeterministic Finite Automata: Formal definition, An application, Text search, Finite automata with epsilon-transitions

Deterministic Finite Automata: Definition of DFA, How A DFA process strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions, Conversion of NFA to DFA, Moore and Melay machines

Self Learning Topics (SLTs): *Minimization of DFA (Text1: Topics: 4.4.3)*

UNIT-II	**9 Hrs**

Regular Expressions: Finite automata and regular expressions, Applications of regular expressions, Algebraic laws for regular expressions, Conversion of finite automata to regular expressions

Pumping Lemma for Regular Languages: Statement of the pumping lemma, Closure properties of regular languages

Context-Free Grammars: Definition of context-free grammars, Derivations using a grammar, Leftmost and rightmost derivations, The language of a grammar, Parse trees, Ambiguity in grammars and languages, Removal of ambiguity in grammars, Pumping lemma of context-free languages, Simplification of CFG, Chomsky normal form (CNF)

Self Learning Topics (SLTs): *applications of regular expressions (Text1: Topics: 3.3), applications of pumping lemma (Text1: Topics: 4.1.2)*

UNIT-III	**9 Hrs**

Push Down Automata: Definition of the pushdown automaton, The languages of a PDA, Equivalence of PDA and CFG, Acceptance by final state, Acceptance by empty store

Turing Machines: Introduction to turing machine, Formal description, Instantaneous description, The language of a turing machine

Undecidability: Undecidability, A language that is not recursively enumerable, An undecidable problem that is RE, Undecidable problems about turing machines, Post-correspondence problem

Self Learning Topics (SLTs): *Recursive languages and recursively enumerable languages (Text1: Topics: 9.2.1)*

UNIT-IV	9 Hrs

Introduction: The structure of a compiler

Lexical Analysis: The Role of the lexical analyzer, Input buffering, Recognition of tokens

Syntax Analysis: Top-down parsing, Bottom-up parsing, Introduction to LR parsing: Simple LR, More powerful LR parsers

Syntax-Directed Translation: Syntax-directed definitions, Evaluation orders for SDD's, Syntax directed translation schemes

Intermediate-Code Generation: Intermediate languages, Three-address code

Run-Time Environments: Stack allocation of space, Access to nonlocal data on the stack

Self Learning Topics (SLTs): *Syntax trees (Text 2: Topics: 4.4), Heap Management (Text2: Topics: 7.4)*

Course Learning Outcomes (COs):

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

CO1: apply the concepts of finite automata to model and solve basic computational problems

CO2: apply regular expressions and context-free grammars to develop and analyze formal languages

CO3: analyze computational models like pushdown automata and turing machines to classify languages and understand the limits of computation through undecidability

CO4: analyze the phases of a compiler and apply syntax analysis, intermediate code generation, and code optimization techniques

Text Book(s):

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, *Introduction to Automata Theory, Languages, and Computation*, 3rd ed., New Delhi: Pearson Education, 2006. *(Chapters 1-9)*
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, *Compilers: Principles, Techniques and Tools,* 2nd ed., New Delhi: Pearson, 2014.(*Chapters: 1, 3-8*)

Reference Book(s):

1. Michael Sipser, *An Introduction to the Theory of Computation*, 3rd ed., USA: Cengage Learning, 2012.
2. Peter Linz, Jones, An *Introduction to Formal Languages and Automata*, 6th ed., Burlington, Massachusetts: Barlett Learning, 2017.
3. Kenneth C. Louden, Thomson, *Compiler Construction*, International ed., Boston: Course Technology Inc, Massachusetts, 1997.
4. Mishra and Chandrashekaran, *Theory of Computer Science – Automata languages and computation*, 3rd ed., New Delhi: PHI, 2008.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc21_cs83/preview, *NPTEL Video Lecture on Theory of Computation by Prof. Raghunath Tewari, IIT Kanpur.*
2. https://onlinecourses.nptel.ac.in/noc21_cs07/preview, *NPTEL Video Lecture on Compiler Design by Prof. Santanu Chattopadhyay, IIT Kharagpur.*

Course Articulation Matrix (CAM):		U24AI304 : AUTOMATA THEORY AND COMPILER DESIGN												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24AI304.1	2	2	2	1	-	1	-	1	1	1	1	1	1
CO2	U24AI304.2	2	2	2	1	-	1	-	1	1	1	1	1	1
CO3	U24AI304.3	2	2	2	1	-	1	-	1	1	1	2	1	1
CO4	U24AI304.4	2	2	2	1	-	1	-	1	1	1	2	1	1
U24AI304.1		**2**	**2**	**2**	**1**	**-**	**1**	**-**	**1**	**1**	**1**	**1.5**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Class: B.Tech.III –Semester		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI305**	**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):

This course will develop students' knowledge in /on…

LO1: programming paradigmsand basic java constructs including data types, controlstructures, and classes

LO2: classes, constructors, different types of methodsand strings manipulations

LO3: inheritance, dynamic method dispatch, interfaces and packages

LO4: using I/O, file handling, exception handling and multi-threading

THEORY COMPONENT

UNIT-I	**9 Hrs**

Programming Paradigms: Procedural programming, Modular programming, Object oriented programming (OOP), Generic programming

The History and evolution of Java: Java's Lineage, The Creation of Java, How Java changed the internet, Java's Magic: The Byte Code, The Java buzzwords, The evaluation of Java

An overview of java: Object Oriented Programming, OOP principles, A first simple program

Data types, Variables and arrays: Java is strongly typed language, The primitive types, Integers, Floating-point types, Characters, Booleans, A closer look at literals, Variables, Type Conversion and casting, Automatic type promotion in expressions, Arrays, One dimensional arrays, multi-dimensional arrays, Jagged arrays,

Operators: Arithmetic operators, The bitwise operators, Relational operators, Boolean logical operators, Short-circuit logical operators, The assignment operator, The ? operator, Operator precedence, Using parenthesis

Control statements: Selection statements, Iteration statements, The for-each version of the for loop, Nested loops, Jump statements,

Introducing Classes: Class fundamentals, Declaring Objects, Assigning object reference variables, Introducing Methods

Self Learning Topics (SLTs):*Lexical Issues like Keywords, identifiers, Literals and comments (TextBook-Chapter 2), Type conversions and casting (TextBook-Chapter3)*

UNIT-II	**9 Hrs**

Classes and Methods: Constructors, The *this* keyword, Garbage collection, Overloading methods, Overloading constructors, Using objects as parameters, A closer look at argument passing, Returning objects, Recursion, Introducing access control, Understanding static, Static blocks, Static methods, Introducing final, Arrays revisited, Introducing nested and inner classes, Using command-Line arguments, Varargs: Variable length arguments, Overloading vararg methods, Varargs and ambiguity, Wrapper classes

Strings: Exploring String class and its methods, StringBuffer, StringBuilder and StringTokenizer classes

Self Learning Topics (SLTs): *Overloading Vararg Methods, Varargs and Ambiguity(TextBook-Chapter: 7),Anonymous Inner classes(TextBook-Chapter-25),*

UNIT-III	**9 Hrs**

Inheritance: Inheritance basics, Types of inheritance, Member access and inheritance, A super class variable can reference a subclass object, Using *super*, When constructors are executed, Method overriding, Dynamic method dispatch, Using abstract classes, Using *final* with inheritance, Object class

Interfaces: Defining an interface, Implementing interfaces, Nested interfaces, Variables in interfaces, Interfaces can be extended

Packages: Defining a package, Finding packages and CLASSPATH, Packages and Member Access, Importing packages

Self Learning Topics (SLTs): *Accessing Implementations Through Interface References*, *Default interface methods,Use static Methods in an Interface, private interface methods (TextBook - Chapter-9)*

UNIT-IV	**9 Hrs**

Using I/O: I/O basics, Streams, Byte streams and character streams, Reading console input, Writing console output, Reading, Writing and copying files using byte and character streams

Exception Handling: Fundamentals, Exception types, Uncaught exceptions, Using *try* and *catch*, Multiple catch clauses, Nested try statements, *throw*, *throws*, *finally*, Java's built-in exceptions, Creating your own exception sub classes

Multithreading: The java thread model, Thread priorities, The main thread, Creating a thread, Creating multiple threads, Using isAlive() and join(), Thread priorities, Synchronization, Interthread communication, Suspending, Resuming, and stopping threads, Obtaining a thread state, Using a factory method to create and start a thread

Self Learning Topics (SLTs):*try-with resource, multi catch, chained exception, precise re-throw(TextBook-Chapter:10), Serialization- Writing and reading objects to and from the file-(TextBook-Chapter-22)*

LABORATORY COMPONENT

List of Experiments

Experiment-I:

1. Develop a java program to demonstrate different operators in java.
2. Develop a java program to demonstrate control structures.
3. Develop a java program to demonstrate *switch* statement.

Experiment-II:

1. Develop a java program to read an array and display them using *for-each* control. Finally display the sum of array elements.
2. Develop a java program to read a matrix and display whether it is an identity matrix or not. Use *civilizedform* of *break* statement.
3. Develop a java program to define a two-dimensional (2D) array where each row contains different numberof columns. Display the 2D-array using *for-each*.

Experiment-III:

1. Develop a javaprogram to demonstrate class concept
2. Develop a java program to demonstrate *this keyword*
3. Develop a java program to demonstrate object reference variable
4. Develop a java program to demonstrate overloading of methods
5. Develop a java program to demonstrate passing and returning objects

Experiment-IV:

1. Develop a java program to demonstrate variable length argument (using array and ellipsis notation).
2. Develop a java program to demonstrate constructors and garbage collection.
3. Develop a java program to demonstrate nested and inner classes.
4. Develop a java program to demonstrate *static*variables, *static*methods, and staticblocks.

Experiment-V:

1. Read at least five strings from command line argument and display them in sorted order.
2. Develop a java program to demonstrate wrapper class by reading N number of integers from command line and display their sum.
3. Develop a java program to demonstrate wrapper class by reading N floating point numbers from command line and display their average.

Experiment-VI:

1. Develop a java program to accept a string, count number of vowels and remove all vowels.
2. Develop a java program to accept a string, count number of vowels and remove all vowels using *StringBuffer*class**.**
3. Develop a javaprogram to accept a line of text, tokenize the line using *StringTokenizer* class and print the tokens in reverse order.

Experiment-VII:

1. Develop a java program to demonstrate single level-inheritance.
2. Develop a java program to demonstrate multilevel inheritance using super.
3. Develop a java program to demonstrate method overriding.

Experiment-VIII:

1. Develop a java program to demonstrate dynamic method dispatch.
2. Develop a java program to demonstrate use of abstract class.
3. Develop a java program to demonstrate the use of overriding *equals()* method of an Object class.

Experiment-IX:

1. Develop a java program to implement interfaces.
2. Develop a java program to extend the interfaces
3. Develop a java program to demonstrate implementation of nested interfaces.

Experiment-X:

1. Develop a java program to create a *package* anddemonstrate to import the*package* into any java program (Consider the behaviour of all access specifiers).

Experiment-XI:

1. Develop a java program to demonstrate *try-catch* block.
2. Develop a javaprogram to demonstrate *throw* clause.
3. Develop a java program to demonstrate *throws* clause.
4. Develop a java program to demonstrate *re-throw*an exception and *finally* block.

Experiment-XII:

1. Develop a java program to demonstrate read/write/copy a file using *byte stream*.
2. Develop a javaprogram to demonstrate read/write/copy a file using *character stream*.
3. Develop a java program to create a thread (using *Thread* class or *Runnable* interface).
4. Develop a java program to demonstrate *synchronization* of threads.
5. Develop a java program to demonstrate *Inter-threadcommunication*.

Text Book(s):

1. HerbertSchildt, *Java TheComplete Reference*, 13th ed., New Delhi:McGraw-Hill Education, 2019.

Reference Book(s):

1. Balaguruswamy, *Programming with Java: A Primer*, 7th ed., New Delhi:McGraw-Hill Education India Pvt. Ltd., 2019.
2. KathySierra, BertBates, *Head First Java*, 2nd ed., Boston:O'Reilly Publications,2005.
3. Harvey Deitel, Paul J. Deitel, *Java How to Program,* 11thed., New Delhi:Pearson Publications,2018.

Web and Video link(s):

1. https://nptel.ac.in/courses/106105191 NPTEL *Video Lecture onJava Programming*by Prof. Debasis Samanta,Professor of CSE,IIT Kharagpur.

