B.TECH. CURRICULUM

ACADEMICYEAR:2024–25

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING

Undergraduate Rules and Regulations-2024 (URR24)
In accordance with the National Education Policy 2020
w.e.f AY 2024-25

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

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 506 015 TELANGANA

(UGC Autonomous Institute Under Kakatiya University, Warangal)

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

History:

PROGRAM	DESCRIPTION	
	INTAKE	NBA ACCREDITATION
UG in B.Tech. COMPUTER SCIENCE & ENGINEERING	• Started with 60seatsin1994 • Intake increased to 120 in 2002 • Intake increased to 180 in 2015	• First time accreditation: 2008 • Reaccreditation-1: 2014 • Reaccreditation-2: 2016 • Reaccreditation-2: 2018 • Reaccreditation-2: 2020 • Reaccreditation-2: 2022

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: VISION AND MISSION

VISION

Attaining center of excellence status in various fields of Computer Science and Engineering by offering worth full education, training and research to improve quality of software services for ever growing needs of the industry and society.

MISSION

M1:	Practice qualitative approach and standards to provide students better understanding and profound knowledge in the fundamentals and concepts of computer science with its allied disciplines
M2:	Motivate students in continuous learning to enhance their technical, communicational, and managerial skills to make them competent and cope with the latest trends, technologies, and improvements in computer science to have a successful career with professional ethics.
M3	Involve students to analyze, design and experiment with contemporary research problems in computer science to impact socio-economic, political and environmental aspects of the globe.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1:	Escalate the technical skills within and across disciplines of Computer Science Engineering for productive career by maintaining professional ethics
PEO2:	Develop and exercise their capabilities to demonstrate their creativity in engineering practice and team work with increasing responsibility and leadership
PEO3:	Refine their knowledge and skills to attain professional competence through lifelong learning such as higher education, advanced degrees and professional activities

PEO TO MISSION MAPPING

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

PEO Statements	Mission Statements	Mappig 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.
PEO2	M1	3	A Good understanding of core principles in Computer Science is mandatory for a successful career. Mastery of these principles ensures that graduates are well-prepared for various professional roles, higher education, or entrepreneurial endeavors.
	M2	2	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.
	M3	3	To address contemporary research challenges and contributing to innovative solutions prepare students for high-impact careers. The ability to solve global issues using advanced technologies of computer science and engineering 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	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	The focus on professional ethics and embracing new technologies supports life-long learning and the development of soft skills nCSEssary 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.

PROGRAM SPECIFIC OBJECTIVES

PSO1: (Software Development and Quality assurance)	Transform various legacy or manual systems into computer automated systems using modern programming languages, integrated development environments and apply testing tools for efficient verification and validation of this software systems.
PSO2: (Immediate professional practice)	Work as software practitioner or continue higher education by adopting advanced technologies in various fields of Computer Science and Engineering.

PO/PSO TO PEO MAPPING

PO's		PEO1	PEO2	PEO3
PO1	Engineering Knowledge	3	2	3
PO2	Problem Analysis	3	3	3
PO3	Design/Development of solutions	3	3	3
PO4	Conduct investigations of complex problems	3	3	3
PO5	Modern tool usage	3	3	3
PO6	The engineer and society	1	3	1
PO7	Environment and sustainability	1	2	3
PO8	Ethics	2	3	3
PO9	Individual and Teamwork	3	3	2
PO10	Communication	2	3	3
PO11	Project management and finance	3	3	2
PO12	Lifelong Learning	3	3	3
PSO1	Transform various legacy or manual systems into computer automated systems using modern programming languages, integrated development environments and apply testing tools for efficient verification and validation of this software systems.	3	2	3
PSO2	Work as software practitioner or continue higher education by adopting advanced technologies in various fields of Computer Science and Engineering.	3	3	2

DESIGN OF CURRICULUM

Salient Features

- The URR24 regulations are inline with the National Education Policy 2020 (NEP2020) 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 16 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 learing the PRACTICUM is a semester long project work included in I to IV semesters, having a weightage of 1 credit in each semester. Under PRACTICUM, the students are expected to implement a micro level project (at a level of course project) solving a practical problem or a project based on the combination of different theory or lab courses being studied in a corresponding semester. The 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 URR24 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 fifteen core courses referred to as Program Core. Several academic models from reputed institutions in the country and outside the country are studied in articulating this Program Core, to make curriculum globally competitive. The courses are augmented with laboratory components as per the need.

Program Electives Courses (PEC)

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

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

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

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

The NEP-2020quotes, "*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 disciplines would 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, ethic of personal and social engagement to ensure holistic development of the learner. Activity based liberal learning courses covering life, literature, and culture are added. Every learner is expected to take one such course in first four semesters. We strongly believe that these four liberal learning modules will expose the learners to multidisciplinary and holistic education as envisaged in NEP2020.

(END OF THE SALIENT FEATURES OF URR24)

Undergraduate Rules and Regulations-2024 (URR24)
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 Competency - Focused Outcome Based Curriculum (CF-OBC)

2. **Scope:**

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

3. **Duration of Programmes:**

   The undergraduate degree should be of four years duration, with multiple entry and multiple 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; UG Diploma in CSE after the study of two academic years (four semesters); and B. Voc in CSE 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 degree with optional Minor/Honours/ Honours with Research.

4. **Credit Requirement:**

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

Qualification Type and Credit Requirements		
NHEQF Levels	**Exit with**	**Credit Requirements**
4.5	**Undergraduate Certificate** (in the field of learning/discipline) for those who exit after the first year (two semesters) of the undergraduate programme. (Programme duration: first year or two semesters of the 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 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 6** : 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 7** : 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 8** : 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 f holistic and multidisciplinary education with the support of ABC

(iii) The quality assurance of the implementation of ABC at the level of the registered university shall be looked by the Director, Examinations and Evaluation of the Institute of the officer nominated by him different from ABC nodal officer, under the directives and guidance of Controller of Examinations of the Institute

(iv) The Institute shall upload, annually, on its website, a report of its activities related to the Academic Bank of Credits, as well as of measures taken by it for Quality Assurance, Quality Sustenance and Quality Enhancements

(v) The Grievance Redressal Committee constituted by the examination section shall be responsible for addressing the Grievance and appeals related to ABC

8. Building Competencies through Pedagogy:

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

(i) Classroom process must encourage rigorous thinking, reading and writing, debate, discussion, peer learning and self-learning

(ii) The emphasis is on critical thinking and challenge to current subject orthodoxy and develop innovative solutions. Curricular content must be presented in ways that invite questioning and not as a body of ready knowledge to be assimilated or reproduced. Faculty should be facilitators of questioning and not authorities on knowledge.

(iii) Classroom teaching should focus on the 'how' of things i.e. the application of theory and ideas. All courses including social sciences and humanities shall have design project and practicums to enable students get relevant hands-on experiences

(iv) Learning must be situated in the Indian context to ensure that there is no sense of alienation from their context, country and culture

(v) Classroom processes must address issues of inclusion and diversity since students are likely to be from diverse cultural, linguistic, socio-economic and intellectual backgrounds

(vi) Cooperative and peer supported activities shall be part of empowering students to take charge of their own learning

(vii) Faculty shall have the freedom to identify and use the pedagogical approach that is best suited to a particular course and student

(viii) Pedagogy PBL (Problem/Project Based Learning) shall be brought into practice as part of curriculum. Experiential learning in the form of practicum, seminar, minin 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 "lifelong learning" which are essential attributes of a 21st Century learner

(x) Blended Learning (BL) mode shall be used to help learners develop 21stcentury skills. BL should be carefully implemented and should not be replacing classroom time as a privilege

(xi) The UGC regulations, 2021 on Credit Framework for Online Learning Courses through SWAYAM, facilitates an institution to allow up to 40 percent of the total courses being offered in a particular programme in a semester through massive open online courses (MOOCS) offered by the SWAYAM / NPTEL and other e-learning platforms. Students shall be encouraged to complete equivalent courses through SWAYAM / NPTEL and other e-learning platforms, approved by the BoS chair and Dean AA, towards obtaining required credits where ever necessary.

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

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

(i) SWAYA
(ii) IIM-B
(iii) University LMS
(iv) CEC
(v) NPTEL
(vi) IGNOU

(vii) Infosys Spring Board
(viii) Future Skills Prime (digital skilling ecosystem developed by Govt. Of India and NASSCOM)
(ix) Wadhavani Foundation
(x) Tata Strive
(xi) 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 NEP2020

11.1 MULTIPLE EXIT OPTIONS

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

10.2 MULTIPLE ENTRY OPTIONS

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

4.	Fourth Entry	VII-Sem. Of The program	The successful completion of B. Voc in CSE from our institute.

(i) **No. of maximum exits:** as per NEP2020/UGC/AICTE guidelines on MEME

(ii) **No. of maximum entry:** as per NEP2020/UGC/AICTE guidelines on MEME

(iii) **Maximum gap between exit and entry:** as per NEP2020/UGC/AICTE guidelines on MEME

(iv) **Academic Bank of Credits shall be maintained**

11. Options for Degree Certificate

(i). Learners who earn a minimum of total 172 credits will be **awarded *"B.Tech" degree which confirms to NEP2020 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): 172+18 Credits***

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

b) ***B.Tech with "Honours" degree (with additional 18 credits): 172+18 Credits***

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

c) B.Tech–"Honours with Research" degree (with additional 18 credits by research): 172+18 credits

Students are expected to complete 2-months research internship in summer after 2nd year (5 credits), 3rd year (5 credits) and work towards individual research-based project during 4thyear. They have to complete one course on "Research Methodology" through MOOCS or can complete a one week FDP on

"Research Methodology", during 7th semester (4 credits) and finally publish a research paper in a journal indexed by SCI/SCOPUS/WEB OF SCIENCE (4 credits).

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

Semester	B. Tech with "Minor"	B. Tech with "Honours"	B. Tech "Honours with Research"
I	-	-	-
II	-	-	-
III	-	-	-
IV	-	-	-
Summer break after 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)	"Research Methodology" Theory Course (4 Credits)
VIII	1 theory (4 credits)	1 theory (4 credits)	One research publication in Journal indexed by SCI / SCOPUS / Web of Science (4 Credits)
Total additional credits to be earned	**18**	**18**	**18**

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

	I	II	III	IV	V	VI	VII	VIII	Total
B. Tech	22	22	23	23	24	22	21	15	172
B. Tech with Minor	22	22	23	23	24+5*	22+5*	21+4*	15+4*	172+18*
B. Tech with Honours	22	22	23	23	24+5*	22+5*	21+4*	15+4*	172+18*
B. Tech. Honours with Research	22	22	23	23	24+5*	22	21+5* +4*	15+4*	172+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>
</table>

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

***In identified 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 Courses (HSMC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	HSMC	U24MH205	English Communication and Report Writing	II	2
2.	HSMC	U24MB505	Management Course Basket*	V	3
3.	HSMC	U24MH508	Technical English	V	1
Total Credits					6

(For Example: (sample Courses)
(i) English for Technical Writing
(ii) Universal Human Value
(iii) Management / Economics / Accounting / Taxation)

(ii) Basic Science Courses (BSC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	I	3
2.	BSC	U24PY102C	Physics for Computer Science Engineering	I	4
3.	BSC	U24MH201	Differential Calculus and Ordinary Differential Equations	II	3
4.	BSC	U24CY202C	Chemistry for Computer Science Engineering	II	4
5.	BSC	U24MH301D	Discreet Mathematics and Probability, Statistics	III	3
Total Credits					17

(iii) Engineering Science Courses (ESC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	ESC	U24CS104	Programming for Problem Solving with C	I	4
2.	ESC	U24EE105	Basic Electrical & Electronics Engineering	I	4
3.	ESC	U24CS204	Data Structures through C	II	4
4.	ESC	U24ME207	Engineering Graphics Through CAD*	II	1
5.	ESC	U24CN604	Internet of Things	V	4
Total Credits					17

(iv) Program Core Courses (PCC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	PCC	U24CS103	Computer Organization & Architecture	I	3
2.	PCC	U24CS203	Operating System	II	3
3.	PCC	U24CS302	Theory of Computation	III	3
4.	PCC	U24CS303	Advanced Data Structures	III	4
5.	PCC	U24CS304	Computer Networks	III	3
6.	PCC	U24CS305	OOP through Java	III	4
7.	PCC	U24CS401	Database Management Systems Design	IV	4
8.	PCC	U24CS402	Web programming	IV	4
9.	PCC	U24CS403	Software Engineering	IV	3
10.	PCC	U24CS404	Artificial Intelligence	IV	3
11.	PCC	U24CS405	Python Programming	IV	4
12.	PCC	U24CS502	Machine Learning	IV	4
13.	PCC	U24CS503	Design and Analysis of Algorithms	V	4
14.	PCC	U24CS504	Compiler Design	V	4
15.	PCC	U24CS602	Cryptography & Network Security	VI	3
16.	PCC	U24CS603	Full Stack Development		4
17.	PCC	U24CS703	Cloud Computing	VII	4
18.	PCC	U24CS704	Deep Learning	VII	3
19.	PCC	U24CS705	Block Chain Technologies	VII	3
Total Credits					67

(v) Program Elective Courses (PEC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	PEC	U24CS601	Program Elective –I / MOOCs-I	VI	3
2.	PEC	U24CS702	Program Elective - II/ MOOCs-II	VII	3
3.	PEC	U24CS802	Program Elective - III / MOOCs-IV	VIII	3
4.	PEC	U24CS803	Program Elective - IV / MOOCs-V	VIII	3
Total Credits					12

PEC 01: From Verticals of PEC
PEC 02: From Verticals of PEC
PEC 03: From Verticals of PEC
PEC 04: From Verticals of PEC

(vi) Experiential Learning Courses (ELC)

Sr. No.	Course Type	Curse 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**	**U24CS509**	**Seminar**	V	1
6.	**ELC**	**U24CS608**	**Mini Project**	VI	1
7.	**ELC**	**U24CS706**	**Internship Evaluation***	VII	1
8.	**ELC**	**U24CS707**	**Major Project, Phase-1 / Industrial Internship - 1**	VII	4
9.	**ELC**	**U24CS804**	**Major Project, Phase – 2 / Industrial Internship - 2**	VIII	6
Total Credits					17

(vii) Indian Knowledge System Courses (IKSC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	IKSC 01	**U24SK100**	**AICTE Mandated Student Induction Programme (Universal Human Values – I)**	I	-
2.	IKSC 02	**U24VA506A**	**EITK**	V	2
3.	IKSC 03	**U24VC606B**	**UHV-II**	VI	2
Total Credits					4

(viii) Multidisciplinary Open Electives Courses (MOPEC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	**MOPEC**	**U24OE501XX**	**MOPEC Elective –I**	V	3
2.	**MOPEC**	**U24OE701XX**	**MOPEC Elective –II**	VII	3
3.	**MOPEC**	**U24OE801XX**	**MOPEC Elective –III**	VIII	3
Total Credits					9

(ix) Value Added Courses (VAC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	VAC	U24CY106	Environmental Studies	I	--
2.	VAC	U24VA109	SEA – I / SAA-1	I	1
3.	VAC	U24VA206	Sports & Yoga	II	1
	VAC	U24VA210	SEA-2 / SAA -2	II	1
4.	VAC	U24VA306	QALR	III	2
5.	VAC	U24VA309	SEA-3 / SAA -3	III	1
6.	VAC	U24VA406	Soft & Interpersonal Skills	IV	1
7.	VAC	U24VA409	SEA - 4 / SAA - 4	IV	1
8.	VAC*	U24CH411*	Environmental Sciences*	IV	3
Total Credits					11

(x) Skill Enhancement Courses (SEC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	SEC	U24SE208	Programming Skill Development (PSD) Lab – 1	II	1
2.	SEC	U24SE307	PSD LAB-02	III	1
3.	SEC	U24SE407	PSD Lab-03	IV	1
4.	SEC	U24SE507	PSD Lab-04	V	1
5.	SEC	U24SE607	PSD Lab-05	VI	1
Total Credits					5

(xi) Ability Enhancement Courses (AEC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	AEC	U24AE107	IDEA Lab Makerspace	I	1
2.	AEC	U24AE110	Expert Talk Series-1	I	1
3.	AEC	U24AE211	Expert Talk Series-2	II	1
4.	AEC	U24AE310	Expert Talk Series-3	*III*	1
5.	AEC	U24AE410	Expert Talk Series-4	IV	1
6.	AEC	U24AE510	Expert Talk Series-5	V	1
7.	AEC	U24AE609	Expert Talk Series-6	VI	1
Total Credits					7

(xii) Startups and Entrepreneurship Courses (STE)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	**STE**	**U24ST505X**	**S&E Basket Basket**	V	3
Total Credits					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-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
		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

13. SUMMARY OF CURRICULUM COMPONENTS

S.NO.	ABBREVIATION	COURSE COMPONENT	TOTAL COURSE	TOTAL CREDITS	CURRICULUM CONTENT (%OF CREDITS)
1	HSMC	Humanity Sciences and Management Courses	3	6	3.48
2	BSC	Basic Science Course	5	17	9.88
3	ESC	Engineering Science Course	5	17	9.88
4	PCC	Program Core Course	19	67	38.90
5	PEC	Program Elective Course	4	12	6.97
6	MOPEC	Multidisciplinary Open Elective Course	3	9	5.23
7	ELC	Experiential Learning	9	17	9.88
9	VAC	Value Added Course	8	11	4.65
10	SEC	Skill Enhancement Course	5	5	2.9
11	AEC	Ability Enhancement Course	7	7	4.06
12	IKS	Indian Knowledge Systems	2	4	2.32
13	STE		1	3	1.74
Total				**172**	**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**	**IKC**	**STE**	**TOTAL**
I	2/7	2/8		1/3				2/1	1/1	2/2			10/22
II	2/7	2/5	1/2	1/3			1/1	2/2	1/1	1/1			11/22
III	1/3			4/14			1/1	2/3	1/1	1/1			10/23
IV				5/18			1/1	2/2	1/1	1/1			10/23
V			1/1	3/12	1/3		1/1		1/1	1/1	1/2	1/3	10/24
VI		1/4	1/3	2/7		1/3	1/1		1/1	1/1	1/2		9/22
VII				3/10	1/3	1/3			2/5				7/21
VIII					1/3	2/6			1/6				4/15
Total	**5/17**	**4/17**	**3/6**	**19/67**	**3/9**	**4/12**	**5/5**	**8/8**	**9*/17**	**7/7**	**2/4**	**1/3**	**71/172**
% Weightage of Course Category	9.88% (17/172)	9.88% (17/172)	3.48 % (6/172)	38.90% (67/172)	5.23% (9/172)	6.97 % (12/172)	2.90 % (5/172)	4.65% (8/172)	9.88% (17/172)	4.06% (7/172)	2.32% (4/172)	1.74% (3/172)	100 % (172/172)

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

B. Tech (CSE) –CURRICULUM(KITSW-URR24)

SEMESTER-WISECURRICULUMWITHSCHEME 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 – I

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
-	IKSC	U24IK100	U24SK100 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	U24PY102C	Engineering Physics *(for CSE)*	2	1	2	5	10	4
3	PCC	U24CS103	Computer Organization & Architecture	2	1	-	4	7	3
4	ESC	U24CS104	Programming for Problem Solving with C	2	1	2	5	10	4
5	ESC	U24EE105C	Basic Electrical Engineering	2	1	2	5	10	4
6	VAC	U24CY106	Environmental Studies	2	-	-	3	5	-
7	AEC	U24AE107	IDEA Lab Makerspace	-	-	2	2	4	1
8	ELC	U24EL108	Practicum-1	-	-	-	4	4	1
9	VAC	U24VA109XXXXX	SEA – I / SAA-1	-	-	-	2	2	1
10	AEC	U24AE110	Expert Talk Series-1	-	-	-	1	1	1
			Total:	12	5	8	37	62	22
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-NiL-					

Pool – I (Physics)		
S. No.	Course Code	Course Title
1.	U24PY102A	Engineering Physics *(for Civil Engineering)*
2.	U24PY102B	Engineering Physics *(for ECIE)*
3.	U24PY102C	Engineering Physics *(for CSE)*
4.	U24PY102D	Engineering Physics *(for EEE)*
5.	U24PY102E	Engineering Physics *(for ECE)*

Pool – II (Basic Electrical & Electronics Engineering)		
S. No.	**Course Code**	**Course Title**
1.	U24EE105A	Basic Electrical and Electronics Engineering ***(for Civil Engineering)***
2.	U24EE105B	Basic Electrical Engineering ***(Common to ECE and ECI)***
3.	U24EE105C	Basic Electrical Engineering ***(for CSE)***
4.	U24EE105D	Basic Electrical Engineering ***(for EEE)***

II SEMESTER

Stream-I

Sl. 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	U24CY202C	Engineering Chemistry *(for CSE)*	2	1	2	5	10	4
3	PCC	U24CS203	Operating Systems	2	1	-	4	7	3
4	ESC	U24CS204	Data Structures Through C	2	1	2	5	10	4
5	HSMC	U24MH205	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA206	Sports & Yoga	-	-	2	2	4	1
7	ESC	U24ME207	Engineering Graphics Through CAD*	-	-	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	U24VA210	SEA-2 / SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
			Total:	10	4	10	36	60	22
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				**Unix shell programming** *(Supports Computer Network and Complier Design courses)*					1

*** For CE and ME, it will be a three (03) credit (1-0-4) course on Engineering Graphics & Design (Pedagogy: Sessions with conventional drafter and CAD).**

Pool – III (Chemistry)		
S. No.	**Course Code**	**Course Title**
1.	U24CY202A	Engineering Chemistry *(for Civil Engineering)*
2.	U24CY202B	Engineering Chemistry *(for ECIE)*
3.	U24CY202C	Engineering Chemistry *(for CSE)*
4.	U24CY202D	Engineering Chemistry *(for EEE)*
5.	U24CY202E	Engineering Chemistry *(for ECE)*

Bridge Courses for exit:

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

OR

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

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

(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: Any Two (02) Courses during the 2 - Months internship									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	PCC	U24CS211X	Java Programming	2	-	2	-	4	3
2	PCC	U24CS212X	Database Management	2	-	2	-	4	3
3	PCC	U24CS213X	Fundamental of Python Programming	2	-	2	-	4	3
4	PCC	U24CS214X	Computer Aided Software Engineering	2	-	2	-	4	3
5	PCC	U24CS215X	Web Designing	2	-	2	-	4	3
6	PCC	U24CS216X	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: Any Two (02) Skill based Courses -:									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	SEC	U24SE211X	Advanced Excel (NSIC Course)	-	-	6	-	6	3
2	SEC	U24SE212X	Web Development (NSIC course)	-	-	6	-	6	3
3	SEC	U24SE213X	Linux (NSIC course)	-	-	6	-	6	3
4	SEC	U24SE214X	Oracle SQL/PLSQL Programming (NSIC course)	-	-	6	-	6	3
5	SEC	U24SE215X	CCNA: Computer Networks Essentials	-	-	6	-	6	3
6	SEC	U24SE216X	Power BI (NASSCOM futureskills course)	-	-	6	-	6	3
7	SEC	U24SE217X	Foundational Course in Cyber Security (NASSCOM futureskills course)	-	-	6	-	6	3
8	SEC	U24SE218X	Any other skill-based course approved by BoS Chair and Dean AA	-	-	6	-	6	3

III SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24CS301	Software Engineering	2	1	-	6	9	3
2	PCC	U24CS302	Theory of Computation	2	1	-	4	7	3
3	PCC	U24CS303	Advanced Data Structures	2	1	2	5	10	4
4	PCC	U24CS304	Computer Networks	2	1	-	4	7	3
5	PCC	U24CS305	Object Oriented Programming through JAVA	2	1	2	5	10	4
6	VAC	U24VA306A	Quantitative Aptitude and Logical Reasoning	2		-	2	4	2
7	SEC	U24SE307	Programming Skill Development Lab - 2	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
			Total:	12	5	6	35	58	23
Summer/ Inter-Sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				Data Structures through C* *(Supports Lateral Entry students in Advance data structures & DAA course)*					1*

**For Lateral Entry Students Only*

Training & Placement Basket		
S.No	Course Code	Course Title
1	U24VA306A	Quantitative Aptitude and Logical Reasoning
2	U24VA306B	Soft and Interpersonal Skills

IV SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24MH401	Discrete Mathematics and Probability Statistics	2	1	-	6	9	3
2	PCC	U24CS402	Web programming	2	1	2	5	10	4
3	PCC	U24CS403	Database Management Systems	2	1	2	5	10	4
4	PCC	U24CS404	Artificial Intelligence	2	1	-	4	7	3
5	PCC	U24CS405	Python Programming	2	1	2	5	10	4
6	VAC	U24VA406B	Soft and Interpersonal Skills@	-	-	2	2	4	1
7	SEC	U24SE407	Programming Skill Development Lab - 3	-	-	2	2	4	1
8	ELC	U24EL408	Practicum-4	-	-	-	4	4	1
9	VAC	U24VA409	SEA - 4 / SAA – 4	-	-	-	2	2	1
10	AEC	U24AE410	Expert Talk Series-4	-	-	-	1	1	1
11	VAC*	U24CH411*	Environmental Studies*	2*	1*	-	2*	5*	3*
			Total:	10	5	10	34	59	23
Summer/ Inter-Sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				Mobile Application Development *(Supports Major and Minor Project works)*					1

**For Lateral Entry Students Only*

.

Training & Placement Basket		
S.No	Course Code	Course Title
1	U24VA406A	Quantitative Aptitude and Logical Reasoning
2	U24VA406B	Soft and Interpersonal Skills

Bridge Courses for exit:

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

OR

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

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

(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: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24EC411X	Data Analytics	2	-	2	-	4	3
2	PCC	U24EC412X	Machine Learning Fundamentals	2	-	2	-	4	3
3	PCC	U24EC413X	Essentials of Network security	2	-	2	-	4	3
4	PCC	U24EC414X	Introduction to Internet of Things	2	-	2	-	4	3
5	PCC	U24EC415X	Compiler Design Fundamentals	2	-	2	-	4	3
	PCC	U24CS214X	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 CSE: Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE416X	Software Testing with Selenium (NSIC Course)	-	-	6	-	6	3
2	SEC	U24SE417X	Dot Net Programming (NSIC Course)	-	-	6	-	6	3
3	SEC	U24SE418X	Android App Development (NSIC Course)	-	-	6	-	6	3
4	SEC	U24SE419X	CCNA: Switching Routing and Wireless essentials	-	-	6	-	6	3
5	SEC	U24SE420X	Tableau: Data Analytics (NASSCOM futureskills course)	-	-	6	-	6	3
6	SEC	U24SE421X	IoT Foundation (NASSCOM futureskills course)	-	-	6	-	6	3
7	SEC	U24SE422X	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

Sl. 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	U24CS502	Machine Learning	2	1	2	5	10	4
3	PCC	U24CS503	Full Stack Development	2	1	2	5	10	4
4	PCC	U24CS504	Compiler Design	2	1	2	5	10	4
5	STE	U24ST505X	S&E Basket *	2	1	-	2	5	3
6	IKSC	U24IK506A	Essence of Indian Traditional Knowledge	2	-	-	2	4	2
7	SEC	U24SE507	Programming Skill Development Lab - 4	-	-	2	2	4	1
8	HSMC	U24MH508	Technical English	-	-	2	2	4	1
9	ELC	U24CS509	Seminar	-	-	-	2	2	1
10	AEC	U24AE510	Expert Talk Series-5	-	-	-	1	1	1
Total:				12	5	10	29	56	24
Additional Learning@: Maximum credits allowed for Honours /Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	29
Summer/ Inter-Sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-NiL-					

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

*** Dean AA will allot the courses S&E Basket, Management Course Basket, 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

Startups &Entrepreneurship Basket		
Sr. No.	Course Code	Course Title
1.	U24ST505A	Design Thinking
2.	U24ST505B	Innovative Product Design and Development
3.	U24ST505C	Entrepreneurship
4.	U24ST505D	Design Studio
5.	U24ST505Z	Any other course approved by BoS Chair and Dean AA

VI SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PEC	U24CS601	Program Elective –I / MOOCs-I	2	1	-	4	7	3
2	PCC	U24CS602	Cryptography & Network Security	2	1	-	4	7	3
3	PCC	U24CS603	Design and Analysis of Algorithms	2	1	2	5	10	4
4	ESC	U24IN604	Internet of Things	2	1	2	5	10	4
5	HSMC	U24MB605X	Management Course Basket	2	1	-	2	5	3
6	IKSC	U24IK606B	UHV-II	2	-	-	2	4	2
7	SEC	U24SE607	PSD Lab-05	-	-	2	2	4	1
8	ELC	U24CS608	Mini Project	-	-	2	2	4	1
9	AEC	U24AE609	Expert Talk Series-6	-	-	-	1	1	1
Total:				12	5	8	25	50	22
Additional Learning@: Maximum credits allowed for Honours/Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	27
Summer/ Inter-Sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				Digital Image Processing *(Supports Deep learning, Minor/Major Projects)*					1

#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 undergo a 2-Month Mandatory Research Internship-II(5 Credits) at respective department during the summer vacation after VI Semester.

Management Courses Basket		
Sr. No.	Course Code	Course Title
1.	U24MBA605A	Management Economics and Accountancy
2.	U24MBA605B	Industrial Psychology
3.	U24MBA605C	E-Commerce and Digital Marketing
4.	U24MBA605D	Organizational Behaviour
5.	U24MBA605Z	Any other course approved by BoS Chair and Dean AA

Bridge Courses for exit:

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

OR

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

C. After Third Year: (B. Tech (Vocational) in CSE)

(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: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24CS610X	Cloud computing Essentials	2	-	2	-	4	3
2	PCC	U24CS611X	Data Visualization with R programming	2	-	2	-	4	3
3	PCC	U24CS612X	Industrial IoT	2	-	2	-	4	3
4	PCC	U24CS613X	DevOps Development						
4	PCC	U24CS614X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

(OR)

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

Exit Option to Qualify B. Voc in CSE: Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE614X	Data Analytics using R Language (NSIC Course)	-	-	6	-	6	3
2	SEC	U24SE615X	AMOZON Web Services (NSIC Course)	-	-	6	-	6	3
3	SEC	U24SE616X	Augmented & Virtual Reality (NSIC Course)	-	-	6	-	6	3
4	SEC	U24SE617X	CCNA: Enterprise networking, security & automation	-	-	6	-	6	3
5	SEC	U24SE618X	Block Chain Application Developer (NASSCOM Futureskills course)	-	-	6	-	6	3
6	SEC	U24SE619X	Any other course approved by BoS Chair and Dean AA	-	-	6	-	6	3

(Note to HoDs on PCC: Under PCC the departments shall plan appropriate courses upto 6th semester covering GATE syllabus).

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE701XX	MOPEC Elective –II	2	1	-	3	6	3
2	PEC	U24CS702	Program Elective - II/ MOOCs-II	2	1	-	4	7	3
3	PCC	U24CS703	Cloud Computing	2	1	2	5	10	4
4	PCC	U24CS704	Deep Learning	2	1	-	4	7	3
5	PCC	U24CS705	Blockchain Technologies	2	1	-	4	7	3
6	ELC	U24CS706	Internship Evaluation*	-	-	2	-	2	1
7	ELC	U24CS707	Major Project, Phase-1 / Industrial Internship - 1	-	-	8	6	14	4
Total:				10	5	12	26	53	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 on the 2-Month Research internship-II.