Laboratory Manual (for laboratory component):

1. *Object Oriented Programming through java 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: distinguish between various programming paradigms and develop fundamental java programs

CO2: develop java programs using classes, constructors, methods and various string handling techniques

CO3: apply inheritance, interfaces, and packages to build modular, maintainable, and reusable java applications

CO4: analyze and implement robust file I/O operations, exception handling mechanisms, and multithreading to create efficient and fault-tolerant java applications

(based on psychomotor skills acquired from laboratory component)

CO5: develop and test simple java programs demonstrating the use of basic syntax, data types, control structures, and class fundamentals

CO6: develop and test java programs implementing method overloading, constructors, static members, and string manipulation techniques

CO7: use the reusability concepts like inheritance, dynamic method dispatch, interfaces and packages to develop and test modular, reusable and organized code

CO8: develop and test java programs using I/O, file handling, exception handling and multithreading to develop efficient and robust applications

Course Articulation Matrix (CAM):		**U24AI305 : OBJECT ORIENTED PROGRAMMING THROUGH JAVA**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AI305.1**	2	2	2	-	-	-	1	1	1	-	2	1	1
CO2	**U24AI305.2**	2	2	2	1	-	-	1	1	1	-	2	1	1
CO3	**U24AI305.3**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO4	**U24AI305.4**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO5	**U24AI305.5**	1	1	1	1	1	-	1	1	1	-	2	1	1
CO6	**U24AI305.6**	1	2	2	2	1	-	1	1	1	-	2	1	1
CO7	**U24AI305.7**	1	2	2	2	1	-	1	1	1	-	2	2	2
CO8	**U24AI305.8**	1	2	2	2	1	-	1	1	1	-	2	2	2
U24AI305		**1.5**	**1.8**	**1.8**	**1.7**	**1**	**-**	**1**	**1**	**1**	**-**	**2**	**1.5**	**1.5**

SOFT AND INTERPERSONAL SKILLS LABORATORY

Class: B.Tech. III -Semester		**Branch:** Common to all Branches	
Course Code:	**U24VA306B**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-2-2-4**	**CIE**	**100 %**
Total Number of Teaching Hours:	**24 Hrs**	**ESE**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: analysing self and learning to overcome possible threats
LO2: group dynamics to demonstrate respect for the opinions and beliefs of group
LO3: effective presentations using visual aids and analyzing the videos
LO4: communicating professionally, making resume in line with industry expectations

LIST OF ACTIVITIES

Activity 1	Ice-breaking, Self-Awareness and Just a Minute (JAM)
Activity 2	Self-Introduction & Personal SWOT Analysis
Activity 3	Reading Comprehension & Critical Thinking
Activity 4	Active Listening & Non-Verbal Observation (Video + Peer Practice)
Activity 5	Group Discussion - 1
Activity 6	Resume Building & LinkedIn Profile Review
Activity 7	Group Discussion - 2
Activity 8	Presentation Skills with PPT / Storytelling
Activity 9	Group Discussion - 3
Activity 10	Mock Interviews: Technical & HR
Activity 11	Email Etiquette & Professional Communication
Activity 12	Workplace Etiquette & Conflict Resolution

Course Learning Outcomes (COs):

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

CO1: deliver concise & effective self-introduction and demonstrate confidence, spontaneous speaking skills within a limited time
CO2: conduct a personal SWOT analysis to identify areas for self-improvement and career development
CO3: demonstrate clear & respectful communication, leadership, positive attitude and improve interpersonal relationship by actively participating in group discussions, collaborative tasks & mock interviews
CO4: create a professional resume, develop a LinkedIn profile and demonstrate effective video communication by making effective videos on self-introduction, personal SWOT analysis & spontaneous speaking activity along with email & workplace etiquette

Text Book(s):

1. Krishna Mohan, Meera Benerji, *Developing Communications Skills*, 2nd ed., New Delhi: Mcmillan Publications, 2005

Course Articulation Matrix (CAM):		U24VA306B : SOFT AND INTERPERSONAL SKILLS LABORATORY												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24VA306B.1	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	U24VA306B.2	-	-	-	-	-	-	2	3	3	-	1	-	-
CO3	U24VA306B.3	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	U24VA306B.4	-	-	-	-	-	-	1	2	3	-	1	-	-
U24VA306B		-	-	-	-	-	-	**1.5**	**2.25**	**3**	-	**1**	-	-
3 – HIGH, 2 – MEDIUM, 1 - LOW														

Programming Skill Development Lab-2

Class: B.Tech. II -Semester		**Branch:** CSE (AI & ML)	
Course Code:	**U24SE307**	**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: fundamentals on data structures and their implementation with arrays
LO2: representation of data structures using stacks and various forms of queues
LO3: representing the data using various types of linked lists
LO4: various sorting techniques on the given data and representing different hashing techniques

LABORATORY COMPONENT

S. No.	List of Experiments
1.	a) Develop a C-program to shrink an array by removing triplets that satisfy given constraints. Given an integer array, shrink it by removing adjacent triplets that satisfy the given constraints and return the total number of elements in the resultant array. Input: A[] = [1, 2, 3, 5, 7, 8], k = 2 . Output: 3 b) Develop a C-program to find the maximum and minimum elements in an array. c) Develop a C-program to represent a sparse matrix using a 2D array
2.	a) Develop a C-program to allocate memory for an integer array dynamically and accept user's input. b) Implement a C-program to dynamically allocate a 2D matrix and take input from the user. c) Develop a function to free dynamically allocated memory after use
3.	a) To design and implement a web browser navigation system that mimics the behavior of modern browsers using two stacks to manage Back and Forward navigation using C-language. b) Implement a C- program to create and manage multiple stacks in a single array. c) Write a C-program to Convert an infix expression (e.g., (A + B) * C) to its postfix form using a stack.
4.	a) Develop a C-program to implement a circular queue using an array. b) Implement a C-program priority queue where elements are dequeued based on priority. c) Develop a C-program simulate a printer queue system where documents are printed in FIFO order.
5.	a) Write a C-program Tower of Hanoi using Iterative Stack**:** Solve the Tower of Hanoi problem using a stack instead of recursion b) Job Scheduling Simulation**:** Implement a C-program queue-based job scheduler where tasks are executed in FIFO order, but some high-priority jobs can be inserted at the front. c) Circular Queue without Extra Space**:** Implement a C-program circular queue without using extra space or an additional array.
6.	a) Given an array-based implementation and a linked list-based implementation of a list, compare the worst-case complexities for insertion, deletion, and search b) Design an efficient method to merge two sorted singly linked lists without using extra space. c) Consider a scenario where a linked list is frequently modified. How would you optimize memory usage during frequent insertions and deletions?

7.	a) Implement a C-programs on one dimensional array and two-dimensional arrays b) Develop a C-program to detect and remove a cycle in a singly linked list without using extra space**.** Hint: Use Floyd's Cycle Detection Algorithm (Tortoise and Hare approach). c) Given a circular linked list, implement a function to split it into two equal halves. If the list has an odd number of nodes, the first list should have one extra node. **Input**: 1 -> 2 -> 3 -> 4 -> 5 -> 6 -> (back to 1) **Output**: Two lists: (1 ->2-> 3) and (4->5-> 6)
8.	a) Develop a function to remove all duplicate nodes from an unsorted singly linked list without using extra space (no hash set or array allowed). Input: 4 -> 2 -> 3 -> 2 -> 1 -> 3 Output: 4 -> 2 -> 3 -> 1 b) Given a linked list-based stack, implement a function to sort the stack in O(n log n) time using recursion without using extra space**.** c) Develop a C-program to find two odd occurring elements in an array without using any extra space given an integer array, duplicates appear in it an even number of times except for two elements, which appear an odd number of times. Find both odd appearing elements without using any extra memory. For example, Input: arr[] = [4, 3, 6, 2, 4, 2, 3, 4, 3, 3] Output: The odd occurring elements are 4 and 6 6 appears once. 2 appears twice. 4 appears thrice. 3 appears 4 times.
9.	a) Implement a C-program selection sort on a linked list instead of an array, achieving an in-place sorting mechanism. Follow-up**:** Optimize it to work in **$O(n^2)$** time without using extra space. b) Given an array of large floating-point numbers, implement Radix Sort to sort them efficiently. Example: Input: [3.141, 2.718, 1.414, 4.669] Output: [1.414, 2.718, 3.141, 4.669]
10.	a) Develop a C-program for given an array of integers, sort it using Insertion Sort but with the constraint that you can swap only adjacent elements and minimize the number of swaps. Example: Input: [8, 4, 2, 9] ,Output: [2, 4, 8, 9] (with minimum swaps) d) Given an array of integers, sort it using Insertion Sort but with the constraint that you can swap only adjacent elements and minimize the number of swaps. Example: Input: [8, 4, 2, 9] , Output: [2, 4, 8, 9] (with minimum swaps)
11.	a) Implement C-program for Shell Sort with a custom gap sequence that minimizes the worst-case complexity. Compare the performance of: i. Knuth's sequence ii. Hibbard's sequence iii. Original Shell's sequence Run the sort on an input of 1 million elements and report the execution time of each sequence. b) Write a C-program for Sort an array in one swap whose two elements are swapped given an array where all its elements are sorted in increasing order except two swapped elements, sort it in linear time. Assume there are no duplicates in the array. For example, Input: A[] = [3, 8, 6, 7, 5, 9] or [3, 5, 6, 9, 8, 7] or [3, 5, 7, 6, 8, 9] Output: A[] = [3, 5, 6, 7, 8, 9]
12.	a) Design a custom hash function for a dictionary that stores words and their meanings. Ensure minimal collisions when hashing large sets of words (e.g., 100,000 words). b) Implement Chaining (Open Hashing) using a binary search tree (BST) at each bucket instead of a linked list. Insert, Search, and Delete should work in O(log k) time, where k is the number of elements in a bucket.

Text Book(s):

1. Debasis Samanta, *Classic Data Structures*, 2nd ed., New Delhi: Prentice Hall India, 2009.
2. Reema Thareja, *Data Structures using C,* 2nd ed., New Delhi: Oxford University Press, 2022.
3. E Balagurusamy, *Data Structure using C*, 1st ed., Noida: McGraw Hill Education, Uttar Pradesh, 2017.

Reference Book(s):

1. Paul Deitel, Harvey Deitel, *C How to Program: With Case Studies Introducing Applications Programming and Systems Programming*, 9th ed., USA: Pearson Education Limited, 2022.
2. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach with C,* 2nd ed., USA: Cengage Learning, 2007.

Course Learning Outcomes (COs):

After completion of this course, the students should be able to …
(based on psychomotor skills acquired from laboratory component)

CO1: apply static & dynamic memory management for performing different operations using arrays
CO2: analyze the linear data structures stacks and queues in organizing the data.
CO3: organize and retrieve the data through various linked list representations in non-contiguous memory storage
CO4: compare different sorting techniques, hashing techniques for efficient utilization of data

Course Articulation Matrix (CAM):		**U24SE307 : Programming Skill Development Lab-2**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24SE307.1**	2	2	1	1	1	1	1	1	1	1	2	2	2
CO2	**U24SE307.2**	2	2	1	1	1	1	1	1	1	1	2	2	2
CO3	**U24SE307.3**	2	2	1	1	1	1	1	1	1	1	2	2	2
CO4	**U24SE307.4**	2	2	1	1	1	1	1	1	1	1	2	2	2
U24SE307		**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

PRACTICUM-3

Class: B.Tech. III –Semester	**Branch:** Common to all branches		
Course Code:	**U24EL309**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-4-4**	**CIE Marks (%):**	**100**
Total Number of Teaching Hours:	**-**	**ESE Marks (%):**	**-**

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: preparingwell-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:

- **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	U24MH301E	U24AI302	U24AI303	U24AI304	U24AI305	U24VA306B
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

- 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.

- 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 timetableand alsooutside 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 suggestfor addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicumreport 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 teacheras 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 anddefine 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):		**U24EL309: PRACTICUM-3**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24EL309.1**	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	**U24EL309.2**	2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	**U24EL309.3**	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	**U24EL309.4**	2	2	2	2	2	2	2	2	2	2	2	2	2
U24EL309		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

SOCIAL EMPOWERMENT ACTIVITY-3 / SELF ACCOMPLISHMENT ACTIVITY-3 (SEA-3 /SAA-3)

Class: B.Tech. III Semester	**Branch:** Common to all branches		
Course Code:	**U24VA309 (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):

This course will develop students' knowledge in /on…

LO1: holistic development through activity-based learning to gain real-life experiencewhicheffectively help individualsdeal 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 presentationthrough PPTs portraying knowledge, skills,qualitiesacquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) isintroduced 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 andsocial 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** (SelfAccomplishment 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.

(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.

Monitoring SEA/SAA:

(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: E**minent 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 interacteminent 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/presentationand 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 studentshall, identifiesminimum of4 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 makinga well-documented report and an effective oral presentationwith 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):		**U24VA309(SE/SA)ZZZ - Courses listed under SEA-3 /SAA-3**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VA309.1**	-	-	-	-	-	2	2	2	2	2	2	1	1
CO2	**U24VA309.2**	-	-	-	-	-	2	2	2	2	2	2	1	1
CO3	**U24VA309.3**	-	-	-	-	-	2	2	2	2	2	2	1	1
CO4	**U24VA309.4**	-	-	-	-	-	2	2	2	2	2	2	1	1
U24VA309		**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

Course Code: **U24VA309(SE/SA)ZZZ**
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:
Semester: 1 *SEA/SAA course serial number: 09* *SEA/SAA category: SEA* *course number: 302* The **course code** will be U24VA109SE302	*Semester: 4* *SEA/SAA course serial number: 10* *SEA/SAA category: SAA* *course number: 206* The **course code** will be U24VA410SA206

EXPERT TALK SERIES–3

Class: B.Tech. III -Semester	**Branch:** Common to all branches		
Course Code:	**U24AE310**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-1-1**	**CIE Marks (%):**	**100**
Total Number of Teaching Hours:	**-**	**ESE Marks (%):**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: 21st century skills needed for industry, current industry trends, challenges and innovations

LO2: latest technology in practice andapplying knowledge to solve real-world problems

LO3: smart work, soft skills, professional etiquette, networking abilities

LO4: making a well-documented reportportraying the knowledge, skills, qualities acquired and the impact of the learning

In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.

(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.

(b) Learning from industry experts with real-world examples,is important to enhance your educational experience.

(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.

(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".