VIII SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE801XX	MOPEC Elective –III	2	1	-	3	6	3
2	PEC	U24CS802	Program Elective - III / MOOCs-IV	2	1	-	4	7	3
3	PEC	U24CS803	Program Elective - IV / MOOCs-V	2	1	-	4	7	3
4	ELC	U24CS804	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	22	22	23	23	24	22	21	15	172

MULTIDISCIPLINARY OPEN ELECTIVE COURSES (MOPEC) BASKETS:

There are three slots for MOPEC Courses (5th , 7th & 8th semesters). Students can opt any four courses (one course per semester under MOPEC slot) from the available 19 MOPEC Baskets.

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

Course code to be followed for all MOPEC courses:

U	2	4	O	E	X	0	1	C	E	A
URR24 Curriculum			MOPEC Elective		Semester in which MOPEC opted (5/7/8)	1st Subject in that Semister		MOPECs offered by CE Dept.		Serial Order

(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 Testing Methodologies
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	U24OEX01CSZ	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	U24OEX01CHZ	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

PROGRAM ELECTIVE COURSES (PEC)

VERTICAL/ PE	PE1	PE2	PE3	PE4
VERTICAL 1: Artificial Intelligence	**U24CS601A: Natural Language Processing**	**U24CS702A: Robotic Process Automation**	**U24CS802A: Computer Vision**	**U24CS803A: Augmented Reality**
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 2: Data Science	**U24CS601B: Data Mining**	**U24CS702B: Big Data Analytics**	**U24CS802B: Data Visualization**	**U24CS803B: Social Network Analysis**
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 3: Cloud Computing	**U24CS601C: Parallel Computing Algorithms**	**U24CS702C: Edge & Fog Computing High**	U24CS802C: **DevOps Engineering**	**U24CS803C: Quantum Computing**
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 4: Cyber Security	**U24CS601D: Cyber Security Essentials**	**U24CS702D: Ethical Hacking**	**U24CS802D: Cybercrime investigation & Digital Forensics**	**U24CS803D: Web & Database Security**
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 5: Internet of Things	**U24CS601E: IoT Architecture & Protocols**	**U24CS702E: Industrial IoT**	**U24CS802E: Privacy & Security in IoT**	**U24CS802E: IoT Cloud Processing and Analytics**
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			

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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URR24: SYLLABI FOR I & II SEMESTERS
of
B.TECH COMPUTER SCIENCE & ENGINEERING

w.e.f. A.Y. 2024-25

I SEMESTER, B.TECH CSE (W.E.F. A.Y. 2024-25)

Stream – I

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
-	IKSC	U24IK100	U24SK100 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	U24PY102C	Engineering Physics *(for CSE)*	2	1	2	5	10	4
3	PCC	U24CS103	Computer Organization & Architecture	2	1	-	4	7	3
4	ESC	U24CS104	Programming for Problem Solving with C	2	1	2	5	10	4
5	ESC	U24EE105C	Basic Electrical Engineering	2	1	2	5	10	4
6	VAC	U24CY106	Environmental Studies	2	-	-	3	5	-
7	AEC	U24AE107	IDEA Lab Makerspace	-	-	2	2	4	1
8	ELC	U24EL108	Practicum-1	-	-	-	4	4	1
9	VAC	U24VA109XXXXX	SEA – I / SAA-1	-	-	-	2	2	1
10	AEC	U24AE110	Expert Talk Series-1	-	-	-	1	1	1
			Total:	12	5	8	37	62	22
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-NiL-					

Pool – I (Physics)		
S. No.	Course Code	Course Title
1.	U24PY102A	Engineering Physics *(for Civil Engineering)*
2.	U24PY102B	Engineering Physics *(for ECIE)*
3.	U24PY102C	Engineering Physics *(for CSE)*
4.	U24PY102D	Engineering Physics *(for EEE)*
5.	U24PY102E	Engineering Physics *(for ECE)*

Pool – II (Basic Electrical & Electronics Engineering)		
S. No.	Course Code	Course Title
1.	U24EE105A	Basic Electrical and Electronics Engineering *(for Civil Engineering)*
2.	U24EE105B	Basic Electrical Engineering *(Common to ECE and ECI)*
3.	U24EE105C	Basic Electrical Engineering *(for CSE)*
4.	U24EE105D	Basic Electrical Engineering *(for EEE)*

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-Tangentplane 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

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

1. https://youtu.be/4EYko9rdF7g?si=WUu12 *NPTEL Video Lecture on Infinite series by Prof. S.K.Ray, Professor of Mathematics, IITK Kanpur.*
2. https://youtu.be/0apMXhWG_W8?si=M-abw2Gq3buX5HLM *NPTEL Video Lecture on Fundamental mean value theorems by Prof. Jithedra Kumar, Professor of Mathematics, IITK Kharagpur.*
3. https://youtu.be/6r5jfT8xrXM?si=ryLXYVJr4-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**	**PSO1**	**PSO 2**
CO1	**U24MH101.1**	2	2	1	1	-	-	-	-	-	-	1	1	-
CO2	**U24MH101.2**	2	2	1	1	-	-	-	1	1	-	1	1	-
CO3	**U24MH101.3**	2	2	1	1	-	-	-	1	1	-	1	1	-
CO4	**U24MH101.4**	2	2	1	1	-	-	-	1	1	-	1	1	-
U24MH101		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENGINEERING PHYSICS *(for CSE)*			
Class: B.Tech. I- Semester		**Branch: CSE**	
Course Code:	**U24PY102C**	**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): *magnetization, 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

Textbook(s):

1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, *A Text Book of Engineering Physics,* S. Chand & Company Ltd, 11th Edn., 20182018 (Unit-I, II & III- Chapter 5, 6, 27, 41, 42, 44 & 47)
2. S Salivahanan, N Suresh Kumar, *Electronic devices and circuits,* Mc Graw Hill Edn., 2017 (Unit-IV-Chapter 4, 5 & 6)
3. Michael Nielsen and Isaac Chuang, *Quantum Computation and Quantum Information,* Cambridge University Press, 2010 (Unit-III-Chapter 1.1, 1.2 & 1.3)

Reference Book(s):

1. Neil Gershenfeld, *Physics of Information Technology*, Cambridge University 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 Limited, 5th Edn., 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):		U24PY102C- ENGINEERING PHYSICS (*for CSE)*												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**U24PY102C.1**	2	1	1	-	-	1	1	1	1	-	1	1	-
CO2	**U24PY102C.2**	2	1	-	-	-	1	1	1	1	-	1	1	-
CO4	**U24PY102C.4**	2	1	-	-	-	1	1	1	1	-	1	1	-
CO5	**U24PY102C.5**	2	1	-	-	-	1	1	1	1	1	1	1	-
CO6	**U24PY102C.6**	2	1	1	-	1	1	1	1	2	-	1	1	-
CO7	**U24PY102C.7**	2	1	-	-	1	1	1	1	2	-	1	1	-
CO8	**U24PY102C.8**	2	1	-	-	1	1	1	1	2	-	1	1	-
U24PY102C		**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.5**	**1**	**1**	**1**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

COMPUTER ORGANIZATION AND ARCHITECTURE

Class: B.Tech. I- Semester		**Branch: CSE**	
Course Code:	**U24CS103**	**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: digital computer operations, logic circuits and data representation methods
LO2: the instruction set architecture and basic processing unit concepts
LO3: computation of arithmetic operations and various types of memories
LO4: input-output organization and pipeline processing in computer systems

THEORY COMPONENT

UNIT-I	**9 Hrs**

Digital Computers: Introduction to computers, Functional units, Basic operational concepts of a computer, Performance

Data Representation: Binary number system, Octal and hexadecimal numbers, Decimal representation, Alphanumeric representation

Digital Logic Circuits: Logic gates-symbols and truth tables, Map simplification, Flip flops, Registers

Self Learning Topics (SLTs): *Computer types(Text1: topics 1.1), Historical perspective(Text1: topics 1.7), Universal logic gates(Text2: topics 2.3), Don't care conditions (Text2: topics 2.4),Practice problems (Text2:Prob 2.4,Prob 2.8,Prob 2.9)*

UNIT-II	

Instruction Set Architecture: Memory locations and addresses, Memory operations, Instructions and instruction sequencing, Addressing modes

Basic Processing Unit: Fundamental concepts, Instruction execution, Hardware components, Instruction fetch and execution steps, Control signals

Self Learning Topics (SLTs): *Decimal representation(Text2: topics 4.1), Practice problems(Text2: Prob 4.5,Prob 4.7,Prob 4.10), Assembly language notation(Text1: topics 2.5.3), Solved problems(Text 1: Prob 2.1,Prob 2.2,Prob 2.3), Practice problems (Text1: Prob 2.1, Prob 2.2, Prob 2.3)*

UNIT-III	**9 Hrs**

Arithmetic: Addition and subtraction of signed numbers, Multiplication of numbers, Integer division

The Memory System: Basic concepts, Semiconductor RAM memories- Internal organization of memory chips, Static memories, Dynamic RAMs; Read-only memories, Memory hierarchy, Cache memories, Direct memory access, Performance considerations

Self Learning Topics (SLTs): *Addition/Subtraction logic unit(Text1:topics 9.1.1),Solved problems (Text1: Prob 9.2, Prob 9.4),Practice problems (Text1: Prob 9.2, Prob 9.4, Prob 9.9), Solved problems(Text1:Prob 8.3, Prob 8.4,Prob 8.5),Practice problems(Text1:Prob 8.3,Prob 8.5)*

UNIT-IV	9 Hrs

Input-Output Organization: Input-output interface- I/O bus and interface modules, I/O versus memory bus, Isolated versus memory-mapped I/O, Asynchronous data transfer-Strobe control, Handshaking

Pipeline Processing: Pipelining, Arithmetic pipeline, Instruction pipeline

Self Learning Topics (SLTs): *Asynchronous serial transfer(Text2: topics 12.3),Practice problems (Text2:Prob 12.1,Prob 12.8,Prob 12.10,Prob 12.29), Pipeline hazards(Text 2: topics:10.4),Practice problems (Text2: Prob 10.3, Prob 10.9, Prob 10.11)*

Course Learning Outcomes (COs):

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

CO1: examine the study of the basic structure and operation of a digital computer operations and performance, data representation methods, and digital logic circuit analysis.

CO2: analyze instruction execution, addressing modes, hardware components, and control mechanisms in processors.

CO3: apply ALU operations on positive and negative numbers and analyze the features of various types of memory.

CO4: analyze I/O interfaces, bus systems, data transfer methods, and pipeline processing concepts.

Textbook(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", McGraw-Hill Education, 6th Edition, ISBN-9789355323729, 2023.(ChapterNos.1,2,5,7,8,9)

M. Morris Mano, "Computer System Architecture", Revised Third Edition, Pearson Education, ISBN: 978-93-325-8560-7, 2019. (ChapterNos.9,10,11,12,14)

Reference Book(s):

1. B Ram, Sanjay Kumar, "Computer Fundamentals: Architecture and Organization", *New Age International Publishers*, 5th Edition, ISBN: 978-81-224-3610-5,2018.
2.W. Stallings, "Computer Organization and Architecture - Designing for Performance", 7th Edition, Pearson Education, ISBN 978-81-7758-993-1,2009.

Web and Video link(s):

1. **https://youtu.be/Kn5ipjXJvpQ?si=qsl9paRizepEmRZ5;** ***NPTEL Video Lecture on Fast Addition , Multiplication by Prof. Anshul Kumar, Professor of CSE ,IIT Delhi***
2. **https://youtu.be/CSkN0wj0zZU?si=suwgssCvvwvTIytn;** ***NPTEL Video Lecture on DMA transfer by Prof. Jatindra Kumar Deka, Professor of CSE, IIT Guwahati.***

Course Articulation Matrix (CAM):		**U24CS103 COMPUTER ORGANIZATION AND ARCHITECTURE**												
CO		**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO10**	**PO11**	**PSO1**	**PS O2**
CO1	**U24CS103.1**	2	2	2	1	-	1	-	-	-	-	1	1	2
CO2	**U24CS103.2**	2	2	2	1	-	1	-	-	-	-	1	1	2
CO3	**U24CS103.3**	2	2	2	1	-	1	-	-	-	-	1	1	2
CO 4	**U24CS103.4**	2	2	1	1	-	1	-	-	-	-	1	1	2
U24CS103		**2**	**2**	**1.75**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

PROGRAMMING FOR PROBLEM SOLVING WITH C

Class: B.Tech. I -Semester		**Branch:** Common to all branches	
Course Code:	**U24CS104**	**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

13. Programs using input output functions, operators (arithmetic, relational and conditional)
14. Programs using operators (bit-wise, logical, increment and decrement)
15. Programs using conditional control structures: if, if-else, nested if
16. Programs using else if ladder, switch and goto statements
17. Programs using loop control structures: while
18. Programs using loop control structures: do-while and for
19. Programs on one dimensional array and two-dimensional arrays
20. Programs on String operations and string handling functions
21. Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
22. Programs using structures, unions, pointers to arrays and pointers to strings
23. Programs using array of pointers and pointers to structures
24. Programs on File operations and file handling functions for sequential text files

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

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

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

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

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

CO3: develop string operations and modular programming with functions

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

(based on psychomotor skills acquired from laboratory component)

CO5: develop programs using operators and decision making statements

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

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

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

Course Articulation Matrix (CAM):		**U24CS104: 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	**U24CS104.1**	2	1	1	1	-	-	-	1	-	1	2	1	2
CO2	**U24CS104.2**	2	2	2	1	-	-	-	1	-	1	2	2	2
CO3	**U24CS104.3**	2	2	3	1	-	-	-	1	-	1	2	2	2
CO4	**U24CS104.4**	2	2	3	2	-	-	-	1	-	1	2	2	2
CO5	**U24CS104.5**	1	1	1	1	1	-	-	1	1	1	2	1	2
CO6	**U24CS104.6**	1	2	2	2	1	-	-	1	1	1	2	2	2
CO7	**U24CS104.7**	1	2	3	2	1	-	-	1	1	1	2	2	2
CO8	**U24CS104.8**	1	2	3	2	1	-	-	1	1	1	2	2	2
U24CS104		**1.5**	**1.75**	**2.25**	**1.5**	**1**	**-**	**-**	**1**	**1**	**1**	**2**	**1.75**	**2**

BASIC ELECTRICAL ENGINEERING

Class: B.Tech. I -Semester		**Branch:** CSE	
Course Code:	U24EE105 C	**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

Textbook(s):

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

Reference Book(s):

4. B.L.Thereja, A.K.Thereja, *Electrical Technology Vol. I & II* , S.Chand & Company Ltd, Edition , 2005.
5. Edward Hughes, *Electrical & Electronics Technology* , Pearson Education, 10th Edition., 2010.
6. D. P. Kothari and I. J. Nagrath, *Basic Electrical Engineering* , Tata McGraw Hill, Edition , 2010.
7. Chakravarthy A, Sudhipanath and Chandan Kumar, *Basic Electrical Engineering* , Tata McGraw Hill Ltd, Edition, 2009.