But how would you know all this without venturing into the industry?

(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.

(f) Through Industry expert talks students get to know so much more that textbooks don't explain.

(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.

(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

(i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal 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 (*sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks*)	60 marks
Attendance (*out of 10 quizzes*)	20 marks
Report in prescribed format (*max 30% plagiarism*)	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.

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

ii. **Supplementary Exam:**

(i) Student has to register for ETS supplementary examination if he/she scores less than 40 marksin CIE

(ii) 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.

(iii) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE

(iv) 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…

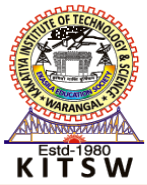
CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology

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):		**U24AE310 : EXPERT TALK SERIES-3**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AE310**.1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO2	**U24AE310**.2	1	1	1	1	1	1	2	1	2	1	2	1	1
CO3	**U24AE310**.3	1	1	1	1	1	1	2	1	2	1	2	1	1
CO4	**U24AE310**.4	1	1	1	1	1	1	2	1	2	1	2	1	1
U24AE310		**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														



KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
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Semester -IV Syllabi

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

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24AI401	Database Management Systems	2	1	2	5	10	4
2	PCC	U24AI402	Artificial Intelligence	2	1	-	5	8	3
3	PCC	U24AI403	Software Engineering	2	1	-	4	7	3
4	PCC	U24AI404	Computer Networks	2	1	-	4	7	3
5	PCC	U24AI405	Python Programming	2	1	2	5	10	4
6	VAC*	U24VA406A*	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	62	23
Summer/ Inter-semBridge 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*

*** VAC (Value Added Course):**

T&P Basket		
S. No.	Course Code	Course Title
1.	U24VA406A	Soft & Interpersonal
2.	U24VA406B	Qunatitative Aptitude and Logical Reasoning

DATABASE MANAGEMENT SYSTEMS

Class: B.Tech. IV -Semester		**Branch:** CSE (AI&ML)	
Course Code:	**U24AI401**	**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):

This course will develop students' knowledge in /on…

LO1: fundamental database concepts, including database architecture, the relational model, and SQL, while evaluating the roles of database users and systems, enforcing data constraints, and recognizing appropriate use cases for DBMS and NoSQL technologies using SQL

LO2: conceptual and enhanced entity-relationship models, apply specialization and generalization concepts, and map ER/EER diagrams to relational schemas

LO3: design and optimization of relational database schemas using normalization principles, functional dependencies, and relational query languages, while applying query processing and optimization techniques for efficient data retrieval

LO4: transaction processing concepts, concurrency control techniques, database recovery methods, and security measures to ensure efficient, reliable, and secure database management

THEORY COMPONENT

UNIT-I	**9 Hrs**

Databases and Database Users: Introduction, Characteristics of the database approach, Actors on the scene, Workers behind the scene, Advantages of using a DBMS

Database System Concepts and Architecture: Data models, Schemas and instances, Three-schema architecture and Data independence, Database languages, The database system environment, Classification of database management systems

The Relational Data Model, Relational Database Constraints: Relational model concepts, Relational constraints and the relational database schemas, Update operations, Dealing with constraint violations

Basic SQL: SQL data definition, Specifying constraints in SQL, Basic retrieval queries in SQL, Insert, Delete, and Updatestatements in SQL

Self Learning Topics (SLTs): *Database Principles (Reference 2: Chapter 1), Examples of Databases, When not to use a DBMS (Text1: Chapter 1), Database Interfaces (Text1: Chapter 2), UNIQUE and NOT NULL constraints (Text1: Chapter 5),NoSQL(Text1: Chapter 24), SQL commands (Text1: Chapters 1-2 & 5-6), Review questions, Exercises, SQL exercises, Interview Questions (Text1: Chapters 1-2 & 5-6)*

UNIT-II	**9 Hrs**

Data Modeling Using the Entity-Relationship Model: Using high-level conceptual data models for database design, Entity types, Attributes and keys, Relationships types, Roles and structural constraints, Weak entity types, ER diagrams

Enhanced Entity-Relationship: Specialization and generalization, Constraints and characteristics of specialization and generalization hierarchies, Modeling of union types using categories

Relational Database Design by ER and EER-to-Relational Mapping: Relational database design using ER-to-relational mapping, Mapping EER model constructs to relations

Self Learning Topics (SLTs): *Entity sets, Relationship sets (Text1: Chapter 3), Sub classes, Super classes and Inheritance (Text1: Chapter 4), Sample ER, EER diagrams(Text1: Chapters 3 & 4), Review Questions, ER, EER design Exercises, Interview Questions (Text1: Chapters 3 & 4)*

UNIT-III	**9 Hrs**

Database Design Theory and Normalization: Informal design guidelines for relation schemas, Functional dependencies, Normal Forms based on primary keys, General definitions of second and third normal forms, Boyce-Codd normal form, Algorithms for relational database schema design, Multivalued dependency and fourth normal form , Join dependencies and fifth normal form

The Relational Algebra and Relational Calculus: Examples of queries in relational algebra, The tuple relational calculus, The domain relational calculus

Query Processing and Optimization: Translating SQL queries into relational algebra, Using heuristics in query optimization

Self Learning Topics (SLTs): *Determining the Candidate Keys given the Functional Dependencies (Text1: Chapter 14), Basic relational Algebra Operations (Text1: Chapter 8), Solved problems, Review Questions, Exercises, Interview Questions (Text1: Chapters 8, 9, 14, 15 & 19)*

UNIT-IV	**9 Hrs**

Introduction to Transaction Processing Concepts and Theory: Introduction to transaction processing, Transaction and system concepts, Desirable properties of transactions, Characterizing schedulesbased on recoverability, Characterizing schedules based on serializability

Concurrency Control Techniques: Two-phase locking techniques for concurrency control, Concurrency control based on timestamp ordering

Database Recovery Techniques: Recovery concepts, NO-UNDO/REDO recovery based on deferred update, Recovery techniques based on immediate update, Shadow paging

Database Security and Authorization: Introduction to database security issues, Discretionary access control based on granting and revoking privileges, Mandatory access control and Role-based access control for multilevel security

Self Learning Topics (SLTs):*Concurrency Control (Text1: Chapter 21), Undo-Redo operations, Paging (Text1: Chapter 22), Access Control, Granting & Revoking Privileges (Text1: Chapter 30). Solved problems, Review questions, Exercises, Interview Questions (Text1: Chapter 20 to 22 & 30)*

LABORATORY COMPONENT

List of Experiments

1. Design and execute DDL and DCL commands in SQL.
2. Design and execute DML and TCL commands in SQL.
3. Design and execute SQL commands to implement Column level and table level constraints.
4. Design and execute SQL commands to implement Queries using built-in date, character, and number functions.
5. Design and execute SQL commands to implement Queries on aggregate functions.
6. Design and execute SQL commands to implement simple and complex index, sequences and views.

7. Design and execute SQL commands to implement Queries on joins and Nested Queries.
8. Design and execute PL/SQL programs to implement user-defined data types, conditional and iterative statements.
9. Design and execute PL/SQL programs to implement cursors, exceptions and triggers.
10. Design and execute PL/SQL programs to implement stored procedures and functions.
11. Implement Oracle TOAD to visually create, maintain, and document databases.
12. Design and execute DDL and DML commands in PSQL (Postgresql).

Text Book(s):

1. Ramez Elmasri and Shamkanth B. Navathe, *Fundamentals of Database Systems*, 6th ed., India: Pearson Education , 2010. *(Chapters 1-9, 14, 15, 19-22, 24, 30)*

Reference Book(s):

1. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, 3rd ed., Singapore: McGraw-Hill Education, 2002.
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, *Database System Concepts*, 3rd ed., New York: McGraw-Hill Education, 1997.
3. Thomas Connolly and Carolyn Begg, *Database Systems*, 3rd ed., England: Pearson Education, 2003.
4. Carlos Coronel, Stephen Morris, Peter Rob. *Database Principles: Fundamentals of Design, Implementation and Management*. 10th ed., Delhi: Cengage India Private Limited, 2014.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc22_cs91*NPTEL Video Lecture on Data Base Management System by Prof. ParthaPratim Das, Professor of CSE, IIT Kharagpur.*
2. https://onlinecourses.nptel.ac.in/noc25_cs40*NPTEL Video Lecture on Introduction to Database Systems by Prof. Sreenivasa Kumar, Professor of CSE, IIT Madras.*

Laboratory Manual (for laboratory component):

1. *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: apply core database concepts including database architecture, the relational model, and SQL, while understanding database user roles, enforcing data constraints, and evaluating the appropriate use of DBMS and NoSQL technologies

CO2: design high-level conceptual data models using ER and EER diagrams, translate these models into relational schemas, and apply ER-to-relational mapping techniques for effective relational database design

CO3: apply database design theory and normalization techniques to create efficient relational schemas, use relational algebra and calculus for query formulation, and implement query processing and optimization strategies to enhance database performance

CO4: apply transaction processing concepts, concurrency control techniques, recovery methods, and security measures to ensure the integrity, reliability, and security of database systems

(based on psychomotor skills acquired from laboratory component)

CO5: design and execute SQL commands including DDL, DCL, DML, TCL, and constraints to define structures, control access, manipulate data, manage transactions, and enforce data integrity in relational databases

CO6: design and execute SQL queries using built-in date, character, number, and aggregate functions, as well as various types of joins to retrieve and analyze data from relational databases

CO7: design and execute SQL and PL/SQL programs using nested queries, conditional and iterative control structures, and cursors to solve complex data processing tasks in relational databases

CO8: design and implement PL/SQL programs to handle exceptions, create stored procedures and functions, and execute DDL and DML commands using PostgreSQL for robust database application development

Course Articulation Matrix (CAM):		**U24AI401: DATABASE MANAGEMENT SYSTEMS**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AI401.1**	2	3	3	1	2	1	1	1	1	1	2	1	2
CO2	**U24AI401.2**	3	3	3	2	2	1	1	1	1	1	3	2	2
CO3	**U24AI401.3**	2	2	3	3	2	2	1	1	1	1	2	2	2
CO4	**U24AI401.4**	3	3	2	2	2	1	1	1	1	1	2	2	2
CO5	**U24AI401.5**	2	2	3	3	3	1	1	1	1	1	2	1	2
CO6	**U24AI401.6**	3	3	2	2	3	1	1	1	1	1	2	2	2
CO7	**U24AI401.7**	2	2	3	2	3	1	1	1	1	1	2	2	2
CO8	**U24AI401.8**	2	2	3	3	3	2	1	2	1	1	3	2	2
U24AI401		**2.375**	**2.5**	**2.75**	**2.25**	**2.5**	**1.25**	**1**	**1.12**	**1**	**1**	**2.25**	**1.75**	**2**

ARTIFICIAL INTELLIGENCE

Class: B.Tech. IV – Semester		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI402**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-5-8**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: agents, problem solving approaches and searching techniques
LO2: local search algorithms, constraint satisfaction problems and adversarial search algorithms
LO3: propositional logic syntax and semantics, first order logic, and automated planning
LO4: probabilistic reasoning, uncertainty quantification and robotics

UNIT-I	**9 Hrs**

Introduction: Introduction to AI, The foundations and history of AI

Intelligent Agents: Agents and environments, Nature of environments, Structure of agents

Problem Solving: Problem-solving agents, Example problems searching for solutions, Uninformed and informed search strategies, Heuristic functions

Self Learning Topics (SLTs): *Foundations of AI (Text1: Chapter 1.2), Risks and benefits of AI(Text1: Chapter 1.5),Concept of rationality(Text1: Chapter 2.2), Diagrams and pseudo code related to structure of agents (Text1: Chapter 2.4)*

UNIT-II	**9 Hrs**

Search in Complex Environments: Local search and optimization problems, Local search in continuous space, Searching in nondeterministic actions, Search in partially observable environments

Constraint Satisfaction Problems (CSP): Constraint propagation, Backtracking search for CSPs

Adversarial Search: Game theory, Optimal decision in games, Mini-max search procedure, Heuristic alpha-beta tree search

Self Learning Topics (SLTs): *Online search problems(Text1: Chapter 4.5.1),Inference in CSPs(Text1: Chapter 5.2), Examples on backtracking for CSPs (Text1: Chapter 5.3), Optimal decisions in multiplayer games(Text1: Chapter 6.2.2)*

UNIT-III	**9 Hrs**

Logical Agents: Knowledge based agents, Wumpus world, Propositional logic

First Order Logic (FOL): Syntax and semantics, Using FOL, Knowledge engineering, Inference in FOL, Forward chaining, Backward chaining, Resolution

Automated Planning: Definition, Algorithms for planning state space search, Planning graphs, Classical planning approaches, Heuristics for planning, Hierarchical planning, Planning in non deterministic domains, Time schedule and resources

Self Learning Topics (SLTs): *Logical connectives(Text1:Chapter 7.4.1), Inference and proofs (Text1: Chapter 7.5.1), Compare propositional and first order inference (Text1: Chapter 9.1), Example proofs of resolution(Text1: Chapter 9.5.3)*

UNIT-IV	9 Hrs

Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Bayes' Rule

Probabilistic Reasoning: Representing knowledge in an uncertain domain, The semantics of bayesian networks, Efficient representation of conditional distributions, Exact and approximate inference in bayesian networks, Probabilistic reasoning over time, Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman filters, Dynamic bayesian networks

Robotics: Robotic hardware, Robotic perception, Planning and control, Application domains

Case study: IBM Watson Health: Revolutionizing Patient Care with AI

Self Learning Topics (SLTs): *Summarizing uncertainty(Text1: Chapter 12.1.1),Case study: Car insurance(Text1: Chapter 13.2.4), A simple one-dimensional example of Kalman filter (Text1: Chapter 14.4.2), Robotics -applications domains (Text1: Chapter 26.10)*

Course Learning Outcomes (COs):

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

CO1: apply AI problem solving techniques for various engineering problems

CO2: apply search strategies including local search, CSP's and adversarial search to solve complex AI problems in deterministic, nondeterministic and partially observable environments

CO3: develop effective decision-making AI systems using first order logic and planning concepts

CO4: apply probabilistic reasoning for decision-making and demonstrate hardware and software concepts used in robotics

Text Book(s):

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed., New Delhi: Prentice Hall Series in AI, 2022. *(Chapters 1 to 9, 11, 12, 13, 14, 26)*

Reference Book(s):

1. Elaine rich and Kevin knight, *Artificial Intelligence*, 2nd ed., New Delhi: Tata McGraw-Hill, 2002.
2. Mark Stefik, *Introduction to Knowledge Systems*, 1st ed., San Francisco: Morgan Kaufman, 1995.
3. Winston, Patrick Henry, *Artificial Intelligence*, 3rd ed., California: Addison Wesley, 1995.
4. Dan W. Patterson, *Introduction to Artificial Intelligence and Expert Systems*, 2nd ed., New Delhi: Prentice Hall of India, 1997.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc25_cs07/preview, *NPTEL Video Lecture on Artificial Intelligence: Knowledge Representation And Reasoning by Prof. Deepak Khemani, IIT Madras.*

Course Articulation Matrix (CAM):		U24AI402 : ARTIFICIAL INTELLIGENCE											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24AI402.1	2	2	2	2	1	1	1	1	1	-	2	2	1
CO2	U24AI402.2	2	3	3	2	1	1	1	1	1	-	2	3	1
CO3	U24AI402.3	2	3	3	2	1	1	1	1	1	-	2	3	1
CO4	U24AI402.4	2	2	2	3	1	1	1	1	1	-	2	3	1
U24AI402		**2**	**2.5**	**2.5**	**2.25**	**1**	**1**	**1**	**1**	**1**	**-**	**2**	**2.75**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

SOFTWARE ENGINEERING

Class: B.Tech. IV -Semester		**Branch:** CSE (AI&ML)	
Course Code:	**U24AI403**	**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):

This course will develop students' knowledge in /on…

LO1: fundamental concepts of software and different types of software models
LO2: different types of design concepts and patterns
LO3: software design principles and test strategies
LO4: metrics for quality analysis of software and risk management

UNIT-I	**9 Hrs**

Software Engineering Concepts: The changing nature of software, Software application domains, Legacy software, Software myths, Software engineering layered technology, A process framework, The capability maturity model integration (CMMI), Agile software
Process Models -Prescriptive process models, RAD model, Specialized process models, Unified process model, Personal and team process models
Agile Development: Agility and the cost of change, Agile process, Extreme programming, Other agile process models
Software Engineering Practices: Communication principles, Planning principles, Modeling principles, Construction principles, Deployment principles

Self Learning Topics (SLTs): *Construction principles & deployment principles (Text1: Chapter 4.3.4)*

UNIT-II	**9 Hrs**

Requirements Engineering Tasks: Requirements analysis and modelling strategies, User requirement, System requirement, Software requirements document.
Requirements modelling: Case studies on scenario-based methods(Hospital management system and Airline reservation system)
Design Engineering: Design within the context of software engineering, Design process, Design concepts, The design model
Architectural Design: Software architecture, Architectural genres, Architectural styles, Architectural design, Assessing alternative architectural designs, Designing class based components, Conducting component level design, Design for WebApps, Designing traditional components

Self ***Learning Topics (SLTs):*** *Component-level design for webapps (Text1: Chapter 10.4)*

UNIT-III	**9 Hrs**

User Interface Design: The golden rules, User interface analysis and design, Interface analysis, Interface design steps, WebApp and mobile interface design
Testing Strategies: Software testing fundamentals, Test strategies for conventional software, Test strategies for object-oriented software, Validation testing, System testing, The art of Debugging, White box testing, Basis path testing, Control structure testing, Black box testing
Testing Web Applications: Testing concepts for webapps, The testing process, Content testing, User interface testing, Component-level testing, Navigation testing, Configuration testing, Security testing, Performance testing, Case studies on testing methods (Banking App – Security Testing, Online Education Platform – Load Testing and E-Commerce Website – Functional Testing)

Self Learning Topics (SLTs): Navigation testing*(Text1: Chapter 20.6)*

UNIT-IV	9 Hrs

Product Metrics: Measures, Metrics and indicators, Metrics for the requirements model, Metrics for the design model, Metrics for source code, Metrics for testing, Metrics for maintenance

Process and Project Metrics: Metrics in the process and project domains, Software measurement, Metrics for software quality, Integrating metrics within the software process, The W5HH principle project scheduling: Project scheduling, Scheduling for WebApps projects, Earned value analysis

Risk Management: Reactive versus Proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, RMMM plan

Self Learning Topics (SLTs): *Halstead Metrics, Proactive risk strategies, Software risks (Text1: Chapter 28.1,28.2)*

Course Learning Outcomes (COs):

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

CO1: design the appropriate software model for a given real time application
CO2: develop architectural designs and class based components for given software
CO3: apply an appropriate testing method for a given software
CO4: apply metrics to assess the quality of software and analyze the risk management in project scheduling

Text Book(s):

1. Roger S.Pressman and Bruce R.Maxim, *Software Engineering: A Practitioner's Approach*, 8th ed., New York: McGraw-Hill Education, 2019 (*Chapters* 1 to 5, 12, 13, 15, 22, 25, 30, 34 and 35)

Reference Book(s):

1. Ian Sommerville, *Software Engineering*, 10th ed., Boston: Pearson, 2016.
2. Deepak Jain, *Software Engineering: Principles and Practices*, 3rd ed., New Delhi: oxford, 2008.
3. Pankaj Jalote, *Software Engineering: A Precise Approach*, 1st ed., New Delhi: McGraw Hill Education, 2010.

Web and Video link(s):

1. https://archive.nptel.ac.in/courses/106/105/106105182, *NPTEL Video Lecture on Use case modelling by Prof. Rajib Mall,IIT Kharagpur.*

Course Articulation Matrix (CAM):		**U24AI403 : SOFTWARE ENGINEERING**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AI403.1**	1	1	1	1	-	-	-	1	1	1	2	2	1
CO2	**U24AI403.2**	1	1	1	1	-	-	-	1	1	1	2	1	1
CO3	**U24AI403.3**	2	2	1	1	-	1	1	1	1	1	2	2	1
CO4	**U24AI403.4**	2	2	2	1	-	1	1	1	1	1	2	2	1
U24AI403		**1.5**	**1.5**	**1.25**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**2**	**1.75**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

COMPUTER NETWORKS

Class: B.Tech. IV -Semester		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI404**	**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):

This course will develop students' knowledge in /on…

LO1: network reference models, physical layer components, data link and medium access control protocols

LO2: network Layer design, Various routing and Congestion control algorithms

LO3: internetworking, IPv5: addressing, routing and IPV6 & Transport Layer services, connection, error and flow control management and error handling

LO4: TCP and UDP services, error, congestion management; Application Layer: DNS, Mail, WWW, Streaming Audio and Video, Server Farms and Web Proxies, Content Delivery Networks, P2P Networks

UNIT-I	**9 Hrs**

Introduction: Network hardware, Network software. OSI reference model, TCP /IP reference model.

Physical Layer: Guided transmission media, Wireless transmission. Circuit and Packet switching.

Data Link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols. MAC sublayer**:** Channel allocation problem, ALOHA, Carriers sense multiple access, Collision free protocols, **IEEE standard 802**: Token bus, Token ring.

Ethernet: Switched Ethernet, Fast Ethernet, Gigabit Ethernet.

Data link layer switching: Repeaters, Hubs, Bridges, Switches, Routers, and Gateway, Virtual LANs.

Self Learning Topics (SLTs): *Model comparison (Text1, 1.4.5), A Critique of the OSI Model and Protocols (Text1, 1.5), Example Networks (Text1, 1.6), Network Standardization (Text1, 1.6), Virtual Local Area Networks (VLANs) (Text 2, 6.4.4), Data Center Networking (Text 2,6.6), 5G Cellular Networks: (Text 2,7.4.6)*

UNIT-II	**9 Hrs**

Network Layer: Network layer design issues, Routing algorithms - Optimality principle, shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, broadcast routing, Multicast routing, any cast routing.

Congestion Control Algorithms: Approaches to congestion control, Traffic aware routing, admission control, Traffic throttling, Load shedding.

Self Learning Topics (SLTs): *Comparison of Virtual-Circuit and Datagram Networks (Text1: Chapter 5.1.5), Integrated Services (Text1: Chapter 5.4.5), Differentiated Services (Text1: Chapter 5.4.6)*

UNIT-III	9 Hrs

Internetworking: How networks differ, how networks can be connected, Tunnelling, Internetwork routing.

Network Layer - The Internet: IP version 4 protocol, IP addresses, IP version 6 protocol, Internet control protocols, OSPF – Interior gateway routing protocol, BGP – Exterior gateway routing protocol.

Transport Layer: Transport services, Elements of transport protocols – Connection establishment and release, Error control and flow control.

Self-Learning Topics (SLTs): Packet Fragmentation (Text1, 5.5.5), Internet multicasting (Text1, 5.6.8), Internet Multicasting (Text1, 5.6.9), Mobile IP (Text1, 6.2.5), Multiplexing (Text1, 6.2.5), Crash Recovery (Text1, 6.2.6)

UNIT-IV	9 Hrs

Internet transport protocols – UDP: Remote procedure call, Real Time Transport Protocol

TCP: Service Model, Protocol, Sliding Window, Timer Management and Congestion Control

Application Layer: Domain name system (DNS), Electronic mail, World Wide Web, **Content Delivery**: Server Farms and Web Proxys, Streaming Live Media.

Self-Learning Topics (SLTs): Real-Time Conferencing (Text1, 7.4.5), Content Delivery Networks (Text1, 7.5.3), Peer-to-Peer Networks (Text1, 7.5.4), Internet Video (Text 2,2.6.1), HTTP Streaming and DASH (Text 2,2.6.2), Content Distribution Networks (Text 2,2.6.3), Case Studies: Netflix and YouTube (Text 2,2.6.4)

Course Learning Outcomes (COs):

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

CO1: analyze the functionalities of the OSI and TCP/IP models, evaluate transmission media and switching techniques, and explain data link layer protocols, MAC mechanisms, Ethernet technologies, and the role of networking devices in LAN switching

CO2: analyze network layer design concepts and apply suitable routing and congestion control algorithms for optimal data transfer in computer networks

CO3: explain internetworking techniques and Internet protocols (IPv4, IPv6), and analyze routing protocols and transport layer services for reliable end-to-end communication

CO4: compare the functionalities of UDP and TCP protocols, and evaluate application layer services such as DNS, email, web access, and content delivery systems

Text Book(s):

1. Andrew S. Tannenbaum, David J. Wetherall, *Computer Networks'*, 5th ed., London: Pearson Education, 2011.
2. James F. Kurose and Keith W. Ross, *Computer Networking A Top-Down Approach*, 6th ed. London: Pearson Education, 2013.