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

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

CO2: apply suitable network theorems to analyze DC circuits

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

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

(based on psychomotor skills acquired from laboratory component)

CO5: validate mesh and nodal analysis

CO6: validate network theorems

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

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

Course Articulation Matrix (CAM):		**U24EE105C : 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**	**PS O1**	**PSO 2**
CO1	**U24EE105C.1**	2	1	-		-	-	1	1	1	1	**1**	1	1
CO2	**U24EE105C.2**	2	2	-	-	-	-	1	1	1	1	**1**	1	1
CO3	**U24EE105C.3**	3	3	1	1	1		1	1	1	1	**1**	1	1
CO4	**U24EE105C.4**	3	3	1	1	1	1	1	1	1	1	**1**	1	1
CO5	**U24EE105C.5**	2	1	-	-	-	-	1	1	1	1	**1**	1	1
CO6	**U24EE105C.6**	2	2	-	-	-	-	1	1	1	1	**1**	1	1
CO7	**U24EE105C.7**	3	3	1	1	1		1	1	1	1	**1**	1	1
CO8	**U24EE105C.8**	3	3	1	1	1	1	1	1	1	1	**1**	1	1
U24EE105C		**2.5**	**2.25**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENVIRONMENTAL STUDIES

Class: B.Tech. I Semester		**Branch:** Common to CE, EEE, ECIE, ECE & CSE	
Course Code:	**U24CY106**	**Credits:**	**0**
Hours/Week (L-T-P-O-E):	**2-0-0-5-7**	**CIE:**	**60%**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

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's control measures

LO4: environmental legislation and green methodology

UNIT-I	**6 Hrs**

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

Natural Resources: Forest Resources-Use and over exploitation of forests, Deforestation, Timber extraction, Mining, Dams and their effects on forests and tribal people**;** Water Resources-Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water**;** Mineral Resources-Environmental effects of extracting and using mineral resources**;** Energy Resources-Renewable and non-renewable energy sources, Use of alternate energy sources

Self Learning Topics (SLTs): *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	**6 Hrs**

Ecosystem and Biodiversity:

Ecosystem: Concepts of an ecosystem, Food chain, Food webs, Ecological pyramids, Energy flow in the ecosystem and ecological succession

Biodiversity and its Conservation: Introduction, Definition, Genetic, Species and ecosystem diversity, Value of biodiversity, Biodiversity in India, Hot spots of biodiversity, Man-wildlife conflicts, Endangered and endemic species of India; In-situ and Ex-situ conservation

Self Learning Topics (SLTs): *Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)*

UNIT-III	**6 Hrs**

Environmental Pollution: Global issues**-**Global climatic change, Greenhouse gases, Effects of global warming, Ozone layer depletion

International Conventions/Protocols: Earth summit, Kyoto protocol, Montreal protocol **Environmental Pollution-**Causes and effects of air, Water, Soil, Marine and noise pollution with case studies

Solid and Hazardous Waste Management: Introduction, Types, Effects of urban industrial and nuclear waste

Natural Disaster Management: Introduction to disaster, Management of disaster, Disaster management of flood, earthquake, cyclone and landslides

Role of information technology in environment and human health

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

UNIT-IV	6 Hrs

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

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

Green Methodology: Principles of green chemistry, Green methods in electronic production, Impact of electronic waste on public health and environment

The Sustainable Development Goals (SDGs): United Nations Sustainable Development Goals

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

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

1. https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ch27/ *video lecture on renewable energy resources by Prof. Vaibhav. V. Goud and Dr. R. Anandalakshmi, Dept. Of Chemical Engineering, Guwahati.*
2. https://sdgs.un.org/goals; UN's webpage on 17 sustainable Development Goals
3. **https://onlinecourses.nptel.ac.in/noc23_hs57/preview** United Nations sustainable Development Goals

Course Learning Outcomes (COs):

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

CO1: identify the natural resources and practice their usage more equitably
CO2: develop an action plan for sustainable alternatives and conserving biodiversity
CO3: examine and perceive the solutions for the environmental pollution
CO4: adapt issues involved in enforcement of environmental legislation and green methodology

Course Articulation Matrix (CAM):		**U24CY106 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	**U24CY106.1**	2	1	2	1	-	2	1	1	1	-	-	-	-
CO2	**U24CY106.2**	-	-	2	-	-	1	1	1	1	1	-	-	-
CO3	**U24CY106.3**	1	2	1	-	-	1	1	1	1	1	1	-	-
CO4	**U24CY106.4**	-	-	1	-	-	1	1	1	1	-	1	-	-
U24CY106		**1.50**	**1.50**	**1.50**	**1.00**	**-**	**1.25**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**-**	**-**

IDEA Lab Makerspace

Class: B.Tech. I & II -Semester		**Branch:** Common to all branches	
Course Code:	**U24AE107 / 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):

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

Course Learning Outcomes (COs):

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

(based on psychomotor skills acquired from laboratory component)

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

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

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

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

Course Articulation Matrix (CAM):		**IDEA Lab Makerspace**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO 2**
CO1	**U24AE107.1**	2	2	1	1	2	1	1	2	2	-	1	1	-
CO2	**U24AE107.2/**	2	2	1	1	2	1	1	2	2	-	1	1	-
CO3	**U24AE107.3**	2	2	1	1	2	1	1	2	2	-	1	1	-
CO4	**U24AE107.4**	2	2	1	1	2	1	1	2	2	-	1	1	-
U24AE107		**2**	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**-**	**1**	**1**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

II SEMESTER B.TECH CSE (W.E.F. A.Y. 2024-25)

Stream-I

Sl. 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	U24CY202C	Engineering Chemistry *(for CSE)*	2	1	2	5	10	4
3	PCC	U24CS203	Operating Systems	2	1	-	4	7	3
4	ESC	U24CS204	Data Structures Through C	2	1	2	5	10	4
5	HSMC	U24MH205	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA206	Sports & Yoga	-	-	2	2	4	1
7	ESC	U24ME207	Engineering Graphics Through CAD*	-	-	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	U24VA210	SEA-2 / SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
			Total:	10	4	10	36	60	22
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				Unix shell programming *(Supports Computer Network and Complier Design courses)*					1

*** For CE and ME, it will be a three (03) credit (1-0-4) course on Engineering Graphics & Design (Pedagogy: Sessions with conventional drafter and CAD).**

Pool – III (Chemistry)		
S. No.	Course Code	Course Title
1.	U24CY202A	Engineering Chemistry *(for Civil Engineering)*
2.	U24CY202B	Engineering Chemistry *(for ECIE)*
3.	U24CY202C	Engineering Chemistry *(for CSE)*
4.	U24CY202D	Engineering Chemistry *(for EEE)*
5.	U24CY202E	Engineering Chemistry *(for ECE)*

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

Textbook(s):

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

Reference Book(s):

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

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**	**PSO1**	**PSO 2**
CO1	**U24MH201.1**	2	2	1	1	-	-	-	1	1		1	-	-
CO2	**U24MH201.2**	2	2	1	1	-	-	-	1	1		1	-	-
CO3	**U24MH201.3**	2	2	1	1	-	-	-	1	1		1	-	-
CO4	**U24MH201.4**	2	2	1	1	-	-	-	1	1		1	-	-
U24MH201		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**		**1**	**-**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENGINEERING CHEMISTRY (*for CSE*)

Class: B.Tech. II-Semester		**Branches:** CSE	
Course Code:	**U24CY202C**	**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, Specific conductance, Equivalent conductance, Effect of dilution; Conductometric titrations-Acid base titrations-Strong acid vs strong base, Strong acid vs weak base, Weak acid vs strong base, Weak acid vs weak base, Advantages of conductometric titrations; Galvanic cell, Electrode potential, Electrochemical series, Nernst equation; Potentiometric titrations-Acid base titrations and advantages of potentiometric titrations

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-Ion exchange method, Desalination processes, 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-Cathodic protection-Impressed current cathodic protection, Sacrificial anodic protection

Self Learning Topics (SLTs): *Units of hardness (Text 1: 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; Nanoscale materials-Fullerenes, Carbon nanotubes and Graphene, Properties and applications, Biosensors

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

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 Edn., 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 Edn., Dhanpat Rai Publishers, 2003
3. S.S. Dara, S.S. Umare, *A Text book of Engineering Chemistry*, 12th Edn., S. Chand & Company Ltd.,2010

Web and Video link(s):

ps://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 of nanomaterial and polymer

Course Articulation Matrix (CAM):		**U24CY202C-ENGINEERING CHEMISTRY (*for CSE*)**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO 2**
CO1	**U24CY202C.1**	2	-	-	-	1	1	1	-	1	-	1	-	-
CO2	**U24CY202C.2**	2	-	-	-	1	1	1	-	1	-	1	-	-
CO3	**U24CY202C.3**	2	-	-	-	1	1	1	-	1	-	1	-	-
CO4	**U24CY202C.4**	2	-	-	-	1	2	1	-	1	-	1	-	-
CO5	**U24CY202C.5**	2	1	-	-	-	1	1	-	1	-	1	-	-
CO6	**U24CY202C.6**	2	1	-	-	2	1	1	-	1	-	1	-	-
CO7	**U24CY202C.7**	2	1	-	-	-	1	1	-	1	-	1	-	-
CO8	**U24CY202C.8**	2	1	-	-	-	1	1	-	1	-	1	-	-
U24CY202C		2	1	-	-	-	1	1	-	1	-	1	-	-
3 – HIGH, 2 – MEDIUM, 1 - LOW														

OPERATING SYSTEMS

Class: B.Tech. II -Semester		**Branch:** CSE	
Course Code:	**U24CS203**	**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: operating system services and its structure
LO2: scheduling and process synchronization techniques
LO3: deadlocks, memory management and virtual memory techniques
LO4: file system organization , disk management and protection techniques

UNIT-I	**9 Hrs**

Introduction: What operating systems do, Operating-system operations, Process management, Computing environments

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

Process Concept: Process concept, Interprocess communication

Self Learning Topics (SLTs): *Dual mode and multi mode operation (Text1: topics 1.5.1), Mobile computing and distributed systems (Text1: topics 1.11.2,1.11. 3), File management and device management (Text1: topics 2.4.2,2.4.3), Hybrid systems (Text1: topics 2.7.5), Threads (Text1: topics 3.1.4), Message-passing systems (Text1: topic 3.4.2)*

UNIT-II	**9 Hrs**

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms – first- come first serve, Shortest-job-first, Priority, Round-robin

Synchronization: Background, The critical-section problem, Peterson's solution, Synchronization hardware, Mutex locks, Semaphores, Monitors

Self Learning Topics (SLTs): *Practice problems (Text1: Prob 6.3, 6.16, 6.17), Deadlocks and starvation and priority inversion (Text1: topics 5.6.3, 5.6.4), Implementing a monitor using semaphores (Text1: topic 5.8.3)*

UNIT-III	**9 Hrs**

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

Memory Management: Background, Swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table-hierarchical paging, Hashed page tables, Inverted pagetables

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

Self Learning Topics (SLTs): *No preemption and circular wait (Text1: topics 7.4.3, 7.4.4), Detection-algorithm usage (Text1: topics 7.6.3), Resource preemption (Text1: topics 7.7.2), Dynamic loading and dynamic linking and shared libraries (Text1: topics 8.1.4, 8.1.5), Practice problems (Text1: Prob 7.3, 7.8, 7.9, 7.22, 7.23), Practice problems (Text1: Prob 9.8, 9.21, 9.30).*

UNIT-IV	**9 Hrs**

File System: File concept, Access methods, Directory structure, Implementing file systems - Allocation methods, Free space management.

Mass Storage Structure: Overview of mass storage structure, Disk structure, Disk scheduling, Disk management, Swap-space management.

System Protection: Goals of protection, Principles of protection, Domain of protection.

Self Learning Topics (SLTs): *Solid state disks and magnetic tapes (Text1: topics 10.1.2, 10.1.3), File types and file structure (Text1: topics 11.1.3, 11.1.4), Practice problems (Text1: Prob 10.11), An Example: UNIX, An example: MULTICS (Text1: topics 14.3.2, 14.3.3)*

Course Learning Outcomes (COs):

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

CO1: build the operating system services and system calls
CO2: analyze CPU scheduling and synchronization algorithms
CO3: assess the deadlock related problems and memory management issues
CO4: develop the file, disk and system protection techniques

Textbook(s):

3. Abraham Silberschatz , Peter B Galvin, Gerg Gagne, "*Operating System Concepts*", Wiley , 10thEdition, ISBN-978-1-119-32091-3, 2018.

Reference Book(s):

1. Ekta Walia, "*Operating System Concepts*", Khanna Publishers, Delhi, 2nd Edition, ISBN-10: 9789380016658, ISBN-13: 978-9380016658,2019.
2. Dhananjay M. Dhamdhere, "*Operating Systems A Concept-Based Approach*", McGraw Hill Education, ISBN-10: 0072957697 ISBN-13: 978-0072957693,2008
3. William Stalling, "*Operating Systems*", Maxwell, McMillan International Editions, ISBN 81-203-1187-6, 1992.

Web and Video link(s):

1. https://www.youtube.com/watch?v=jciGIvn7UfM&list=PLyqSpQzTE6M9SYI5RqwFYtFYab94gJpWk; *NPTEL Video Lecture on Introduction to Operating Systems By Prof. Chester Rebeiro, IIT Madras.*

Course Articulation Matrix (CAM):		**U24CS203 OPERATING SYSTEMS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO2**
CO1	**U24CS203.1**	2	1	2	1	-	-	-	1	-	-	2	2	2
CO2	**U24CS203.2**	3	2	2	2	-	-	-	-	-	-	2	2	2
CO3	**U24CS203.3**	3	2	2	2	2	-	-	-	-	1	2	2	2
CO4	**U24CS203.4**	2	2	2	1	2	1	-	1	-	1	1	2	2
U24CS203		2.5	1.75	2	1.5	2	1	-	1	-	1	1.75	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

DATA STRUCTURES THROUGH C

Class: B.Tech. II –Semester		**Branch:** CSE	
Course Code:	**U24CS204**	**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.

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

3. *Data Structures through C Laboratory Manual and Record Book,* Department of CSE, 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):		**U24CS204 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	**U24CS204.1**	2	2	2	1	-	-	1	-	1	-	1	2	1
CO2	**U24CS204.2**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	**U24CS204.3**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	**U24CS204.4**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO5	**U24CS204.5**	2	2	2	1	-	-	1	1	1	-	1	2	1
CO6	**U24CS204.6**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO7	**U24CS204.7**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO8	**U24CS204.8**	2	2	2	2	-	-	1	1	1	-	2	2	2
U24CS204		**2**	**2**	**2**	**1.75**	**-**	**-**	**1**	**1**	**1**	**-**	**1.75**	**2**	**1.75**

ENGLISH COMMUNICATION AND REPORT WRITING

Class: B.Tech. I & II –Semesters		**Branch:** Common to all branches	
Course Code:	**U24MH205**	**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.

Textbook(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):		**U24MH205: 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	**U24MH205.1**	-	-	-	-	-	1	2	2	2	-	2	-	-
CO2	**U24MH205.2**	-	-	-	-	-	1	2	2	2	-	2	-	-
CO3	**U24MH205.3**	-	-	-	-	-	1	2	2	2	-	2	-	-
CO4	**U24MH205.4**	-	-	-	-	-	1	2	2	2	-	2	-	-
U24MH205		**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**2**	**-**	**2**	**-**	**-**
1-LOW 3 – HIGH, 2 – MEDIUM,														

SPORTS /YOGA

Class: B.Tech. II-Semester		**Branch: All UG Branches**	
Course Code:	**U24VA206**	**Credits:**	**1**
Hours/Week(L-T-P-O-E):	**0-0-2-2-4**	**CIE (%):**	**60**
Total Number of Teaching Hours:	**130Hrs (13weeksX10 hours)**	**ESE (%):**	**40**

Course Learning Objectives (LOs): This course Sports/Yoga will enable students to:

LO1: know about Yoga and its Benefits

LO2: develop skills and techniques of various Sports &Games.

LO3: inculcate Sportsman spirit.

LO4: all round development of the students to meet the requirements of the society.