Reference Book(s):

1. William Stallings, *Data and Computer Communications*, 10th ed., London: Pearson Education, 2014
2. Behrouz Forouzan, *Data Communication and Networking*, 5th ed., New York: Tata McGraw Hill, 2012.
3. Larry Peterson, Bruce S Davie, *Computer Networks*, 5th ed., New York: Elsevier Inc., 2011

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc25_cs15/preview *NPTEL Video Lecture on Computer Networks and Internet Protocol, By Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty, IIT Kharagpur.*

Course Articulation Matrix (CAM):		**U24AI404 : 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**	**PSO 1**	**PSO 2**
CO1	**U24AI404.1**	2	2	2	1	-	-	1	1	1	-	1	1	1
CO2	**U24AI404.2**	2	2	2	1	-	-	1	1	1	-	1	1	1
CO3	**U24AI404.3**	2	2	2	1	-	-	1	1	1	-	1	2	1
CO4	**U24AI404.4**	2	2	2	1	-	-	1	1	1	-	1	2	1
U24AI404.1		**2**	**2**	**2**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**1.5**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

PYTHON PROGRAMMING

Class: B.Tech. IV -Semester		**Branch:** CSE (AI&ML)	
Course Code:	**U24AI405**	**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):

This course will develop students' knowledge in /on…

LO1: basics of python programming, operators, control statements & functions in python

LO2: namespaces, modules, collections, string handling methods & regular expressions

LO3: object oriented programming, inheritance, polymorphism, files, threads & database connectivity using SQLite

LO4: Numpy, pandas and matplotlib libraries of python

THEORY COMPONENT

UNIT-I	**9 Hrs**

Introduction: 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 continue statement, the pass statement, the else statement used with loops

Functions: Function definition, Function call, Variable scope and lifetime, the return statement, Advances in defining in functions, Lambda functions, Recursive functions

Self Learning Topics (SLTs): *More on Defining Functions (Text1: Chapter 5)*

UNIT-II	**9 Hrs**

Modules and Name Spaces: The from…import statement, Naming module, the dir() function, Packages in python, Standard library modules, globals(), locals(), and reload(), Function redefinition

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, Sets, Dictionaries

Self Learning Topics (SLTs): *List Comprehension and Tuples, Variable-length Argument Tuples, The zip() Function (Text1: Chapter 8)*

UNIT-III	**9 Hrs**

Python Object Oriented Programming: Classes and objects, Class method and self-argument, The __init__() method, Class variables and object variables, The __del__() method, Public and private data members, Private methods, Calling a class method from another class method, Built-in class attributes, Class methods, Static methods, Inheritance and polymorphism

Operator overloading: Advantage of operator overloading, Implementing operator overloading

Error and Exception handling: Introduction to errors and exceptions, Handling exceptions, Multiple except blocks, Built-in and user-defined exceptions, The finally block

File Handling: Opening and closing files, Reading and writing files, File positions, Renaming and deleting files, Directory methods

Threads: An introduction to python threading, Multithreading in python

Database Connectivity: SQLite, Creating a database table, Insert and retrieve data from database

Self Learning Topics (SLTs): *Abstract classes and interfaces, Garbage Collection (Text1: Chapter 9), Multiple Exceptions in a Single Block, Serialization, Database browser for SQLite (Text1: Chapter 12).*

UNIT-IV	9 Hrs

NumPy: The basics of NumPy arrays, Array indexing, Array slicing, Reshaping of array, Concatenation and splitting arrays, Introducing UFuncs

Data Manipulation with Pandas: Installing and using pandas, Introducing Pandas objects, data indexing and selection, Handling missing data, Combining datasets, Merge and join, Aggregation and grouping

Visualization with Matplotlib: Importing matplotlib, Saving figures to files, Simple line plots, Simple scatter plots, Histograms, Binnings, and density

Self Learning Topics (SLTs): *Plotting data on maps, Python advanced libraries introduction: Scikit-learn, Seaborn, SciPy.*

LABORATORY COMPONENT

List of Experiments

Experiment-I:

1. Installation of Python and verifying PATH environment variable
2. Running instructions in Interactive interpreter and a python script
    a. Executing instructions in Python Interactive Interpreter
    b. Running python scripts in Command Prompt
    c. Running python scripts in IDLE
3. Write a program to demonstrate importance of indentations. Purposefully raise indentation error and correct it
4. Write a program to take input text as command line argument and display it on screen

Experiment-II

1. Write a program that takes 2 numbers as command line arguments and print its sum
2. Write a program to check whether the given number is even or odd
3. Write a program to calculate GCD of 2 numbers
4. Write a program to find Exponentiation (Power) of a number
5. Write a program to find given year is leap year or not
6. Write a program to develop a simple calculator

Experiment-III

1. Write a program to find the Factorial of a given number
2. Write a program to evaluate the Fibonacci series for a given number 'n'
3. Write a program to find the Armstrong for a given number
4. Write a program to find sum of N numbers
5. Write a program to take a number as input, and print countdown from that number to zero (use while loop)
6. Write a program to find circulating 'n' values

Experiment-IV

1. Write a program to implement a module using import statement (Use python source file as a Module and implement import statement another python source files)
2. Write a program to implement from, import statement
3. Write a program to implement dir() function
4. Write a program to demonstrate packages in python

Experiment-V

1. Write a python program on strings for the following
    a. To display substring in a string

b. To update an existing string
c. To implement string concatenation
d. To demonstrate string formatting operator

Experiment-VI

1. Write a program to demonstrate use of slicing in strings
2. Write a program to compare two strings
3. Write a program which prints the reverse of a given input string. (use a function with name
4. Reverse string and call this function for performing the operation)
5. To demonstrate built-in string methods
6. Write a program to demonstrate list and related functions

Experiment-VII

1. Write a program to demonstrate tuple, set and related functions
2. Write a program to demonstrate dictionaries
3. Write a program to demonstrate RegEx functions
4. Write a program to demonstrate regular expressions using Meta characters

Experiment-VIII

1. Write python program for the following
   a. To demonstrate classes and objects
   b. To demonstrate class method and static method
   c. To demonstrate inheritance
2. Write python program on file operations for the following
   a. To open and read data from a file
   b. To write data into a file
   c. To compute number of characters, words, lines in a file

Experiment-IX

1. Write python programs to implement database connectivity
   a. Install and verify SQLite Connector for Python
   b. To connect check SQLite Database connectivity
   c. To retrieve and display data from a table
   d. To insert data into a table
   e. To delete rows in a table

Experiment-X

1. Install and setup NumPy environment
2. Write a program to demonstrate NumPy array
3. Write a program to demonstrate Slice operation
4. Write a program to demonstrate Reshaping of an array

Experiment-XI

1. Install and setup pandas environment
2. Write a python pandas program to create a series from an ndarray
3. Write a python pandas program to demonstrate indexing and selecting data

Experiment-XII

1. Install and setup matplotlib
2. Write a program to draw a simple line plot
3. Write a program to draw a histogram plot
4. Customize plots and experiment with different maps plots

Text Book(s):

1. Reema Thareja, *Python Programming using problem solving approach*, 1st ed., New Delhi: Oxford University Press, 2017. *(Chapter 1 to 7)*
2. Jake VanderPlas, *Python Data Science Handbook- Essential Tools for Working with Data*, 1st ed., California: O'Reilly Media Inc., 2016. (*Chapter 2 to 4*)

Reference Book(s):

1. Dr.Charles R. Severance, *Python for Everybody-Exploring Data Using Python*, 1st ed., USA: open book, 2016
2. David Beazley, *Python Cookbook*, 3rd ed., California: O'Reilly Media, Inc., 2013
3. Caleb Hattingh, *20 Python Libraries You Aren't Using (But Should)*, 2nd ed., California: O'Reilly Media Inc., 2016
4. Magnus Lie Hetland, *Beginning: from Novice to Professional*, 3rd ed., New York City: A press, 2005

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc23_cs99/ *NPTEL Video Lecture on Python For Data Science by By Prof. Ragunathan Rengasamy, IIT Madras.*
2. https://onlinecourses.nptel.ac.in/noc25_cs17 *NPTEL Video Lecture on Data Analytics with Python By Prof. A Ramesh, IIT Roorkee.*
3. https://onlinecourses.nptel.ac.in/noc25_cs69/ *NPTEL Video Lecture on The Joy of Computing using Python By Prof. Sudarshan Iyengar , 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: apply python syntax, control structures, operators, and functions to develop structured programs to solve basic problems

CO2: develop modular python programs using strings, regular expressions, built-in collections, and namespaces for efficient data handling

CO3: develop python applications using object-oriented principles, exception handling, file operations, operator overloading, threads and database connectivity

CO4: analyze and visualize data using python libraries such as NumPy, pandas, and Matplotlib for data science applications

(based on psychomotor skills acquired from laboratory component)

CO5: develop and test python programs by applying operators, control structures, and user-defined functions to address basic computational problems

CO6: demonstrate the use of namespaces, packages, string handling functions, regular expressions, and built-in data structures to develop optimized python programs

CO7: develop and test object-oriented programs by creating custom classes, manipulating objects, handling files, threads and executing database operations in python

CO8: design visual representations of data using Matplotlib and experiment with Numpy and pandas libraries to analyze datasets programmatically

Course Articulation Matrix (CAM):		U24AI405: 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	PSO 1	PSO 2
CO1	U24AI405.1	1	2	2	2	2	1	-	1	1	1	1	2	2
CO2	U24AI405.2	2	2	2	2	2	1	-	1	1	1	1	2	2
CO3	U24AI405.3	2	2	2	2	3	1	-	1	1	1	1	2	2
CO4	U24AI405.4	2	2	2	2	3	1	-	1	1	1	1	2	2
CO5	U24AI405.5	1	2	2	2	2	1	1	1	1	1	2	2	2
CO6	U24AI405.6	2	2	2	2	2	1	1	1	1	1	2	2	2
CO7	U24AI405.7	2	2	2	2	3	1	1	1	1	1	2	2	2
CO8	U24AI405.8	2	2	2	2	3	1	1	1	1	1	2	2	2
U24AI405		**1.75**	**2**	**2**	**2**	**2.5**	**1**	**1**	**1**	**1**	**1**	**1.5**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

QUANTITATIVE APTITUDE AND LOGICAL REASONING

Class: B.Tech. IV-Semester		**Branch:** Common to all Branches	
Course Code:	**U24VA406A**	**Credits:**	**2**
Hours/Week (L-T-P-O-E):	**2-0-0-2-4**	**CIE**	**60 %**
Total Number of Teaching Hours:	**48 Hrs**	**ESE**	**40 %**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: quantitative aptitude & problem-solving skills

LO2: computation of abstract quantitative information

LO3: application of basic mathematics skills & critical thinking to draw conclusions

LO4: evaluation of validity & possible biases in arguments presented in authentic contexts

UNIT-I	**12 Hrs**

Quantitative Aptitude-I: Number system, Averages, Percentages, Ratios & proportions, Time, Speed & distance, Time and work

UNIT-II	**12 Hrs**

Quantitative Aptitude-II: Simple interest, Compound interest, Profit & loss, Ages, Permutations & Combinations, Probability

UNIT-III	**12 Hrs**

Logical Reasoning-I: Series completion, Analogy, Coding and decoding, Blood relations, Number, Ranking & Time sequence test, Linear & Circular arrangements

UNIT-IV	**12 Hrs**

Logical Reasoning-II: Data sufficiency, Logical Venn diagram, Syllogisms, Statement & Arguments, Statement & Assumptions, Direction sense test

Course Learning Outcomes (COs):

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

CO1: apply arithmetic concepts such as averages, percentages, ratios, and time-based calculations to solve real-life quantitative problems

CO2: analyze and solve problems involving financial, arithmetic and probability using structured quantitative methods

CO3: identify patterns and apply deductive reasoning to solve series, coding-decoding, and arrangement-based logical problems

CO4: evaluate logical statements, assess validity, and draw conclusions using tools like syllogisms, Venn diagrams, and argument analysis

Note: Students should go through the QALR course supplementary material made available on online learning platform

- *Contents covered in class shall be practiced through the material available on the online learning platform. At home practice problems and practice tests shall be made available on the online learning platform*
- *Tutorial classes shall be conducted on the online learning platform and hence students shall attend the tutorial classes with laptop/tab*
- *All assessments shall be conducted through online learning platform*

Text Book(s):

1. R S Agarwal, *Quantitative Aptitude for Competitive Examinations*, 3rd ed. New Delhi: S. Chand Publications, 2019. *(Chapters 1,6,7,8,10,11,12,15,17,21,22,30,31 - for Unit I & II)*
2. R S Agarwal, *A Modern Approach to Verbal and Non-Verbal Reasoning*, 3rd ed. New Delhi: S. Chand Publications, 2019. *(Chapters Section I: 1,3,4,5,6,8,16, Section II: 2,3 - for Unit III & IV)*

Reference Book(s):

1. Dinesh Khattar, *Quantitative Aptitude for Competitive Examinations*, 1st ed., New Delhi: Pearson India, 2019.
2. Nishit K Sinha, *Reasoning for Competitive Examinations*, 1st ed., New Delhi: Pearson India, 2019.
3. R.N.Thakur , *General Intelligence and Reasoning*, 1st ed., New Delhi: McGraw Hill Education, 2017.

Course Articulation Matrix (CAM):		**U24VA406A QUANTITATIVE APTITUDE & LOGICAL REASONING**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VA406A.1**	1	2	-	1	-	-	-	-	-	-	1	1	-
CO2	**U24VA406A.2**	1	2	-	1	-	-	-	-	-	-	1	1	-
CO3	**U24VA406A.3**	-	1	-	2	-	2	-	-	-	-	1	1	-
CO4	**U24VA406A.4**	-	1	-	2	-	2	-	-	-	-	1	1	-
U24VA406A		**1**	**1.5**	**-**	**1.5**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

PROGRAMMING SKILL DEVELOPMENT LAB-3

Class: B.Tech. IV -Semester		**Branch:** CSE (AI & ML)	
Course Code:	**U24SE407**	**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: basic java implementation that demonstrates the use of data types, type casting, arrays, and class concepts
LO2: classes, methods and strings
LO3: types of inheritance, dynamic method dispatch, interface and packages
LO4: streams (I/O), exception handling and mutli-threading

LABORATORY COMPONENT

S. No.	List of Experiments
1.	a) Develop a Java program using a class named Arithmetic. Read two numbers from the command line arguments and perform all basic arithmetic operations: addition, subtraction, multiplication, division, and modulus. Use separate methods for each operation: add() for addition, sub() for subtraction, mul() for multiplication, div() for division, mod() for modulus. b) Develop a Java program using a class named Matrix to perform the multiplication of two matrices. The matrix values should be read from the keyboard. The program should: i. Read two matrices (of user-defined size) from the keyboard. ii. In the Matrix class, implement a method mul() to multiply two matrices. iii. Before performing multiplication, check whether the multiplication condition is satisfied (i.e., the number of columns in the first matrix must be equal to the number of rows in the second matrix). iv. If the condition is satisfied, compute and display the product of the two matrices. v. Otherwise, display a message indicating that matrix multiplication is not possible with the given matrix dimensions. c) Develop a Java program to demonstrate wrapper class by read five numbers using command line arguments and print the prime numbers from the given numbers.
2.	a) Develop a Java program to recursively linearly search an element in an array. b) Develop a Java program to interchange elements of first and last in a matrix across rows and interchange elements of first and last in a matrix across columns. **Note:** Read the first matrix from user input for the second program take the first program output as input. c) Develop a Java program to implement a seating reservation system using a 2D array in Java. **Hint:** A cinema hall has a fixed number of rows and columns of seats. A 5x5 array represents the seating arrangement (1 for booked, 0 for available). Users can select seats, and the program should update availability.
3.	a) Develop a Java program to determine whether two strings are anagram or not. b) Develop a Java program to simulate an ATM Application. The application should include the following functionalities: like 1) Withdraw 2) Deposit 3) Check balance 4) Exit.

	The program should allow the user to choose an option from a menu and perform the corresponding operation. Proper validations (like checking for sufficient balance during withdrawal) should be implemented
4.	a) Develop a Java program to find all the permutations of a string. Hint: Permutations of "abc": abc acb bac bca cab cba. b) Develop a Java program to find the largest and smallest word in a string based on the length of the word. c) Develop a Java program to find the duplicate words in a string.
5.	a) Develop a Java function to split the string using a string tokenizer using following scenario. A CSV file contains the following line: "John,Doe,35,New York, Software Engineer" You need to extract and print: First Name Last Name Age City Job Title. b) Develop a Java program based on following scenario. A user types "I love Java" but wants to insert "programming" between "love" and "Java", making it: "I love programming Java".
6.	a) Develop a Java program that design a class Employee with multiple ways to initialize it. One constructor takes an employee ID and name, while another takes an employee ID, name, and salary. Based on above data implement constructor overloading in Java. b) Develop a Java program by writing an overridden getNumberOfTeamMembers method that prints the same statement as the super class getNumberOfTeamMembers method, except that it replaces with (the number of players on a Soccer team). **Output Format** When executed, your completed code should print the following: **Generic Sports** Each team has n players in Generic Sports **Soccer Class** Each team has 11 players in Soccer Class
7.	a) Develop a Java program that a bank has different types of accounts. A Savings Account is a specialized type of **Bank Account** that has additional features like interest calculation.

		We implement this scenario using single inheritance where SavingsAccount inherits from Bank Account. Bank Account (Parent Class): **Hint:** Holds account details and common operations (deposit, withdraw, display Account Details). Savings Account (Child Class, Single Inheritance): Inherits Bank Account properties and methods. Adds a new method addInterest() to calculate interest. Main Class (Bank Application): Creates a Savings Account object, performs operations, and displays details b) Develop a Java program that design a payment gateway system that supports multiple payment methods such as Credit Card and UPI. Define an interface Payment with a method processPayment(double amount). Implement two classes: **CreditCardPayment** that implements processPayment() and displays "Processing credit card payment of $" + amount. **UPIPayment** that implements processPayment() and displays "Processing UPI payment of $" + amount. In the main() method, accept a payment method and amount from the user and process the payment accordingly.
8.		a) Develop a java program to demonstrate on a hierarchy of classes representing different types of animals: Animal, Dog, and Cat. Animal has a method called makeSound(). Dog and Cat override this method to provide their specific sounds. b) Develop a java program to demonstrate the scenario which involves implementing a Notification System where different services (Email, SMS, Push) send messages using a common interface, Notifier, with the method void send(String message), and a method that accepts any Notifier to send a notification. c) Develop a java program to demonstrate the scenario demonstrates the Strategy Pattern using interfaces by defining a SortStrategy interface with a void sort(int[] arr) method, and implementing different sorting algorithms like BubbleSort, QuickSort, and MergeSort, allowing the user to choose and apply a sorting strategy at runtime.
9.		a) Develop a java program based on the following scenario You are working on an e-commerce website where an order processing system runs in the background while users continue shopping. How will you ensure the background process does not affect user experience? **Hint:** Use ScheduledExecutorService for this task. b) Develop a java program to demonstrate the scenario involves building a modularized Library Management System in Java by organizing the application into packages—library.books, library.users, and library.transactions—each containing relevant classes like Book, User, and IssueTransaction, with a Main class in the library.main package to manage the overall system.

10.	a) Develop a java program based on the scenario 'Payment Gateway Exception Handling' that you are integrating a payment gateway for an e-commerce website. Sometimes, payments fail due to network issues or incorrect card details. How will you handle these exceptions gracefully? Write code for failed transactions. Write code for the users are notified properly. b) Develop a java program demonstrate on 'you are tasked with creating a program that processes two numbers input by the user prompt the user has to enter two numbers: numerator and denominator and validate the inputs like if the user enters non-numeric values, the program should handle it gracefully and Perform the division and display the result. Handle the following exceptions: InputMismatchException if non-integer values are entered. ArithmeticException if the denominator is zero. Any other Exception that might occur unexpectedly.
11.	a) Develop a java program based on the following scenario Reading from a File You are developing a program that reads a list of students' names from a file called students.txt and displays them on the console. How would you handle file reading exceptions? What happens if the file does not exist? b) Develop a java program based on the following scenario Scenario: Student Management System you can create a package called student containing a Student class, and another package main containing the Main class to use the Student class.
12.	a) Develop a java program based on the following **Scenario**: Implementing a Producer-Consumer System **Problem Statement:** You are tasked with implementing a producer-consumer system where multiple producer threads generate data and place it into a shared buffer, and multiple consumer threads process the data from the buffer. The system should ensure that the buffer has a fixed size and can hold a limited number of items,producers should wait if the buffer is full, consumers should wait if the buffer is empty and the system should handle synchronization to prevent race conditions. b) Develop a java program based on the following **scenario**: Managing a Shared Resource **Problem Statement:** You are tasked with implementing a system where multiple threads represent users accessing a shared printer. The printer can only handle one user at a time, and each user requires a random amount of time to print a document. Your goal is to ensure that only one user can access the printer at any given time, users should wait if the printer is currently in use and once a user finishes printing, another waiting user should be allowed to use the printer.

Text Book(s):

1. Herbert Schildt, *Java The Complete Reference*, 13th ed., New Delhi: McGraw-Hill Education, 2019.
2. Harvey Deitel, Paul J. Deitel, *Java How to Program,* 11th ed., New Delhi: Pearson Publications, 2018.
3. KathySierra, BertBates, *Head First Java*, 2nd ed., Boston: O'Reilly Publications, 2005.

Reference Book(s):

1. Uttam K. Roy, *Advanced JAVA Programming*, 1st ed., England: Oxford Publications,2013
2. Balaguruswamy, *Programming with Java: A Primer*, 7th ed., New Delhi: McGraw-Hill Education India Pvt. Ltd., 2019.
3. TanweerAlam, *Internet and Java Programming*, 1st ed., New Delhi: Khanna Publishing House, 2010.

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 and test various java programming paradigms and java fundamental programs

CO2: develop and test java programs using classes, constructors and various string concepts

CO3: analyze how reusability concepts such as inheritance, interfaces, and packages are utilized in building efficient, maintainable java programs

CO4: develop and test java programs using streams (Input/output), exception handling and multithreading concepts

Course Articulation Matrix (CAM):		**U24SE407 : PROGRAMMING SKILL DEVELOPMENT LAB-3**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24SE407.1**	2	2	1	1	1	-	1	1	1	1	1	2	2
CO2	**U24SE407.2**	2	2	1	1	1	-	1	1	1	1	1	2	2
CO3	**U24SE407.3**	2	2	1	1	1	-	1	1	1	1	1	2	2
CO4	**U24SE407.4**	2	2	1	1	1	-	1	1	1	1	1	2	2
U24SE407		**2**	**2**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**2**	**2**

PRACTICUM-4

Class: B.Tech. IV -Semester	**Branch:** Common to all branches		
Course Code:	**U24EL409**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-4-4**	**CIE Marks (%):**	**100**
Total Number of Teaching Hours:	**-**	**ESE Marks (%):**	**-**

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: preparingwell-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:

- **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	U24AI401	U24AI402	U24AI403	U24AI404	U24AI405	U24VA406A
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

- 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.
- 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.	ll number of the student	Practicum topic Allotted	acticum 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 timetableand alsooutside 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 suggestfor addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicumreport 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 teacheras 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:

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 anddefine 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):		**U24EL409 : PRACTICUM-4**													
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 2**
CO1	**U24EL409.1**	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	**U24EL409.2**	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	**U24EL409.3**	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	**U24EL409.4**	2	2	2	2	2	2	2	2	2	2	2	2	2	2
U24EL409		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW															

SOCIAL EMPOWERMENT ACTIVITY-4 / SELF ACCOMPLISHMENT ACTIVITY-4 (SEA-4 /SAA-4)

Class: B.Tech. IV Semester	**Branch:** Common to all branches		
Course Code:	**U24VA409(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):

This course will develop students' knowledge in /on…

LO1: holistic development through activity-based learning to gain real-life experiencewhicheffectively help individualsdeal 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 presentationthrough PPTs portraying knowledge, skills,qualitiesacquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) isintroduced 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 andsocial 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** (SelfAccomplishment 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.

(f) Each SEA/SAA activity is treated as one credit course

(g) Student must select one activity per semester,through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester.

(h) Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA

(i) To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc.,

(j) 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.

Monitoring SEA/SAA:

(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: E**minent 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.

i. **For appointment to interacteminent personalities**: Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction

ii. On fieldwork, student is expected to demonstrate solid time management, organisational and note taking skills during fieldwork

iii. **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

iv. Student is expected to take care of health and Safety practices for fieldwork and travel

v. 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.

vi. 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.

vii. **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/presentationand 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 studentshall, identifiesminimum of4 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 makinga well-documented report and an effective oral presentationwith 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):		**U24VA409(SE/SA)ZZZ - Courses listed under SEA/ SAA - 4**												
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	**U24VA409.1**	-	-	-	-	-	2	2	2	2	2	2	2	1	1
CO2	**U24VA409.2**	-	-	-	-	-	2	2	2	2	2	2	2	1	1
CO3	**U24VA409.3**	-	-	-	-	-	2	2	2	2	2	2	2	1	1
CO4	**U24VA409.4**	-	-	-	-	-	2	2	2	2	2	2	2	1	1
U24VA409		-	-	-	-	-	2	2	2	2	2	2	2	1	-
3 – HIGH, 2 – MEDIUM, 1 – LOW															

Course Code: **U24VA409(SE/SA)ZZZ**

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:
Semester: 1 *SEA/SAA course serial number: 09* *SEA/SAA category: SEA* *course number: 302* The **course code** will be U24VA109SE302	*Semester: 4* *SEA/SAA course serial number: 10* *SEA/SAA category: SAA* *course number: 206* The **course code** will be U24VA410SA206

EXPERT TALK SERIES – 4

Class: B.Tech. IV -Semester	**Branch:** Common to all branches		
Course Code:	**U24AE410**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-1-1**	**CIE Marks (%):**	**100**
Total Number of Teaching Hours:	**-**	**ESE Marks (%):**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: 21st century skills needed for industry, current industry trends, challenges and innovations

LO2: latest technology in practice andapplying knowledge to solve real-world problems

LO3: smart work, soft skills, professional etiquette, networking abilities

LO4: making a well-documented reportportraying the knowledge, skills, qualities acquired and the impact of the learning

In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.

(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.

(b) Learning from industry experts with real-world examples,is important to enhance your educational experience.

(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.

(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".

But how would you know all this without venturing into the industry?

(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.

(b) Through Industry expert talks students get to know so much more that textbooks don't explain.

(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.

(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

(e) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal 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 (*sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks*)	60 marks
Attendance (*out of 10 quizzes*)	20 marks
Report in prescribed format (*max 30% plagiarism*)	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.

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

ii. Supplementary Exam:

(i) Student has to register for ETS supplementary examination if he/she scores less than 40 marksin CIE

(ii) 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.