Sports and Games

List of Sports and Games

1. Badminton
2. Basket Ball
3. Chess
4. Carrom
5. Foot Ball
6. Table Tennis
7. Volley Ball
8. Cricket
9. Hand Ball
10. Kabaddi
11. Kho-Kho
12. Yoga Aasanas

Textbook(s):

1. Badminton for Schools – Author -Jake Downey, Publisher - S.Chand & Company Ltd., Ram Nagar, New Delhi-110055. Length : 159 Pages.
2. Basketball Skills & Rules – Author – O.P.Sharma, Publisher – Khel Sahitya Kendra, 4264/3, Ansari Road, Darya Ganj, New Delhi-110002, Length : 166 pages.
3. Title. How to Reassess Your Chess: Chess Mastery Through Chess Imbalances. Author:Jeremy Silman, Edition, 4, illustrated, reprint, Publisher : Silman-James Press, 2010, ISBN.1890085138, 9781890085131, Length : 658 pages, Subject :Games & Activities ,General.
4. Football Skills & Rules – O.P.Sharma, Publisher – Khel Sahitya Kendra, 4264/3, Ansari Road, Darya Ganj, New Delhi-110002, Length : 215 pages.
5. Teaching & Coaching Table Tennis – Author – Deepak Jain, Publisher – Khel Sahitya Kendra, WP-474, Ist Floor, Shiv Market, Ashok Vihar, Delhi-1100052, Length : 196 pages.
6. Volleyball for Schools, Author – Dave James, Publisher - S.Chand & Company Ltd., Ram Nagar, New Delhi-110055. Length : 125 Pages.
7. Yoga Education, Author – Dr.Tarak Nath Pramanik, Publisher – India's First Publisher & Asia's No.1 Stockist of Physical Education & Sports Books, 7/26, Ground Floor, Ansari Road, Daryaganj, New Delhi-110002, Length : 347 pages.
8. Indian Cricket ,1999 compiled by G.VISWANATH,53rd Edition,Pblished by Kasturi &Sons Limited ,Chennai-600002, Length : 784 pages.
9. Health And Fitness, Author – Dr.A.K.Srivastava, Sports Publication, 7/26, Ground Floor, Ansari Road, Darya Ganj, New Delhi-110002, Length : 72 pages.
10. Modern Kabaddi, AuthorE .Prasad Rao, Published by D.V.S New Delhi-110019.

ReferenceBook(s):

1. Rules and Skills of Games and Sports, Author – B.K.Chaturvedi, Publisher – Goodwill Publishing House, B-9, Rattan Jyoti, 18 Rajendra Place, New Delhi – 110008 (India)
2. Dare To Be A Champion.Lee Chong Wei (Brand), Genres**Biography**
3. 199 pages, Paperback,First published July 1, 2012
4. This edition,Format,199 pages, Paperback,Published,January 1, 2012 by Bukuganda Digital & Publication,ISBN,9789671084328,ASIN,967108432X,Language,English.
5. ***The Book of Basketball: The NBA According to the Sports Guy*** is the second book by former ESPN columnist Bill Simmons.[1] Published in 2009, it covers the history of the National Basketball Association (NBA). In 2019, Simmons launched a sequel podcast series, **Book of Basketball 2.0**, which analyzes the evolution of the league since the book was published.
6. Title. How to Reassess Your Chess: Chess Mastery Through Chess Imbalances. Author:Jeremy Silman, Edition, 4, illustrated, reprint, Publisher : Silman-James Press, 2010, ISBN.1890085138, 9781890085131, Length : 658 pages, Subject :Games & Activities ,General.
7. The Stars of Football: The World's Best Players Kindle Edition by Rodolphe Gaudin (Author) Format: Kindle Edition, Games & Activities / Chess, Games & Activities / General
8. The Complete Volleyball Handbook Kindle Edition, by Bob Bertucci (Author), Makoto Katsumoto (Author), Yasumi Nakanishi (Author), Toshiaki Yoshida (Author) Format : Kindle Edition. 4.5.4.5 out of 5 stars 15 ratings.
9. Cricket skills& Rules, Author.V.Thani,khel sahitya Kendra ,4264/3,Ansari Road,Darya Ganj,New Delhi-110002. Length : 202 pages
10. Health Exercise And Fitness, Author – J.P.Muller, Sports Publication, WP-474, 1st Floor, Shiv Market, Ashok Vihar, Delhi -110052, Length : 117 Pages.
11. Yogic Science, Author – Dr.T.Thangamani, Dr.T.Godwin Vedanayagam Rajkumar, Publisher - Physical Education & Sports Books, 7/26, Ground Floor, Ansari Road, Daryaganj, New Delhi-110002, Length : 274 pages.

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 …

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.

ESE-40. .CIE-60.

		Grade-P (50%)	Grade-D (60%)	Grade-C (70%)	Grade-B (80%)	Grade-A (90%)	Grade-S (100%)
50 mts / 30 mts (Sprint)	Women	11sec above	10-11 sec	9-10 sec	8-9 sec	7-8 sec	7 sec below
		5	6	7	8	9	10
	Men	11sec above	10-11 sec	9-10 sec	8-9 sec	7-8 sec	7 sec below
		5	6	7	8	9	10
Jump (Standing Broad Jump)	Women	0.90 – 1 mts	1.00 – 1.25 mts	1.25 – 1.50 mts	1.5 – 1.75 mts	1.75 – 2 mts	2 mts above
		5	6	7	8	9	10
	Men	1.50 – 1.7 mts	1.7 – 1.9 mts	1.90 – 2.1 mts	2.30 – 2.1 mts	2.5 – 2.7 mts	2.70 mts above
		5	6	7	8	9	10
Throw (Shot-put)	Women	3.5-4.0mts	4.0-4.5mts	4.5.5.0mts	5.0-5.5mts	5.5-6.0mts	6.0-6.5mts
		5	6	7	8	9	10
	Men	4.0-5.0mts	5.0-6.0mts	6.0-7.0mts	7.0-8.0mts	8.0-9.0mts	9mts above
		5	6	7	8	9	10
Yoga Aasanas (Surya Namaskaras)	Women	2 repetition (12min)	3 repetition (18min)	4 repetition (24min)	5 repetition (30min)	6 repetition (36min)	7 repetition (42min)
		5	6	7	8	9	10
	Men	2 repetition (12min)	3 repetition (18min)	4 repetition (24min)	5 repetition (30min)	6 repetition (36min)	7 repetition (42min)
		5	6	7	8	9	10

		Grade-P	Grade-D	Grade-C	Grade-B	Grade-A	Grade-S
	Attendance %	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
	Marks	10	12	14	16	18	20
	Performance in Regular Participation in classes : 15						
	Performance in Selected Event : 25						

Course Articulation Matrix (CAM):		**U24VA206 Sports / Yoga for all UG Branches**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO 2**
CO1	**U24VA206**	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	**U24VA206**	-	-	-	-	-	-	-	1	-	-	-	-	-
CO3	**U24VA206**	-	-	-	-	-	-	2	-	-	-	-	-	-
CO4	**U24VA206**	-	-	-	-	-	-	-	-	1	-	1	-	-
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENGINEERING GRAPHICS THROUGH CAD			
Class: B. Tech. II –Semester		**Branch:** Common to all (except CE & ME)	
Course Code:	**U24ME207**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-2-2-4**	**CIE :**	**100 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE :**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

LABORATORY COMPONENT

List of Experiments

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

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs)

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

CO1: draw projections of points and straight lines inclined to one plane with Auto CAD.

CO2: develop the projections of planes using Auto CAD

CO3: construct the projections of solids and sections of solids using Auto CAD

CO4: create orthographic and isometric projections and develop the simple electrical and electronic circuit using Auto CAD

Course Articulation Matrix (CAM): U24ME207 ENGINEERING GRAPHICS THROUGH CAD														
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24ME207.1**	2	1	1	-	2	-	1	-	2	-	1	-	-
CO2	**U24ME207.2**	2	1	1	-	2	-	1	-	2	-	1	-	-
CO3	**U24ME207.3**	2	1	1	-	2	-	1	-	2	-	1	-	-
CO4	**U24ME207.4**	2	1	1	-	2	-	1	-	2	-	1	-	-
U24ME207		**2**	**1**	**1**	**-**	**2**	**-**	**1**		**2**	**-**	**1**	**-**	**-**

Bridge Courses for exit after B.Tech I Year

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

OR

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

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

(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: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24CS211X	Java Programming	2	-	2	-	4	3
2	PCC	U24CS212X	Database Management	2	-	2	-	4	3
3	PCC	U24CS213X	Fundamental of Python Programming	2	-	2	-	4	3
4	PCC	U24CS214X	Computer Aided Software Engineering	2	-	2	-	4	3
5	PCC	U24CS215X	Web Designing	2	-	2	-	4	3
6	PCC	U24CS216X	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: Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE211X	Advanced Excel (NSIC Course)	-	-	6	-	6	3
2	SEC	U24SE212X	Web Development (NSIC course)	-	-	6	-	6	3
3	SEC	U24SE213X	Linux (NSIC course)	-	-	6	-	6	3
4	SEC	U24SE214X	Oracle SQL/PLSQL Programming (NSIC course)	-	-	6	-	6	3
5	SEC	U24SE215X	CCNA: Computer Networks Essentials	-	-	6	-	6	3
6	SEC	U24SE216X	Power BI (NASSCOM futureskills course)	-	-	6	-	6	3
7	SEC	U24SE217X	Foundational Course in Cyber Security (NASSCOM futureskills course)	-	-	6	-	6	3
8	SEC	U24SE218X	Any other skill-based course approved by BoS Chair and Dean AA	-	-	6	-	6	3

JAVA PROGRAMMING

Class: B.Tech. I Yr- (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS211X**	**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…

LO5: java programming data types, operators, control statements, classes and objects

LO6: java methods, constructors and strings

LO7: types of inheritances and interfaces

LO8: packages, streams (I/O), exceptional handling

THEORY COMPONENT

UNIT-I	**4 Hrs**

Java Basics: History and evolution of java, 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, Variable length arguments, Constructors, Overloading constructors, Garbage collection, *static* variables, *static* blocks and *static* methods, Nested and inner classes, Command line arguments, Wrapper classes.

Strings: Exploring String, StringBuffer, StringBuilder, and StringTokenizer classes.

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, Interfaces can be extended.

UNIT-IV	**4 Hrs**

Packages: Packages, Access protection, Importing packages.

Using I/O: I/O basics, 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*.

LABORATORY COMPONENT

List of Experiments

13. Write programs to demonstrate different operators, control structures , switch statement, one dimensional and two-dimensional arrays in java.
14. Develop programs to demonstrate class and object concepts, inner classes, garbage collection and static keyword.
15. Write programs on command line arguments and wrapper classes
16. Write programs on String, StringBuffer and StringTokeneizer classes
17. Develop programs on different types of inheritances
18. Develop programs on abstract classes

19. Write programs to implement interfaces
20. Write programs to implement packages
21. Develop programs on Exception handling
22. Develop programs on files

Textbook(s):

1. Herbert Schildt, *Java The Complete Reference*, McGraw-Hill Education India Pvt. Ltd, 9th edition , 2014

Reference Book(S):

4. Kathy Sierra, Bert Bates, *Head First Java,* , O'Reilly Publications, 2nd Edition , 2013
5. Uttam Roy K., *Advanced JAVA Programming*, Oxford Publications; 1st edition, 2013

Laboratory Manual (for laboratory component):

2. *Object Oriented Programming through Java laboratory manual and Record Book* Department of CSE

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 java object-oriented concepts in problem solving
CO2: develop java methods, constructors, and strings
CO3: apply reusability concepts like inheritance, dynamic method dispatch, and interfaces
CO4: develop packages, apply streams (I/O) and exception handling

(based on psychomotor skills acquired from laboratory component)

CO5 : implement java object-oriented concepts
CO6 : implement java methods, constructors, and strings
CO7 : apply reusability concepts like inheritance, dynamic method dispatch, and interfaces
CO8 : implement packages, apply streams (I/O) and exception handling

Course Articulation Matrix (CAM):								**U18CS211X Java Programming**					
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
U18CS211X.1	1	1	1	1	-	-	-	-	1	-	-	1	1
U18CS211X.2	2	2	2	1	-	-	-	-	1	-	2	2	1
U18CS211X.3	2	2	2	1	-	-	-	-	1	-	2	2	1
U18CS211X.4	2	2	2	1	-	-	-	-	1	-	2	2	1
U18CS211X.5	2	2	2	1	-	-	-	-	1	-	-	2	2
U18CS211X.6	2	2	2	1	-	-	-	-	1	-	2	2	2
U18CS211X.7	2	2	2	1	-	-	-	-	1	-	2	2	2
U18CS211X.8	2	2	2	1	-	-	-	-	1	-	2	2	2
U18CS211X	**1.87**	**1.87**	**1.87**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**1.87**	**1.62**
3 – HIGH, 2 – MEDIUM, 1 - LOW													

DATABASE MANAGEMENT

Class: B.Tech. I Yr- (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS212X**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**3-0-0-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**32 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: SQL queries involved in the design and implementation of a database management system

LO2: physical and logical database designs, database modelling and different database models

LO3: distinct normalization techniques on database systems and query optimization technique

LO4: database structure and build up essential DBMS concepts like database security, data integrity and concurrency control

THEORY COMPONENT

UNIT-I	**4 Hrs**

Databases and Database Users: Introduction, Characteristics of the database approach, Actors on the scene, Workers behind the scene, Advantages of using a DBMS, when not to use a DBMS.

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-II	**4 Hrs**

Data modelling 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.

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

UNIT-III	**4 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.

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

UNIT-IV	**4 Hrs**

Introduction to Transaction Processing Concepts and Theory: Introduction to transaction processing, Transaction and system concepts, Desirable properties of transactions, Characterizing Schedules Based, Characterizing Schedules Based on Serializability.

Concurrency Control Techniques: Two-Phase Locking techniques for concurrency control, Concurrency control based on Timestamp Ordering.

LABORATORY COMPONENT

List of Experiments

23. Queries using DDL, DML, TCL and DCL commands.
24. Queries on column level and table level constraints.
25. Queries using built-in functions of NUMBER, CHARACTER, DATE Datatypes.
26. Queries on Data type conversion functions, single row functions and operators.
27. Queries on aggregate functions.
28. Queries on joins and nested queries.
29. Write sample PL/SQL programs using conditional, iterative statements and cursors.
30. Write PL/SQL programs to handle exceptions.
31. Write PL/SQL programs using stored procedures and functions.
32. Write PL/SQL programs for creating packages and triggers.

Textbook(s):

1. Ramez Elmasri and Shamkanth B. Navathe, "Fundamentals of Database Systems", *Pearson Education*, 6thEdition, ISBN-13: 978-0-136-08620-8,2010.

Reference Book(S):

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems ", *McGraw-Hill Education*, 3rd Edition, ISBN-13: 978-0072465631,2002.
2. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", *McGraw-Hill Education,* 3rd Edition, ISBN: 0-07-114810-8, 1997.
3. Thomas Connolly and Carolyn Begg, "Database Systems", *Pearson Education*, 3rdEdition, ISBN: 81-7808-861-4,2003.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc22_cs91/preview; *NPTEL Video Lecture on Database Management System by Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay | IIT Kharagpur*

Laboratory Manual (for laboratory component):

1. Database Management Systems Laboratory Manual, *Prepared by the faculty of Department of CSE.*

Course Learning Outcomes (COs)

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

(based on cognitive skills acquired from theory component)

CO1: *design the database management system effectively*
CO2: *design the databases, which includes Enhanced Entity Relationship model.*
CO3: *optimize the database by using normalization and query optimization techniques to avoid redundancy and maintain the performance of database.*
CO4: *manage multi-level security, correctness of data and control over access on database.*
(based on pragmatic skills acquired from laboratory component)
CO5: *execute SQL queries using DDL/DML/TCL/DCL commands to create and manipulate data in database by enforcing constraints*
CO6: *implement various database objects using SQL queries*

CO7: *implement block structured programming with cursors to enable traversal over the records of the database*

CO8: *implement pre-compiled stored programs, run-time errors checking, database objects collection in PL/SQL packages and high-level security using triggers*

Course Articulation Matrix (CAM):		**U24CS212 DATABASE MANAGEMENT**												
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**	**PSO2**
CO1	**U24CS212X.1**	2	2	2	2	1	-	-	-	1	-	2	2	2
CO2	**U24CS212X.2**	2	2	2	2	1	-	-	-	1	-	3	3	3
CO3	**U24CS212X.3**	2	2	2	2	1	-	-	-	1	-	2	2	2
CO4	**U24CS212X.4**	2	2	2	2	1	-	-	-	1	-	3	2	2
CO5	**U24CS212X.5**	2	2	2	2	2	-	-	1	1		2	1	2
CO6	**U24CS212X.6**	2	2	2	2	2	-	-	1	1		2	1	2
CO7	**U24CS212X.7**	2	2	2	2	2	-	-	1	1		2	1	3
CO8	**U24CS212X.8**	2	2	2	2	2	-	-	1	1		2	1	3
U24CS212		**2**	**2**	**2**	**2**	**1.5**	**-**	**-**	**0.5**	**1**	**-**	**2.2**	**2.6**	**2.35**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

FUNDAMENTALS OF PYTHON PROGRAMMING

Class: B.Tech. I Yr- (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS213X**	**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 programming operators, control statements & functions
LO2: namespaces, modules, string handling methods & collections
LO3: object oriented programming, files & database
LO4: Numpy and Pandas

THEORY COMPONENT

UNIT-I	**4 Hrs**

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

UNIT-II	**4 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

UNIT-III	**4 Hrs**

Data Structures: Sequences, Lists, Tuple, Sets, Dictionaries

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

Database Connectivity: Database browser for SQLite, creating a database table, Insert and retrieve data from database

UNIT-IV	**4 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

LABORATORY COMPONENT

List of Experiments

1. Python installation, path verification and running python script on command prompt
2. Python programs on control statements and iterative statements
3. Python programs on functions, variable arguments and lambda functions
4. Python programs on implementing modules and namespaces
5. Python programs on collections: Strings and Regular expressions
6. Python programs on collections: List, Tuples, Sets and Dictionaries
7. Python programs on implementing object-oriented programming
8. Python programs on File operations and exception handling
9. Python programs to implement database connectivity
10. Python programs to demonstrate Numpy Package and related operations

Textbook(s):

1. Reema Thareja, *Python Programming using problem solving approach*, New Delhi: Oxford University Press, 2017.
2. Jake VanderPlas, *Python Data Science Handbook- Essential Tools for Working with Data*,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*, 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*,New York City: Apress, 2005

Web and Video link(s):

ps://onlinecourses.nptel.ac.in/noc24_cs113/preview; *NPTEL Video Lecture on The Joy of Computing using Python by Prof. Sudarshan Iyengar, Professor of CSE, IIT Ropar.*

Laboratory Manual (for laboratory component):

1. *Python Programming laboratory manual,* 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: apply python control statements, operators and functions for problem solving
CO2: develop programs using collections, namespaces, packages &strings
CO3: analyse object-oriented programming principles, files & databases
CO4: apply packages like Numpy or Pandas for statistical analysis& data handling

(based on psychomotor skills acquired from laboratory component)

CO5: develop python programs using operators, control statements &functions
CO6: implement packages, string handling methods and collections
CO7: build new classes, create objects, perform operations on files and databases
CO8: develop statistical & data handling applications using packages Numpy and Pandas

Course Articulation Matrix (CAM):

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	**U24CS213X.1**	2	2	1	1	2	1	-	-	1	-	-	2	1
CO2	**U24CS213X.2**	2	2	2	1	2	1	-	-	1	-	-	2	1
CO3	**U24CS213X.3**	2	2	2	2	2	1	-	-	1	-	2	3	2
CO4	**U24CS213X.4**	2	2	2	2	3	1	-	1	1	-	2	2	2
CO5	**U24CS213X.5**	2	2	2	2	2	-	-	1	1	-	-	2	2
CO6	**U24CS213X.6**	2	2	2	2	2	-	-	1	1	-	-	2	2
CO7	**U24CS213X.7**	2	2	2	2	2	-	-	2	1	-	1	3	3
CO8	**U24CS213X.8**	3	2	2	2	3	-	-	2	1	-	2	2	3
U24CS213X		**2..1**	**2**	**1.8**	**1.75**	**2.25**	**0.5**	**-**	**0.875**	**1**	**-**	**0.87**	**2.25**	**2**

3 – HIGH, 2 – MEDIUM, 1 - LOW

COMPUTER AIDED SOFTWARE ENGINEERING

Class: B.Tech. I-Yr (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS214X**	**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: software and software process models
LO2: software requirement, design concepts and patterns
LO3: software design principles and test strategies
LO4: software quality and risk management

THEORY COMPONENT

UNIT-I	**4 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

UNIT-II	**4 Hrs**

Requirements Engineering Tasks: Requirements analysis and modeling strategies, User requirement, System requirement, Software requirementsdocument

Design Engineering: Design within the context of software engineering, Design process, Design concepts, The design model

Architectural Design: Creating an architectural design - Software architecture, Architectural genres, Architectural styles, Architectural design, Assessing alternative architectural designs.

UNIT-III	**4 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, The testing process, Content testing, User interface testing, Component-level testing, Navigation testing, Configuration testing, Security testing,Performance testing

UNIT-IV	**4 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

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

LABORATORY COMPONENT

List of Experiments

Experiment-I

- Project scheduling using Microsoft project management tool
- Project estimation using Microsoft project management tool

Experiment-II

Construct Use case and Class diagrams for the following

- Online shopping
- Banking system
- Cab dispatching system

Experiment-III

Construct Collaboration and Sequence diagrams for the following

- Librarian issues books to student
- Mobile phone

Experiment-IV

Construct Activity and State chart diagrams for the following.

- ATM transaction
- Ticket machine
- Credit card processing

Experiment-V

- Case study: Develop class diagram of Unified library application and model it in different views i.e. logic view, component view, deployment view, database design and perform forward & reverse Engineering

Experiment-VI

- Manual testing: Take any system (e.g. ATM system) and study its system specifications and report the various bugs

Experiment-VII

- Introduction to Selenium Testing Tool
- Exploring Features of Selenium

Experiment-VIII

- Test a web application using Selenium in NetBeans IDE

Experiment-VIII

- Test a web application using Selenium in Net

Experiment-IX

- Working with Selenium Integrated Environment-Execution of IDE Commands
- Selenium IDE locating strategies (validation of GUI components)

Experiment-X

- Selenium IDE test case execution
- Implement GUI tests (a web application's User Interface) using Selenium IDE

Textbook(s):

1. Roger S.Pressman and Bruce R.Maxim, "*Software Engineering: A Practitioner's Approach*" , 9th ed., NewDelhi: McGraw Hill, 2020

Reference Book(S):

1. Ian Sommerville, "*Software Engineering*", 10th ed., Delhi:Pearson Education, 2020
2. Deepak Jain, "*Software Engineering: Principles and Practices*", 3rd ed., Delhi: Oxford University Press, 2008
3. PankajJalote, "*Software Engineering: A Precise Approach*", NewDelhi:Wiley India, 2010
4. Waman S. Jawadekar, "*Software Engineering: A Primer*", NewDelhi:TataMcgraw Hill, 2008

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc24_cs119/announcements?force=true; *NPTEL Video Lecture on Software Engineeringby Prof. Rajib Mall is Professor, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur*

Laboratory Manual (for laboratory component):

1. *CASE Tools Laboratory Manual*, 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: design the appropriate software model for a given application
CO2: develop different types of software designs & patterns
CO3: apply an appropriate testing method for a software application
CO4: asses the quality of software and analyze the risk management in project scheduling

(based on psychomotor skills acquired from laboratory component)

CO5: create schedule, cost estimation of the software project using Microsoft project management tool, and construct analysis model using unified modelling approach
CO6: design a software system using unified modelling approach
CO7: test with Selenium tool to improve the quality of the project/product being developed
CO8: apply Test director and Test Link testing tools for traceability and test management

Course Articulation Matrix (CAM):		U24CS214X SOFTWARE ENGINEERING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CS214X.1	1	1	1	1	-	-	-	1	1	2	1	2	1
CO2	U24CS214X.2	1	1	1	1	-	-	-	1	1	2	1	1	1
CO3	U24CS214X.3	2	2	1	1	-	1	-	1	1	2	1	2	1
CO4	U24CS214X.4	2	2	2	2	-	1	-	1	1	2	1	2	1
CO5	U24CS214X.5	2	2	2	2	-	-	1	1	1	1	1	2	1
CO6	U24CS214X.6	2	2	2	2	2	-	1	1	1	1	1	2	2
CO7	U24CS214X.7	2	1	2	2	2	-	1	1	1	1	1	2	1
CO8	U24CS214X.8	1	2	2	2	2	-	1	1	1	1	1	2	2
U24CS214X		1.6	1.6	1.6	1.6	2.0	1.0	1.0	1.0	1.0	1.5	1.0	1.9	1.3
3 – HIGH, 2 – MEDIUM, 1 - LOW														

WEB DESIGNING

Class: B.Tech. I Yr (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS215X**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-0-2-0-4**	**CIE Marks (%):**	**50**
Total Number of Teaching Hours:	**32 Hrs**	**ESE Marks (%):**	**50**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: HTML Tags and CSS properties for designing a static webpage
LO2: JavaScript to design a dynamic webpage
LO3: PHP to develop server-side scripts for web applications
LO4: interoperation of PHP and MYSQL to build web applications

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.

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

UNIT-II	**4 Hrs**

JAVASCRIPT: JavaScript syntax, Embedding JavaScript in HTML page. Usage of variables, Working with operators, Control-flow statements, Functions and array, Creating objects, Handling events.

UNIT-III	**4 Hrs**

Introduction to PHP: Overview of PHP, Advantages of PHP over scripting languages, Creating and running a PHP script, handling errors. Working with variables and constants: Variables, Data types and operators. Controlling program flow: Conditional statements, Looping statements, Break, Continue and exit statements. Working with functions, Arrays.

UNIT-IV	**4 Hrs**

Database using PHP: Exploring relational database model, records and primary keys. Working with sql statements. Using PHP and MySql: Checking configuration, connecting to database, Selecting a database, Adding and altering a table in a database, Inserting and modifying data in a Table, Retrieving data from a table.

Working with Forms: Web forms and form elements, processing a web form, validating a web form.

LABORATORY COMPONENT

List of Experiments

1. Design the following static web pages with the following attributes:
   a. BasicTags., b. HeadingTags., c.List (Ordered andUn-Ordered).,d. Textbox,Buttons.
2. Design the following static web pages required for an online book store web

site.

HOMEPAGE, LOGINPAGE

3. The catalogue page should contain the details of all the books available in the web site in a table. The details should contain the following:

A. Snap shot of Cover Page. B. Author Name andPublisher.

4. Design a registration form and validate its field by using JavaScript.
5. To design the scientific calculator and make event for each button using JavaScript.
6. JavaScript program to validate username and password
7. Write a HTML file to create a simple form with 5 input fields (Name, Password, Email, Pin code, Phone No. and a Submit button) and demonstrate required field validations to validate that all input fields are required and display error messages if the above validations do not hold.
8. Design a server side script with functions and arrays in PHP
9. Design a PHP program to elicit different ways to connect to MySql
10. Create a Create, Read, Update, Delete operations for PHP Page using MySql

Textbook(s):

1. Kogent, "Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML", 1stEdition, Dreamtech Press (Black Book), ISBN-13:9789351192510,2013.

Reference Book(S):

1. *Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP", 4thEdition,BPB Publications,ISBN-13: 978-8183330084,2009,*
2. *UttamK.Roy, "Web Technologies", 7thEdition, Oxford Higher Education, ISBN-10: 0-19-806622-8, ISBN-13: 978-0-19-806622-4,2010*
3. *Luke Welling, Laura Thomson,"PHP and MySQL Web Development", 3rdEdition, Sams Publications, ISBN: 0-672-32672-8,2005*

Web and Video link(s):

Laboratory Manual (for laboratory component):

1. *Web Designing laboratory manual,* 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: design a static web pages using HTML Tags and CSS properties
CO2: design a dynamic web pages using JavaScipt.
CO3: develop web server side applications using PHP concepts
CO4: develop enterprise databases for web-based applications using PHP and MySQL. *(based on psychomotor skills acquired from laboratory component)*

CO5 : implementing HTML Tags and CSS for creating static web pages
CO6: design dynamic web page for web applications using JavaScript
CO7: design a web base application in PHP.
CO8 : creating different web applications using PHP and MySql

Course Articulation Matrix (CAM):		U24CS215X Web Designing												
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	PSO2
CO1	U24CS215X.1	2	2	2	1	2	1	1	2	1	2	1	2	2
CO2	U24CS215X.2	2	2	2	1	2	1	1	2	1	2	1	2	2
CO3	U24CS215X.3	2	2	2	1	2	1	1	2	1	2	1	2	2
CO4	U24CS215X.4	2	2	2	1	2	1	1	2	1	2	1	2	2
CO5	U24CS215X.5	2	2	2	1	2	1	1	2	1	2	1	2	2
CO6	U24CS215X.6	2	2	2	1	2	1	1	2	1	2	1	2	2
CO7	U24CS215X.7	2	2	2	1	2	1	1	2	1	2	1	2	2
CO8	U24CS215X.8	2	2	2	1	2	1	1	2	1	2	1	2	2
U24CS215X		**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**2**

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 తెలంగాణా, 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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URR24: SYLLABI FOR III & IV SEMESTERS
of
B.TECH COMPUTER SCIENCE & ENGINEERING

w.e.f. A.Y. 2024-25

III SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24CS301	Software Engineering	2	1	-	6	9	3
2	PCC	U24CS302	Theory of Computation	2	1	-	4	7	3
3	PCC	U24CS303	Advanced Data Structures	2	1	2	5	10	4
4	PCC	U24CS304	Computer Networks	2	1	-	4	7	3
5	PCC	U24CS305	Object Oriented Programming through JAVA	2	1	2	5	10	4
6	VAC	U24VA306A	Quantitative Aptitude and Logical Reasoning	2		-	2	4	2
7	SEC	U24SE307	Programming Skill Development Lab - 2	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
			Total:	12	5	6	35	58	23
Summer/ Inter-Sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				Data Structures through C* *(Supports Lateral Entry students in Advance data structures & DAA course)*					1*

**For Lateral Entry Students Only*

Training & Placement Basket		
S.No	Course Code	Course Title
1	U24VA306A	Quantitative Aptitude and Logical Reasoning
2	U24VA306B	Soft and Interpersonal Skills

SOFTWARE ENGINEERING

Class: B.Tech. III –Semester		**Branch:** CSE	
Course Code:	**U24CS301**	**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: software process models, agile development

LO2: software requirements modelling and software design diagrams

LO3: software quality assurance and software testing techniques

LO4: software metrics and risk management

UNIT-I	**9 Hrs**

Introduction to Software and Software Engineering: The nature of software, Defining the discipline, The software process, Software engineering practice

Software Process Models: A generic process model, Defining a framework activity, Prescriptive process models, Product and process

Agility and Process: What is agility, Agility and the cost of change, Agility principles, Scrum, The XP framework, DevOps

Modeling: Principles that guide practice- Core principles, Principles that guide each framework activity

Self Learning Topics (SLTs): *Process assessment and improvement (Text1: topic 2.4), Kanban (Text1: topic 3.5.2) Practice problems (Text1: Prob 1.2, 1.3, 1.6, Prob 2.2, 2.3, 2.4, 2.5)*

UNIT-II	**9 Hrs**

Understanding Requirements: Requirements engineering, Establishing the groundwork, Requirements gathering, Developing the use cases, Building the analysis model

Requirements Modeling: Requirements analysis, Scenario-based modeling, Class-based modelling, Functional modelling, Behavioral modeling

Software Design Concepts: The design process, The design model, UML design diagrams-Use case diagram, Activity diagram, Sequence diagram, State machine diagram, Class diagram, Component diagram, Deployment diagram; Architectural design- Software architecture, Architectural styles, Architectural decisions; Component-level design– Understanding a component, Designing class-based components, Conducting component-level design. Specialized component-level design

Self Learning Topics (SLTs): *Negotiating, monitoring & validating requirements (Text1: topics 7.6, 7.7, 7.8) The design process (Text1: topic 9.2) Architectural considerations (Text1: topic 10.4) (Text1: 7.3, 7.6) Design for mobility (Text1: topics 13.1, 13.2, 13.3, 13.8) Practice problems (Text1: Prob 7.1, 7.4, 7.5, Prob 8.1, 8.3, 8.4, Prob 10.1, 10.4, Prob 11.1, 11.7)*

UNIT-III	**9 Hrs**

Software Quality: Quality concepts- Quality factors, Quality assessment, software quality dilemma, Achieving software quality, Software quality assurance- Elements, SQA processes and product characteristics, SQA tasks, goals and metrics, Statistical software quality assurance, software reliability, The ISO 9000 quality standards

Software Testing- Component level: A strategic approach to software testing, Test-case design, White-box testing, Black-box testing, Object-oriented testing.