(iii) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE

(iv) 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):		**U24AE410 EXPERT TALK SERIES - 4**												
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	**U24AE410**.1	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO2	**U24AE410**.2	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO3	**U24AE410**.3	1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO4	**U24AE410**.4	1	1	1	1	1	1	1	2	1	2	1	2	1	1
U24AE410		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW															

ENVIRONMENTAL STUDIES

Class:B.Tech. IV Semester		**Branch:** Common to ME, CSM, CSD, IT, CSN & CSO	
CourseCode:	**U24CY411**	**Credits:**	**0**
Hours/Week(L-T-P-O-E):	**2-0-0-5-7**	**CIE:**	**60%**
Total Number of Teaching Hours:	**24Hrs**	**ESE:**	**40%**

CourseLearningObjectives(LOs):

This course will develop students' knowledge in/on…

LO1: natural resources and their usage more equitably

LO2: ecosystem and the importance of biodiversity conservation

LO3: environmental pollution and it'scontrol measures

LO4: environmental legislation and green methodology

UNIT-I	**6Hrs**

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and importance

Natural Resources: Forest Resources-Use and overexploitation 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): *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)*

UNIT-II	**6Hrs**

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): *Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)*

UNIT-III	**6Hrs**

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): *Role of individual in prevention of pollution (Text1: unit 5, topic 5.10)*

UNIT-IV	6Hrs

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

SelfLearningTopics(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 legislationand green methodology

Text Book(s):

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

Reference Book(s):

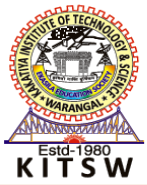
1. Y. Anjaneyulu, *Introduction to Environmental Science*, B.S. Publications, 2004.
2. Gilbert M. Masters, *Introduction to Environmental Engineering & Science*, 3rd Ed., Prentice Hall of India,1991
3. Anubha Kaushik, C.P. Kaushik, *Environmental Studies*, 4th Ed., New Age International Publishers, 2014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

CourseArticulationMatrix(CAM):				U24CY411 : ENVIRONMENTAL STUDIES										
CO		PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CY411.1	2	1	2	1	-	2	1	1	1	1	1	1	1
CO2	U24CY411.2	-	-	2	-	-	2	1	1	1	1	1	1	1
CO3	U24CY411.3	1	2	1	-	-	1	1	1	1	1	1	1	1
CO4	U24CY411.4	-	-	1	-	-	2	1	1	1	1	1	1	1
U24CY411		1.50	1.50	1.50	1	-	1.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00

ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2020 Rank Band: 201-250



KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
website: www.kitsw.ac.in E-mail: principal@kitsw.ac.in ✆ : +91 9392055211, +91 7382564888

Semester -IV Exit Option Syllabi

Bridge Courses for exit:

Successful completion of twosubjects (6-Credits)during 2-months internship at the institute

OR

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

B. After Second Year: (UG Diploma in CSE (AI & ML))

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

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

Exit Option to Qualify UG Diploma in CSE (AI & ML): Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24AI412X	Machine Learning	2	-	2	-	4	3
2	PCC	U24AI413X	Computer Vision and Image Processing	2	-	2	-	4	3
3	PCC	U24AI414X	Data Warehousing and Data Mining	2	-	2	-	4	3
4	PCC	U24AI415X	Web Technologies	2	-	2	-	4	3
5	PCC	U24AI416X	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 (AI & ML): 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/noc19_cs58/preview	-	-	6	-	6	3
3	SEC	U24SE419X	R Programming for Data Analytics Reference: https://onlinecourses.nptel.ac.in/noc19_ma33/preview	-	-	6	-	6	3

Exit Option to Qualify UG Diploma in in CSE (AI & ML): Any Two (02) Skill based Courses -:									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
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/noc22_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.

MACHINE LEARNING

Class: B.Tech. IV – Semester (Exit Course)		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI412X**	**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):

This course will develop students' knowledge in /on…

LO1: machine learning fundamentals, concept learning and **g**eneral-to-specific ordering of hypotheses

LO2: classification, regression and probabilistic learning

LO3: architectures like ANN, multi-layer feed forward and back propagation networks, unsupervised learning

LO4: decision making by ensemble learning, reinforcement learning

THEORY COMPONENT

UNIT-I	**4 Hrs**

Introduction to Machine Learning: Examples of various learning paradigms, Designing a learning system, Perspectives and issues in machine learning, Model evaluation metrics

Concept Learning: Introduction, A concept learning task- inductive learning hypothesis, Concept learning as search- general-to-specific ordering of hypotheses, Find-S- finding a maximally specific hypothesis, Version spaces and the candidate - elimination learning algorithms

UNIT-II	**4 Hrs**

Supervised Learning: Learning a class from examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision trees: ID3, Classification and regression trees (CART), **Regression:** Linear regression and logistic regression, Support vector machines: Linear and non- linear, Kernel functions, K-nearest neighbors, Naïve bayes classifier

UNIT-III	**4 Hrs**

Artificial Neural Networks: Introduction, Neural network representations, Appropriate problems for neural network learning, Perceptron, Multilayer networks and the back propagation algorithm

Unsupervised Learning: Introduction to clustering, Partitional: K-means clustering, Dimensionality reduction- Principal components analysis (PCA)

UNIT-IV	**4 Hrs**

Ensemble Learning: Boosting – AdaBoost, Stacking, Bagging - random forests, Different ways to combine classifiers

Reinforcement Learning: The learning task, SARSA and Q-Learning, Non-deterministic, Rewards and Actions

LABORATORY COMPONENT

List of Experiments

1. Build a basic learning system that takes input data, processes it, and makes predictions.
   Tasks:
   i. Define a machine learning problem (e.g., spam detection, digit recognition).
   ii. Preprocess the data (handle missing values, normalize features).
   iii. Train a simple model (e.g., decision tree) and evaluate performance.
2. Make use of the given dataset and implement the Find-S algorithm to find the most specific hypothesis.
   Sample dataset:

Sky	Temp	Humidity	Wind	Water	EnjoySport
Sunny	Warm	Normal	Strong	Warm	Yes
Sunny	Warm	High	Strong	Warm	Yes
Rainy	Cold	High	Strong	Warm	No
Sunny	Warm	High	Strong	Cool	Yes

3. Develop a python program for the following: -
   i. Linear regression
   ii. Logistic regression
4. Build a linear and non-linear SVM on an appropriate dataset.
5. Develop a python code for KNN Algorithm for classification.
   Note:- Choose an optimal value of K using cross-validation.
6. Build an Artificial neural network by implementing the back propagation algorithm and test the same using appropriate data sets.
7. Develop K-Means clustering on the PCA-transformed data.
   Note: - Use the elbow method to determine the optimal number of clusters (K)
   And plot the Within-Cluster Sum of Squares (WCSS) against the number of clusters to identify the "elbow point".
8. Make use of ensemble techniques and implement bagging and train a Random Forest model.
   Tasks:
   i. Train a single decision tree vs. random forest.
   ii. Compare bias-variance tradeoff.
   iii. Tune number of estimators and analyze performance.
9. Develop a python code for AdaBoost on an appropriate data set.
10. Develop a python code for SARSA (State-Action-Reward-State-Action) and Q-Learning reinforcement learning problems.

Text Book(s):

1. Tom M. Mitchell, *Machine Learning*, Indian ed., Chennai: McGraw-Hill Education, 2017. (*Chapters 1,2,4*)
2. Stephen Marsland, *Machine Learning: An Algorithmic Perspective*, 2nd ed., New York: CRC Press, 2014. (*Chapters 6, 7, 8, 11, 12, 13 and 14*)

Reference Book(s):

1. Peter Flach, *Machine Learning: The Art and Science of Algorithms that Make Sense of Data*, 1st ed., New York: Cambridge University Press, 2012.
2. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed., New York: Pearson Education, 2020.
3. Jason Bell, *Machine Learning: Hands-On for Developers and Technical Professionals*, 2nd ed., USA: John Wiley & Sons, 2020.
4. William W Hsieh, *Machine Learning Methods in the Environmental Sciences: Neural Networks and kernels*, 1st ed., Cambridge: Cambridge University Press, 2009.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_cs81/course; *NPTEL Video Lecture on Introduction To Machine Learning – IITKGP by Prof. Sudeshna Sarkar, Professor of CSE, IIT Kharagpur.*
2. https://onlinecourses.nptel.ac.in/noc24_cs101/course; *NPTEL Video Lecture on Introduction to Machine Learning by Prof. Balaraman Ravindran, Professor of CSE, IIT Madras and Mindtree Faculty Fellow.*

Laboratory Manual (for laboratory component):

1. *Machine Learning 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 learning paradigms, apply concept learning and design effective machine learning systems

CO2 : apply supervised learning techniques, build classification and regression models, and design probabilistic learning solutions for real-world problems

CO3 : apply unsupervised learning techniques for data exploration, use dimensionality reduction methods for feature optimization, and build neural networks for predictive modelling tasks

CO4 : make use of ensemble methods to improve models and apply reinforcement learning for decision-making

(based on psychomotor skills acquired from laboratory component)

CO5 : develop machine learning models and analyze the key challenges like over fitting and hypothesis selection

CO6 : build machine learning models for regression and classification and analyze their performance on real-world datasets

CO7 : design neural networks with backpropagation, implement K-Means clustering, apply PCA for feature reduction

CO8 : develop ensemble models, implement reinforcement learning algorithms like SARSA and Q-Learning

Course Articulation Matrix (CAM):		U24AI412X : MACHINE LEARNING												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24AI412X.1	1	2	2	1	-	-	1	1	1	-	1	2	2
CO2	U24AI412X.2	2	2	2	2	-	-	1	1	1	-	2	2	2
CO3	U24AI412X.3	2	2	2	2	-	-	1	1	1	-	2	2	2
CO4	U24AI412X.4	2	2	3	3	-	-	1	1	1	-	2	2	2
CO5	U24AI412X.5	1	2	2	2	2	-	1	2	1	2	1	2	2
CO6	U24AI412X.6	2	2	2	2	2	-	1	2	1	2	2	2	2
CO7	U24AI412X.7	2	2	2	2	2	-	1	2	1	2	2	2	2
CO8	U24AI412X.8	2	2	3	2	2	-	1	2	1	2	2	2	2
U24AI412X		**1.75**	**2**	**2.25**	**2**	**2**	**-**	**1**	**1.5**	**1**	**2**	**1.75**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

COMPUTER VISION AND IMAGE PROCESSING

Class: B.Tech. IV – Semester (Exit Course)		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI413X**	**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):

This course will develop students' knowledge in /on…

LO1: fundamental concepts of image processing such as basic relationship between pixels, intensity transformation and spatial filtering techniques

LO2: morphological image processing techniques applied on input images to filter the objects present in an input image

LO3: image segmentation techniques applied on input images to segment the objects present in an input image

LO4: providing vision to a computer by extracting the features from an object present in an input image and identify the object using classification techniques

THEORY COMPONENT

UNIT-I	**4 Hrs**

Introduction: What is digital image processing, Examples of fields that use digital image processing, Fundamental steps in digital image processing

Digital Image Fundamentals: Some basic relationships between pixels, Introduction to the mathematical tools used in digital image processing

Intensity Transformations & Spatial Filtering: The basics of intensity transformations and spatial filtering, Basic intensity transformation functions, Histogram processing, Fundamentals of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial enhancement methods.

UNIT-II	**4 Hrs**

Morphological Image Processing: Preliminaries, Erosion and dilation, Opening and closing, Hit-or-miss transformation, Some basic morphological algorithms

UNIT-III	**4 Hrs**

Image Segmentation: Fundamentals, Point, Line and edge detection, Thresholding, Segmentation by region growing and by region splitting and merging, Region segmentation using clustering and superpixels, Segmentation using morphological watersheds

UNIT-IV	**4 Hrs**

Feature Extraction: Background, Boundary preprocessing, Boundary feature descriptors, Region feature descriptors, Principal components as feature descriptors, Whole-image features, Scale-invariant feature transform

Image Pattern Classification: Background, Patterns and pattern classes, Pattern classification by prototype matching, Optimum (Bayes) statistical classifiers

LABORATORY COMPONENT

List of Experiments

1. Develop a program to apply various affine transformations to an input image.
2. Develop a program to apply basic intensity transformation functions.
3. Develop a program to implement contrast stretching and intensity level slicing.
4. Develop a program to implement histogram processing on an input image.
5. Develop a program to implement various smoothing linear and non-linear filters.
6. Develop a program to demonstrate erosion, dilation, opening and closing morphological operation.
7. Develop a program to demonstrate boundary extraction, convex hull, thinning, and thickening and skeletonization morphological operation.
8. Develop a program demonstrate various segmentation techniques.
9. Develop a program to demonstrate various feature extraction techniques.
10. Develop a program to for object detection using various classification techniques.

Text Book(s):

1. Rafael C. Gonzalez, Richard E. Woods, *Digital Image Processing*, 4th ed., New York: Pearson, 2018. *(Chapters 1 to 3, 9 to 12)*

Reference Book(s):

1. Anil K. Jain, *Fundamentals of Image Processing*, 1st ed., Chennai: Pearson, 2015.
2. B. Chanda, D. Dutta Majunder, *Digital Image Processing and Analysis*, 2nd ed., New Delhi: Prentice Hall of India, 2011.
3. S. Sridhar, *Digital Image Processing*, 2nd ed., Noida: Oxford University Press, 2016.
4. Munesh C. Trivedi, *Digital Image Processing*, 1st ed., New Delhi: Khanna Book Publishing, 2014.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc22_ee116/preview; *NPTEL Video Lecture on Dital Image Processing by Prof. Prabir Kumar Biaswas, Professor of EEE, IIT Kharagpur.*

Laboratory Manual (for laboratory component):

1. *Computer Vision and Image Processing 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 the image pre-processing techniques such as intensity transformation & filtering techniques to enhance the look and feel of an input image for further processing

CO2: apply morphological image processing techniques on objects present in input images to extract image components present in the input images

CO3: apply various segmentation techniques to segment the objects present in the input images for further processing

CO4: extract the features to depict the shape of an object and apply classification techniques to identify the object present in an input image

(based on psychomotor skills acquired from laboratory component)

CO5: develop programs to enhance the look and feel of the image by using various intensity transformation and filtering techniques

CO6: apply various morphological algorithms to extract the components of an input image for further processing

CO7: apply various segmentation techniques to extract the components of an input image for further processing

CO8: develop programs to extract the features from input image for identification and classification of the objects

Course Articulation Matrix (CAM):		**U24AI413X : COMPUTER VISION AND IMAGE PROCESSING**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AI413X.1**	1	2	2	1	-	-	1	1	1	-	1	2	2
CO2	**U24AI413X.2**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO3	**U24AI413X.3**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO4	**U24AI413X.4**	2	2	3	3	-	-	1	1	1	-	2	2	2
CO5	**U24AI413X.5**	1	2	2	2	2	-	1	2	1	2	1	2	2
CO6	**U24AI413X.6**	2	2	2	2	2	-	1	2	1	2	2	2	2
CO7	**U24AI413X.7**	2	2	2	2	2	-	1	2	1	2	2	2	2
CO8	**U24AI413X.8**	2	2	3	2	2	-	1	2	1	2	2	2	2
U24AI413X		**1.75**	**2**	**2.25**	**2**	**2**	**-**	**1**	**1.5**	**1**	**2**	**1.75**	**2**	**2**