Software Testing-Integration level: Integration testing, Artificial intelligence and Regression testing, Integration testing in OO context, Validation testing, Testing patterns.

Self Learning Topics (SLTs): The software quality dilemma (*Text1: 15.3) The SQA plan (Text1: 17.9), Testing AI systems, Testing virtual environments (Text1: 21.10, 21.11) Practice problems (Text1: Prob 15.1,*

15.7, Prob 17.1, 17.7, Prob 19.6, Prob 20.2, 20.9)

UNIT-IV	**9 Hrs**

Software Configuration Management: The SCM scenario, Elements, Software configuration items, The SCM repository, Version control systems, The change management process

Software Metrics and Analytics: Software measurement, Product metrics, Metrics for testing, Metrics for maintenance, Process and project metrics, Metrics for software quality

Project Management Concepts: The management spectrum, People, Product, Process, Project, The W^5HHH principle

Risk Management: Reactive versus Proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Risk Mitigation, monitoring and management, The RMMM plan

Self Learning Topics (SLTs): *Mobility and agile change management (Text1: 22.6) Software analytics (Text1: 23.2) Tools-related trends (Text1: 29.6) Practice problems (Text1: Prob 22.3, 22.4, Prob 23.2, 23.3, 23.6, Prob 24.3, 24.6, 24.7, Prob 26.1, 26.3, 26.10)*

Course Learning Outcomes (COs):

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

CO1: analyze various SDLC models with respect to development time, cost, and flexibility to adapt to changing requirements

CO2: apply structured and object-oriented design principles to develop software solutions for real-world applications

CO3: apply appropriate software testing techniques to ensure software quality and reliability

CO4: assess software quality using standard metrics like lines of code, function points, cohesion, coupling, and defect density

Textbook(s):

1. Roger S. Pressman and Bruce R. Maxim, *Software Engineering- A Practitioner's Approach*, 9th ed. Chennai: McGraw Hill Education, 2023

Reference Book(s):

1. Ian Sommerville, *Software Engineering*, 10th ed. Noida: Pearson Education, 2017
2. Deepak Jain, *Software Engineering: Principles and Practices*, 3rd ed. Noida: Oxford University Press, 2017
3. Pankaj Jalote, *Software Engineering: A Precise Approach*, 1st ed. New Delhi: Wiley India, 2012
4. RajibMall, *Fundamentals of Software Engineering*, 5th ed. Delhi: PHI Learning, 2018

Web and Video link(s):

1. https://nptel.ac.in/courses/106105182 NPTEL course on Software Engineering by Prof. Rajib Mall, Department of CSE, IIT Kharagpur.

Course Articulation Matrix (CAM):		**U24CS301 SOFTWARE ENGINEERING**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CS301.1**	2	2	2	2	2	1	1	1	1	1	1	3	2
CO2	**U24CS301.2**	2	3	2	2	2	1	1	1	1	1	1	3	2
CO3	**U24CS301.3**	2	2	3	2	3	1	1	1	1	1	1	3	2
CO4	**U24CS301.4**	2	2	3	2	3	1	1	1	1	1	1	3	2
U24CS301		**2**	**2.25**	**2.5**	**2**	**2.5**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

THEORY OF COMPUTATION

Class: B.Tech. III -Semester		**Branch:** Computer Science & Engineering	
Course Code:	**U24CS302**	**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: formal notation for languages, finite automata and regular expressions
LO2: closure properties of regular languages, types of grammars and simplification of context-free grammar
LO3: normal forms for context-free grammars and pushdown automata
LO4: turing machine, undecidable problems and post's correspondence problem

UNIT-I	**9 Hrs**

Automata Theory: Introduction to finite automata, Structural representations and the central concepts of automata theory

Finite Automata: Deterministic finite automata, Non-deterministic finite automata, Finite automata with epsilon-transitions, Finite automata with output

Regular Expressions and Languages: Regular expressions, Finite automata and regular expressions, Applications of regular expressions, Optimization of deterministic finite automata based pattern matchers

Self Learning Topics (SLTs): *Alphabets and Strings and Languages (Text1: topics 1.5.1,1.5.2,1.5.3), Practice Problem (Text1: Prob 2.2.4, 2.2.5, 2.2.6), The Extended Transition Function (Text1: topics 2.3.3), Practice Problem (Text1: Prob 2.3.1, 2.3.3, 2.3.4), Lexical Analysis, Finding Patterns in text (Text1: topics 3.3.2, 3.3.3).*

UNIT-II	**9 Hrs**

Properties of Regular Languages: Proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of automata

Context-free Grammars and Languages: Chomsky classification of languages, Writing grammars, Context free grammars, Parse trees, Construction of syntax trees, Applications of context-free grammars, Ambiguity in grammars and languages, Using ambiguity grammars, Simplification of context-free grammars

Self Learning Topics (SLTs): *Applications of the Pumping Lemma (Text1: topics 4.1.2), Closure of Regular Languages under Boolean Operation (Text1: topics 4.2.1), Why the Minimized DFA can't be beaten (Text1: topics 4.4.4), Parser and the YACC Parser-Generator (Text1: topics 5.3.1, 5.3.2), Inherent Ambiguity (Text1: topics 5.4.4).*

UNIT-III	**9 Hrs**

Properties of Context-free Languages: Normal forms for context-free grammars, Pumping lemma for context-free languages, Closure properties of context-free languages, Decision properties of context-free languages

Pushdown Automata: Definition of the pushdown automaton, Deterministic pushdown automata, Languages of pushdown automata, Equivalence of pushdown automata and context- free grammar

Self Learning Topics (SLTs): *Application of the Pumping Lemma for CFL's (Text1: topics 7.2.3), Practice Problem (Text1: Prob 7.2.1, 7.2.2, 7.2.4), From Empty Stack to Final State, From Final State to Empty Stack (Text1: topics 6.2.3, 6.2.4), Practice problems (Text1: Prob 6.2.1, 6.2.2, 6.2.5), Practice problems (Text1: Prob 6.3.1, 6.3.3, 6.3.5), DPDA's and Context-Free Languages (Text1: topics 6.4.3), Practice problems (Text1: Prob 6.4.5, 6.4.2, 6.4.4).*

UNIT-IV	9 Hrs

Introduction to Turing Machines: Turing machine, Programming techniques for Turing machines, Extensions to the basic Turing machine

Undecidability: A language that is not recursively enumerable, An undecidable problem that is recursively enumerable, Undecidable problems about Turing machines, Post's correspondence problem

Self Learning Topics (SLTs): *Turing Machines and Halting (Text1: topics 8.2.6), Practice problems (Text1: Prob 8.2.1, 8.2.2), Subroutines (Text1: topics 8.3.3), Nondeterministic Turing Machines (Text1: topics 8.4.4), The Universal Language (Text1: topics 9.2.3), Practice problems (Text1: Prob 9.2.2, 9.2.4, 9.2.5),Practice problems(Text1: Prob 9.3.3, 9.3.4, 9.3.8), Completion of the proof of PCP Undecidability (Text1: topics 9.4.3), Practice problems (Text1: Prob 9.4.1, 9.4.3).*

Course Learning Outcomes (COs):

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

CO1: build formal notation for languages, finite automata and regular expressions

CO2: develop context-free grammars and prove the language is not regular

CO3: construct pushdown automata and convert CFG to CNF or GNF

CO4:design Turing machine and verify the given post's correspondence problem has a solution

Textbook(s):

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, *Introduction to Automata Theory, Languages and Computation*, 3rd ed. Hong Kong: Pearson Education Asia, 2013

Reference Book(s):

1. Mishra K. L. P, Chandrasekaran N, *Theory of Computer Science: Automata, Languages and Computation*, 3rd ed. New Delhi: PHI , 2012
2. Harry R. Lewis, Christos H. Papadimitriou, *Elements of the Theory of Computation*, 2nd ed. Hong Kong: Pearson Education Asia, 1998
3. Michael Sipser, *Introduction to the Theory of Computation*, 3rd ed. Boston: Cengage Learning, 2012
4. John Martin, *Introduction to Languages and the Theory of Computation*, 3rd ed. New York: McGraw-Hill, 2007

Web and Video link(s):

1. https://www.youtube.com/watch?v=77nkSUsQqJk&list=PL3-wYxbt4yCgBHUpwXDTLos3JStccGIax; *NPTEL Video Lecture on Theory of Computation By Prof. Raghunath Tewari, IIT Kanpur.*

Course Articulation Matrix (CAM): U24CS302 THEORY OF COMPUTATION

CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CS302.1	2	2	2	2	2	1	1	2	1	1	2	2	1
CO2	U24CS302.2	2	2	2	2	2	-	1	2	1	1	2	2	1
CO3	U24CS302.3	2	2	3	3	2	-	1	2	1	1	3	3	1
CO4	U24CS302.4	2	2	3	3	2	1	1	2	1	1	3	3	1
U24CS302		2	2	2.5	2.5	2	1	1	2	1	1	2.5	2.5	1

ADVANCED DATA STRUCTURES			
Class: B.Tech. III–Semester		**Branch:** CSE	
Course Code:	**U24CS303**	**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: trees, binary trees, expression trees, binary search trees, heap trees and threaded binary trees
LO2: height balanced binary tree, red-black tree, splay trees, B trees and B+ trees
LO3: interval trees, tries, sorting and searching techniques
LO4: graphs, string matching algorithms

THEORY COMPONENT

UNIT-I	9 Hrs

Trees: Basic terminologies, Definitions and concepts, Representations of binary tree, Operations on a binary tree
Types of Binary Trees: Expression tree, Binary search tree- Searching a binary search tree, Inserting a node into a binary search tree, Deleting a node from a binary search tree
Heap Trees: Representation of a heap tree, Operations on a heap tree- Insertion, Deletion
Threaded binary trees: Representation of threaded binary trees

Self Learning Topics (SLTs): *Formation of binary tree from its traversals (Text1: topic 7.4.3.2), Determining the Height of a Binary Search Tree(Reference1: topic 10.2.4), Practice problems (Text1: Prob 7.5, Reference1: Prob 9.11, Prob 9.12, Prob 9.13)*

UNIT-II	9 Hrs

Height Balanced Binary Tree: Definition, Adelson-Velsky and Landis (AVL) rotations, Insertion operation
Red-Black Tree: Definition of a red-black tree, Operation on a red-black tree-Insertion
Splay Tree: Definition. Operations on splay tree, Splaying operation
B Trees: B tree indexing, Operations on a B tree- Inserting, Deleting
B+ Tree Indexing: Searching, Inserting, B tree vs. B+ tree

Self Learning Topics (SLTs): *Huffman's trees (Refernce1: 9.5), AVL tree deletion (Text1: 7.5.5), Practice problem (Text1: 7.17)*

UNIT-III	9 Hrs

Interval Tree: Construction of interval trees
Trie Tree Indexing: Trie structure, Operations on trie, Applications of tree indexing
Sorting: Heap sort, Quick sort, Merge sort, Bitonic generator sort
Searching: Fibonacci search, Interpolation search

Self Learning Topics (SLTs): *Linked representation of binomial heap(Reference1: 12.2.1), operations of binomial heap(Reference1: 12.2.2),Jump search (Reference1: 14.3), Hashtree (http://originstamp.com/ blog/what-is-a-hash-tree-or-merkle-tree/)*

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 Matching Algorithms: Brute force method, Rabin-karp string matching algorithm, Knuth morris pratt(KMP) algorithm, Boyer-moore algorithm

Self-Learning Topics (SLTs): *Directed graphs(Reference1: 13.3.1), practice problems (Reference1: 13.18) String compression -Run Length Encoding (https://www.naukri.com/ code360/library /run-length-encoding)*

LABORATORY COMPONENT

List of Experiments

1. Program to perform following binary tree operations
   i) creation ii) insertion of a node iii) traversal using recursion
2. Program to perform following binary search tree traversal operations without recursion
   i) inorder ii) preorder iii) postorder iv) Spiral order
3. Program to perform following binary search tree operations.
   i) creation ii) insertion of a node iii) deletion of a node
4. Program to implement AVL tree construction
5. Program to implement search and insert operations on Trie
6. Program to implement the following sorting techniques.
   a) Heap sort
   b) Quick sort
7. Program to implement the following sorting techniques.
   a) Merge sort
   b) Bitonic generator sort
8. Program to implement the following search algorithms.
   a) Fibonacci search
   b) Interpolation search
9. Program to implement the following
   i) Graph Representations ii) Topological sort
10. Program to implement the following graph traversal techniques.
    i) Depth first search ii) Breadth first search
11. Program to implement following shortest path algorithms.
    i) Kruskal's Algorithm ii) Prim's Algorithm
12. Program to implement the following string matching algorithms.
    i) Knuth morris pratt algorithm
    ii) Boyer Moore algorithm
    iii) Rabin Karp algorithm

Text Book:

1. Debasis Samanta, *Classic Data Structures*, 2nd ed., Prentice Hall India, New Delhi, 2009 (*Chapters 7 to 11*)

Reference Book(s):

1. Reema Thareja, *Data Structures Using C, 2nd ed.,* New Delhi: Oxford University Press, 2014
2. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy*,5th ed., CareerMonk, 2017

Web and Video link(s):

https://nptel.ac.in/courses/106102064 ; *NPTEL Video Lecture on Data Structures and Algorithms Prof. Naveen Garg, IIT Delhi*

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. *Advanced Data Structures 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: apply binary trees and binary search trees to organise and retrieve the data

CO2: design AVL tree, red black tree and heap trees to optimize database queries

CO3: analyze the time complexities of different sorting and searching techniques

CO4: organize and retrieve the data using Graphs, spanning trees and string matching algorithms

(based on psychomotor skills acquired from laboratory component)

CO5: implement programs using binary trees and binary search trees to organise data efficiently

CO6: implement programs using AVL tree, Red black tree to optimise data storage

CO7: develop programs using sorting techniques on unsorted data and searching techniques for retrieve the data very effectively

CO8: implement Graphs and string manipulation algorithms to organize and retrieve the data

Course Articulation Matrix (CAM):		U24CS303 ADVANCED DATA STRUCTURES												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CS303.1	2	2	2	1	1	-	1	1	-	1	1	2	2
CO2	U24CS303.2	2	2	2	1	1	-	1	1	-	1	1	2	2
CO3	U24CS303.3	2	2	2	2	1	-	1	1	-	1	1	2	2
CO4	U24CS303.4	2	2	2	2	1	-	1	1	-	1	1	2	2
CO5	U24CS303.5	1	1	3	2	1	-	1	1	-	1	1	1	1
CO6	U24CS303.6	1	1	3	2	1	-	1	1	-	1	1	1	1
CO7	U24CS303.7	1	1	3	2	1	-	1	1	-	1	1	1	1
CO8	U24CS303.8	1	1	3	2	1	-	1	1	-	1	1	1	1
U24CS303		1.5	1.5	2.50	1.75	1	-	1	1	-	1	1	1.5	1.5

COMPUTER NETWORKS

Class: B.Tech. III –Semester		**Branch:** CSE	
Course Code:	**U24CS304**	**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 and network switching

LO2: data link and medium access control protocols

LO3: routing algorithms, congestion control algorithms and internetworking

LO4: transport and application layer protocols used in the networks

UNIT-I	**9 Hrs**

Introduction: Uses of computer networks, Types of Computer Networks, Network Technology from Local to Global , Network Protocols

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, Using the Spectrum for transmission, Digital modulation and multiplexing

Switching: Circuit and Packet switching (Chapters: *1.1, 1.2, 1.3, 1.5, 1.6, 2.1, 2.2, 2.3, 2.4.3, 2.4.4, 2.5.4)*