DATA WAREHOUSING AND DATA MINING

Class: B.Tech. IV – Semester (Exit Course)		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI414X**	**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):

This course will develop students' knowledge in /on…

LO1: data warehouse architecture, multidimensional modelling and preprocessing
LO2: algorithms for mining frequent patterns and Association rules
LO3: classification models and relevant evaluation techniques
LO4: clustering techniques and data mining applications on web, finance and retail business

THEORY COMPONENT

UNIT-I	**4 Hrs**

Data Warehouse: Basic concepts, Multitier architecture, Data warehouse models, ETL tools, Metadata repository

Multidimensional Data Modelling: Data cube, Star, Snowflake and Fact constellation schemas, Dimensions, Measures, OLAP operations, Star net query model

Data Warehouse Implementation: Efficient data cube computation, Indexing OLAP, Efficient processing of OLAP queries, OLAP servers

UNIT-II	**4 Hrs**

Data Preprocessing: Data cleaning, Integration, Reduction and Transformation

Data Mining: Introduction, Types of data and patterns can be mined, Technologies used, Major issues in data mining

Association Rule Mining: Basic concepts, Apriori algorithm, Generating association rules from frequent item sets, Improvements of Apriori algorithm

UNIT-III	**4 Hrs**

Classification: Basic concepts, Classification by decision tree induction, Bayesian classification, Rule based classification, Model evaluation and Selection

Advanced Classification: Classification by back propagation, Associative classification, K Nearest Neighbor classifiers

UNIT-IV	**4 Hrs**

Cluster Analysis: Introduction, Types of data in cluster analysis, Partitioning methods by K- Means and K-Medoids, Hierarchical clustering, BIRCH, DBSCAN algorithm, Grid based method with STING, Evaluation of clusters

LABORATORY COMPONENT

List of Experiments

Unit-1:

1. Implement multidimensional data models like Star Schema, Snowflake Schema, and Fact Constellation Schema using SQL, typically follow these steps:
   Create dimension and fact tables
   Insert sample data.
   Run queries to demonstrate OLAP-style analysis (e.g., aggregations).
   Dataset: **Sales Data Warehouse**.
   1.Star Schema
   Tables: FactSales: Stores measurable data.
   DimCustomer, DimProduct, DimStore, DimDate: Denormalized dimension tables
   2. Snowflake Schema
   Normalize dimensions (e.g., categories in separate tables)
   3. Fact Constellation Schema (Galaxy Schema)
   Multiple fact tables sharing dimensions
   Add a new fact table for Inventory.
2. Implement CUBE operations using SQL on the Sales Data Warehouse dataset, use the GROUP BY CUBE clause. This allows us to compute aggregations across multiple dimensions, producing subtotals and a grand total in a single query.
   Tables:
   1. **FactSales**(DateID, CustomerID, ProductID, StoreID, SalesAmount, Quantity)
   2. **DimDate**(DateID, Year, Month)
   3. **3.DimProduct**(ProductID, ProductName, Category)
   4. **4.DimCustomer**(CustomerID, CustomerName, Region)
   5. **5.DimStore**(StoreID, StoreName, Location)

   1. Sales by Year, Category, and Region with CUBE
   2. Quantity Sold by Product, Store, and Month
3. Implement Set Operations in SQL (using UNION, INTERSECT, EXCEPT) on multidimensional data models e.g., a Sales Data Warehouse), perform comparative analysis between subsets of data.
   Use FactSales and related dimension tables like:
   1. **DimCustomer**
   2. **DimProduct**
   3. **DimStore**
   4. **DimDate**

   1. **UNION –** Combine Results from Two Queries
      Example: Customers who bought either electronics or clothing
   2. **INTERSECT –** Common Entries in Two Queries
      Example: Customers who bought both electronics and clothing
   3. **EXCEPT (or MINUS) –** Find Items in One Set Not in Another
      Example: Customers who bought electronics but not clothing.
4. Develop a data warehouse application for sales management using ETL tool

Unit-2:

1. Perform data preprocessing/analysis tasks using WEKA Tool.
2. Write a program in any programming language to create a file in ARFF format consisting of at least 10,000 transactions with at least three items.
3. Write a program to implement Apriori algorithm for association rule mining.
4. Generate association rules using Apriori and FP-Growth methods in WEKA Tool on German credit card dataset.

Unit-3:

1. a) Write a program to implement ID3 classification algorithm.
   b) Generate and compare different classification functions of WEKA Tool on German credit card dataset.
2. Generate the significance of attributes Foreign worker and social status of German credit card dataset in classification process using WEKA Tool.
3. Generate and compare significance of Ten cross fold and Fifty cross fold options of testing data generation for classification using WEKA Tool.
4. Generate and compare significance of Cross validation and boot strapping techniques of evaluation using WEKA Tool.

Unit-4:

1. Write a program to implement simple K-means Clustering algorithm using WEKA Tool.
2. Generate and compare different clustering functions of WEKA Tool on German credit card dataset.
3. Generate the significance of attributes foreign worker and social status of German credit card dataset in clustering process using WEKA Tool.
4. Case Study: Retail Industry – Market Basket Analysis

Text Book(s):

1. Jiawei Han, Micheline Kamber, *Data Mining Concepts and Techniques*, 3rd ed., Singapore: Morgan Kaufmann Publishers, 2016. (*Chapters 1, 3, 4, 5, 6, 8, 10*)

Reference Book(s):

1. Sam Anahory, Dennis Murray, *Data warehousing in the real world*, 1st ed., New Delhi: Pearson, 2003.
2. C.S.R. Prabhu, *Data Warehousing Concepts, Techniques, Products and Applications*, 2nd ed., New Delhi: PHI Learning Private limited, 2002.
3. Arun K. Pujari, *Data Mining Techniques*, 2nd ed., Hyderabad: Universities Press (India) Pvt. Ltd, 2010.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview; *NPTEL Video Lecture on Data Mining Processing by Prof. Pabitra Mitra, Professor of CSE, IIT Kharagpur*.

Laboratory Manual (for laboratory component):

1. *Data Warehousing and Data Mining 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 various techniques to design and develop data warehouse and data mining systems

CO2 : apply frequent pattern mining techniques on data sets for association rules extraction

CO3: analyse efficiency based on classification algorithms

CO4: evaluate clustering techniques and design data mining applications on web financial domains.

(based on psychomotor skills acquired from laboratory component)

CO5: design data warehouse and implement OLAP operations

CO6: apply ETL & OLAP tools for data analysis

CO7: evaluate different data processing techniques using WEKA tool

CO8: implement data mining techniques on various data sets

Course Articulation Matrix (CAM):		**U24AI414X : DATA WAREHOUSING AND DATA MINING**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AI414X.1**	1	2	2	2	1	-	-	1	1	1	1	2	1
CO2	**U24AI414X.2**	1	2	2	2	-	-	-	1	1	-	1	2	1
CO3	**U24AI414X 3**	1	2	2	2	1	-	-	1	1	-	1	2	1
CO4	**U24AI414X.4**	1	2	2	2	-	-	-	1	1	-	1	2	1
CO5	**U24AI414X.5**	1	2	2	2	1	-	-	1	1	1	1	2	2
CO6	**U24AI414X.6**	1	2	2	2	-	-	-	1	1	-	1	2	2
CO7	**U24AI414X.7**	1	2	2	2	1	-	-	1	1	-	1	2	2
CO8	**U24AI414X.8**	1	2	2	2	-	-	-	1	1	1	1	2	2
U24AI414X		**1**	**2**	**2**	**2**	**1**	**-**	**-**	**1**	**1**	**1**	**1**	**2**	**1.5**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

WEB TECHNOLOGIES

Class: B.Tech. IV – Semester (Exit Course)		**Branch:** CSE (AI & ML)	
Course Code:	**U24AI415X**	**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):

This course will develop students' knowledge in /on…

LO1: creating basic HTML webpages using essential tags, headings, links, images, tables, frames and forms with controls

LO2: CSS for styling web pages and JavaScript for enhancing interactivity and functionality

LO3: creating dynamic web pages using advanced JavaScript (including ES6+) and integrate with ReactJS

LO4: gain hands-on experience in building modular and maintainable web applications using React components and hooks

THEORY COMPONENT

UNIT-I	**4 Hrs**

HTML: Document structure, Basic tags, Creating headings, Working with links, Creating paragraph, Working with images, Tables, Frames, Introduction to forms and Controls: Creating HTML form, Specifying action URL and method to send the form, Using html controls

UNIT-II	**4 Hrs**

CSS: CSS (Cascading style sheet) rules and properties, Types: Inline, External and Internal Style sheets, Style classes, Multiple styles

JavaScript: JavaScript syntax, Embedding JavaScript in HTML page, Usage of variables, Working with operators, Control – flow statements, Functions, Arrays, Creating objects, Handling events

UNIT-III	**4 Hrs**

JavaScript for React: Declaring variables, Creating functions, Objects and arrays, The spread operator asynchronous javascript, Simple promises with fetch, Async/await, Building promises classes, ES6 modules, CommonJS, Functional programming with javascript

UNIT-IV	**4 Hrs**

Fundamentals of React: Hello React, Setting up a React project, Meet the React, Component, React JSX, Lists in React, React component instantiation, React DOM

LABORATORY COMPONENT

List of Experiments

1. Design the following static web pages with the following attributes:
   a. Basic Tags.
   b. Heading Tags.
   c. List (Ordered, Un-Ordered and Description).
   d. Textbox, Buttons
2. Design the following static web pages required for an online book store web site.
   a. Home page.
   b. Login page.
   c. Catalogue page.

Logo	Website Name			
Home	Login	Registration	Catalogue	Cart
CSE CSE(AI&ML) CSE(Data Science) CSE(Networks) CSE(IoT)	Login: Password: Submit: Reset:			

3. Develop a form for student registration with fields name, roll no, gender, qualification, DOB, Email-id, phone number and submit button.
4. Build a style sheet template using Inline, Internal, External.
5. Design a registration form and validate its field by using JavaScript.
6. Export and Import modules using ES6 export / import.
7. Destructure an Object and log each variable.
8. Refactor the fetch () example using async/await.
9. Use Fragment to avoid extra DOM elements.
10. Create a Responsive layout with CSS in React.

Text Book(s):

1. Kogent, *Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML*, 1st ed., New Delhi: Dreamtech Press, 2013. (*Chapters 2 to 7*)
2. Alex Banks, Eve Porcello, *Learning React Modern Patterns for Developing React Apps,* 2nd ed. Delhi: Greyscale Indian Edition, 2020

Reference Book(s):

1. Ivan Bayross, *Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP,* 4th ed., New Delhi: BPB Publications, 2009.
2. Uttam K.Roy, *Web Technologies*, 7th ed., New Delhi: Oxford Higher Education 2010.
3. Nabendu Biswas, *Ultimate Full – Stack Web Development with MERN: Design, Build Test and Deploy Production-Grade Web Applications with MongoDB, Express, React and NodeJS*, 1st ed., Delhi: AVA Publisher, 2021.

Web and Video link(s):

1. https://onlinecourses.swayam2.ac.in/nou25_cs09/preview?; *NPTEL Video Lecture on Web Technology by Dr. Ashutosh Kumar Bhatt, Uttarakhand Open University, Haldwani.*

Laboratory Manual (for laboratory component):

1. *Web Technologies 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 structured HTML using various tags and forms, and analyze their usability and data handling

CO2: make use of CSS for styling and JavaScript for behaviour control and event handling to develop dynamic and interactive web pages

CO3: implement client-side interactivity using JavaScript including ES6 features and asynchronous programming concepts

CO4: develop and manage modular web applications using ReactJS and modern frontend development practices

(based on psychomotor skills acquired from laboratory component)

CO5: develop and test web pages using HTML tags, forms, and controls for creating headings

CO6: apply various CSS styles to build a style sheet template that enhances the presentation and maintainability of web pages and JavaScript

CO7: build interactive UI components using ReactJS, including hooks and functional programming practices

CO8: develop full-stack applications with React as frontend and JSP/JDBC as backend, showcasing complete web flow

Course Articulation Matrix (CAM):		**U24AI415X : WEB TECHNOLOGIES**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PSO1**	**PSO2**
CO1	**U24AI415X.1**	2	2	2	1	2	1	-	2	1	2	1	2	2
CO2	**U24AI415X.2**	2	2	2	1	2	1	-	2	1	2	1	2	2
CO3	**U24AI415X.3**	2	2	2	1	2	1	-	2	1	2	1	2	2
CO4	**U24AI415X.4**	2	2	2	1	2	1	-	2	1	2	1	2	2
CO5	**U24AI415X.5**	2	2	2	1	2	1	-	2	1	2	1	2	2
CO6	**U24AI415X.6**	2	2	2	1	2	1	-	2	1	2	1	2	2
CO7	**U24A415X.7**	2	2	2	1	2	1	-	2	1	2	1	2	2
CO8	**U24AI415X.8**	2	2	2	1	2	1	-	2	1	2	1	2	2
U24AI415X		2	2	2	1	2	1	-	2	1	2	1	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														