Self Learning Topics (SLTs): *Types of Wire - UTP, STP, Fiber Optic cables, Coaxial cables, Color codes for Ethernet cables. (Text2: Topics: Chapter2: Understanding Network Cabling), Practice Problems (Text2: Compare UTP vs STP cables in terms of shielding and usage scenarios. Then, design a small network using UTP cables and tests the network's performance using appropriate tools.)*

UNIT-II	**9 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: Channel allocation problem, ALOHA, Carriers sense multiple access, Collision free protocols, Limited contention protocol, Wireless LAN Protocols, Ethernet, Bluetooth, Data link layer switching (Chapters: *3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7)*

Self Learning Topics (SLTs): *Crimping (Text2: Topics: Chapter2: Crimping Ethernet cables, RJ45 connectors, Cable testers), Practice Problems (Text2: Create Ethernet cables using the T568A or T568B standard and check the integrity of a crimped Ethernet cable)*

UNIT-III	**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

Traffic Management at Network Layer: Congestion, Approaches to traffic management, Traffic aware routing, Admission control, Traffic throttling, Load shedding

Internetworking: How networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork routing, Packet fragmentation (Chapters: *5.1, 5.2, 5.3, 5.5)*

Self Learning Topics (SLTs): *Crimping Tools (Text2: Topics: Chapter3: Crimping tools, RJ45 connectors, Stripping cables), Practice Problems (Text2: Create multiple Ethernet cables with varying lengths and test them for functionality. Troubleshoot and repair a faulty Ethernet cable that is not passing the cable tester test. Additionally, compare the performance of different crimping tools when used with various types of cables.)*

UNIT-IV	9 Hrs

Network Layer In 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, Internet multicasting

Transport Layer: Transport services, Primitives, Elements of transport protocols – Addressing, Connection establishment and release, Error control and flow control, Multiplexing, Crash recovery, Congestion control, Internet transport protocols - UDP,TCP

Application Layer: Domain Name System (DNS), Electronic mail, World Wide Web

(Chapters: *5.7, 6.1, 6.2, 6.3, 6.4, 6.5, 7.1, 7.2, 7.3)*

Self Learning Topics (SLTs): *IP Addressing, Subnetting, Public vs Private IPs(Text2: Topics: Chapter5), Practice Problems (Text2: Perform IP subnetting for a given network and create subnets. Configure a static IP address for a device and test its connectivity. Additionally, compare IPv4 and IPv6 in terms of structure and usage.)*

Course Learning Outcomes (COs):

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

CO1: evaluate OSI and TCP/IP reference models with respect to operational framework and switching infrastructure.

CO2: analyze data link layer mechanisms and medium access control protocols for efficient communication.

CO3: apply routing and congestion control algorithms to optimize network performance.

CO4: analyze services provided by transport and application layer protocols in network communication.

Textbook(s):

1. Andrew S. Tanenbaum, David J. Wetherall, Nick Feamster, *Computer Networks*, 6th ed, London: Pearson Education, 2023.
2. Hallberg, Bruce, *Networking A Beginner's Guide*, 6th ed, USA: McGraw-Hill Osborne Media, 2013.

Reference Book(s):

1. William Stallings, *Data and Computer Communications*, 10th ed, USA:Pearson Education, 2014
2. Behrouz Forouzan, *Data Communication and Networking,* 5th ed, USA:Tata McGraw Hill, 2017
3. Larry L. Peterson, Bruce S. Davie, *Computer Networks,* 5th ed, USA:*Morgan Kaufmann Publishers.*, 2011
4. James F.Kurose and Keith W.Ross, *Computer Networking a Top-Down Approach,* 7th ed, USA: Pearson Education, 2016

Web and Video link(s):

1. *https://www.youtube.com/watch?v=O--rkQNKqls* ***Video Lecture on Computer Networks and Internet Protocol, Multiplication by Prof Soumya Kanti Ghosh & Prof Sandip Chakraborty, NPTEL IIT Kharagpur***

Course Articulation Matrix (CAM):		U24CS304 COMPUTER NETWORKS												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CS304.1	2	2	2	2	2	1	1	-	2	1	1	**1**	**1**
CO2	U24CS304.2	2	2	2	2	2	-	-	-	2	1	1	**1**	**1**
CO3	U24CS304.3	2	2	3	3	2	-	-	-	2	1	1	**2**	**1**
CO4	U24CS304.4	2	2	3	3	2	1	1	-	2	1	1	**1**	**1**
U24CS304		2	2	2.5	2.5	2	1	1	-	2	1	1	2.5	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Class: B.Tech. III –Semester		**Branch:** Common to All	
Course Code:	**U24CS305**	**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 paradigms and java programming constructs
LO2: classes, methods and strings
LO3: inheritance, dynamic method dispatch, interfaces and packages
LO4: exception handling, I/O and multi-threading

THEORY COMPONENT

UNIT-I	**9 Hrs**

Programming Paradigms: Procedural programming, Modular programming, Object oriented programming (OOP), Generic programming
Java Basics: The History and evolution of Java, An overview of java, Data types, Variables and arrays, Operators, Control statements
Introducing Classes: Class fundamentals, Declaring Objects, 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-Chapter 3)*

UNIT-II	**9 Hrs**

Classes and Methods: Overloading methods, *this* keyword, Passing and returning objects, Recursion, Variable length arguments, Constructors, Overloading constructors, Garbage collection, Static variables, Static blocks, Static methods, Nested and inner classes, Command line arguments, Wrapper classes
Strings: Exploring String, 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, Using *super*, Method overriding, Order of constructors Execution, Dynamic method dispatch, Abstract classes, *final* with inheritance, Object class
Interfaces: Defining an interface, Implementing interfaces, Nested interfaces, Variables in interfaces, Interfaces can be extended

Packages: Defining a package, 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, 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, Creating your own exception sub classes.*
Multithreading: Creating a thread, Creating multiple threads, Thread priorities, Synchronization, Interthread communication

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 java program 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*static*blocks.

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 java program 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* and demonstrate to import the *package* into any java program (Consider the behavior of all access specifiers).

Experiment-XI:

1. Develop a java program to demonstrate *try-catch* block.
2. Develop a java program 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 java program 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 *Interthreadcommunication*.

Textbook(s):

1. Herbert Schildt, *Java The Complete Reference*, 13th ed. New Delhi: McGraw Hill, 2024

Reference Book(s):

1. Balaguruswamy, *Programming with Java: A Primer*, 7th ed. New Delhi: McGraw Hill, 2023
2. KathySierra and BertBates, *Head First Java*, 2nd ed. Boston: O'Reilly Media, 2005
3. Harvey Deitel and Paul J. Deitel, *Java How to Program,* 11th ed. New Delhi: Pearson, 2018

Web and Video link(s):

https://nptel.ac.in/courses/106105191 *NPTEL Video Lecture on Java 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, 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 the strengths and limitations of various programming paradigms to determine their suitability for solving various programming problems in java

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

CO3: apply reusability concepts like inheritance, dynamic method dispatch, interfaces and packages to build java programs

CO4: develop java programs using I/O, file handling, exception handling and multithreading concepts

(based on psychomotor skills acquired from laboratory component)

CO5: develop java fundamental programs using operators, control structures and arrays

CO6*:* develop java programs using classes, constructors and various string concepts

CO7*:* build java programs on inheritance, dynamic method dispatch, interfaces and packages

CO8*:* develop java programs using I/O, exception handling and multithreading concepts

Course Articulation Matrix (CAM):		U24CS305: 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	U24CS305.1	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	U24CS305.2	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	U24CS305.3	2	2	3	2	1	-	-	-	-	-	1	2	2
CO4	U24CS305.4	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	U24CS305.5	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	U24CS305.6	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	U24CS305.7	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	U24CS305.8	1	2	3	2	2	-	-	1	1	-	1	2	2
U24CS305		**1.5**	**1.87**	**2.37**	**1.5**	**1.62**	**-**	**-**	**1**	**1**	**-**	**1**	**1.5**	**1.5**

QUANTITATIVE APTITUDE AND LOGICAL REASONING

Class: B.Tech. III -Semester & IV-Semester		**Branch:** Common to all Branches	
Course Code:	**U24VA306**	**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: solve arithmetic relationships and interpret data using mathematical models
CO2: apply the concepts of simple interest, compound interest, profit & loss, ages, permutations & probability to real world situations.
CO3: compare & categorize the quantitative information for making decisions.
CO4: evaluate the validity & possible biases in arguments presented in authentic contexts logically & sensibly

Textbook(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)*
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)*

Reference Book(s):

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

Course Articulation Matrix (CAM):		U24VA306A 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	PSO1	PSO2
CO1	U24VA306 .1	1	2	-	1	-	-	-	-	-	-	1	1	-
CO2	U24VA306 .2	1	2	-	1	-	-	-	-	-	-	1	1	-
CO3	U24VA306 .3	-	1	-	2	-	2	-	-	-	-	1	1	-
CO4	U24VA306 .4	-	1	-	2	-	2	-	-	-	-	1	1	-
U24VA306		1	1.5	-	1.5	-	2	-	-	-	-	1	1	-
3 – HIGH, 2 – MEDIUM, 1 - LOW														

IV SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24MH401	Discrete Mathematics and Probability Statistics	2	1	-	6	9	3
2	PCC	U24CS402	Web programming	2	1	2	5	10	4
3	PCC	U24CS403	Database Management Systems	2	1	2	5	10	4
4	PCC	U24CS404	Artificial Intelligence	2	1	-	4	7	3
5	PCC	U24CS405	Python Programming	2	1	2	5	10	4
6	VAC	U24VA406B	Soft and Interpersonal Skills@	-	-	2	2	4	1
7	SEC	U24SE407	Programming Skill Development Lab - 3	-	-	2	2	4	1
8	ELC	U24EL408	Practicum-4	-	-	-	4	4	1
9	VAC	U24VA409	SEA - 4 / SAA – 4	-	-	-	2	2	1
10	AEC	U24AE410	Expert Talk Series-4	-	-	-	1	1	1
11	VAC*	U24CH411*	Environmental Studies*	2*	1*	-	2*	5*	3*
			Total:	10	5	10	34	59	23
Summer/ Inter-Sem Bridge Courses (Approved by BoS and Dean, AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				Mobile Application Development *(Supports Major and Minor Project works)*					1

**For Lateral Entry Students Only*

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Training & Placement Basket		
S.No	Course Code	Course Title
1	U24VA406A	Quantitative Aptitude and Logical Reasoning
2	U24VA406B	Soft and Interpersonal Skills

DISCRETE MATHEMATICS AND PROBABILITY STATISTICS

Class: B.Tech. IV -Semester		**Branch:** Common to CSE, CSN, CSO & IT	
Course Code:	**U24MH401**	**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:* fundamentals of logic.
- *LO2:* elementary combinatorics and recurrence relations.
- *LO3:* various types of graphs, trees and their properties.
- *LO4:* correlation, regression, curve fitting, and probability distributions.

UNIT-I	**9 Hrs**

Foundation: Sets and operations on sets, Relations, Binary relations, Equivalence relations, Partial order relations, Hasee diagram and lattices, Digraphs, Adjacency matrices of binary relations.
Fundamentals of Logic: Propositions and connectives, Truth tables, Propositional functions, Logical inferences, First order logic, Predicate calculus and quantified logic.
Application: Transitive closure of a relation using Warshal's algorithm.

Self-Learning Topics (SLTs): *Monoids, Groups. (Ref 2: topic 3.2), Pigeonhole principle (Text 1: topic 1.7, problems1.7.13(2, 3, 4)), Mathematical Induction (Text 1: topic 1.10, problems 1.10.1, 1.10.3, 1.10.6)*

UNIT-II	**9 Hrs**

Elementary Combinatorics and Recurrence Relations: Basic concepts of permutations and combinations, Enumeration with unlimited repetition and applications, Enumeration with constrained repetitions and applications.
Generating function of sequences: Coefficients of generating function, Recurrence relations and its applications, Solutions of recurrence relations by method of substitution, Characteristic roots, Solving non-linear recurrence relations**.**
Application: Using recurrence relations find the computational complexity of binary search, Towers of Hanoi problem, and Sorting.

Self-Learning Topics (SLTs):
Solutions of recurrence relations by generating function method (Text 1, topic:3.4, problems: 3.4.4, 3.4.5)
Additional problems on recurrence relations (Text 1, topics:3.5 and 3.6, problems:3.5.5, 3.5.6, 3.6.6, 3.6.8, 3.6.10)

UNIT-III	**9 Hrs**

Graphs:
Basic concepts, Isomorphism, Sub graphs, Trees and their properties, Spanning trees, Binary trees, Planner graphs, Euler's formula, Multi graphs and Eulerian circuits, Hamiltonian graphs, Chromatic number, Four color problem.
Applications: Find the shortest path of a network problem.

Self-Learning Topics (SLTs): *Additional problems on* isomorphism *of two graphs (Text 1, topic:5.2, problems:5.2.3, 5.2.4, 5.2.5)*

UNIT-IV	**9 Hrs**

Statistics: Correlation, Rank correlation, Regression – Linear regression equations.
Curve Fitting: Method of least squares –fitting of (i) Straight line (ii) Second degree parabola.
Probability: Random variables, Discrete and continuous probability distributions, mean and variance of a distribution, Binomial distribution, Poisson distribution, Normal and Exponential distributions.
Applications: Fitting of Binomial distribution, Poisson distribution to the given real time data.

Self-Learning Topics (SLTs):

Review of the concepts of probability (Text2, topic:26.4 and 26.5, problems:26.15, 26.20, 26.25), Conditional probability and Bayes theorem (Text 2, topic:26.6, problems: 26.26, 26.27), Normal distribution (Text 2, topic:26.16, problems:26.45, 26.47, 26.48), Uniform, exponential distributions (Text 2, topic:26.19)

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: apply fundamentals of logic to solve various engineering problems
CO2: solve different types of enumeration problems and apply them to real-life scenarios
CO3: solve various graph theory problems and apply them to real-world applications
CO4: interpret the data using various statistical measures and probability distributions

Textbook(s):

1. Mott. J.L, Kandel. K and, Baker. T.P., *Discrete Mathematics for Computer Scientists*, 2nd ed., New Delhi: PHI,1999
2. Grewal, B.S., *Higher Engineering Mathematics*, 43rd ed., New Delhi: Khanna Publishers, 2017

Reference Book(s):

1. S.C. Gupta V.K. Kapoor, *Fundamentals of Mathematical Statistics,* 12th ed., New Delhi: Sultan Chand & Sons Educational Publishers, 2020
2. Jean-Paul Tremblay, Manohar R, *Discrete Mathematical Structures with Applications to Computer Science*, 1st ed., New York: McGraw-Hill, 1975.
3. Zohar Manna., *Mathematical Theory of Computation*,1st ed., New York: McGraw-Hill, 1974
4. C. L. Liu, *Elements of Discrete mathematics*, 3rd ed., New Delhi: Tata Mc. Graw Hill, 2008

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc25_cs26/course: *NPTEL Video Lecture on Discrete Mathematics by Prof. Sudarshan Iyengar, IIT Ropar*
2. https://onlinecourses.nptel.ac.in/noc25_ma33/preview?user_email=dsreddy.hari@gmail.com: *NPTEL Video Lecture on Introduction to Probability Theory and Statistics by Prof. S Dharmaraja, IIT Delhi*

Course Articulation Matrix (CAM):		**U24MH401: DISCRETE MATHEMATICS AND PROBABILITY STATISTICS**												
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	**U24MH401.1**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO2	**U24MH401.2**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO3	**U24MH401.3**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO4	**U24MH401.4**	2	2	1	1	-	-	-	1	1	-	1	2	1
U24MH401		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

Web Programming

Class: B.Tech. IV –Semester		**Branch: Common to all branches**	
Course Code:	**U24CS402**	**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: HTML, CSS, and JavaScript

LO2: dynamic web pages using advanced JavaScript, integrate with ReactJS

LO3: building modular web applications using React components and hooks

LO4: server-side web technologies JSP and connect applications with databases using JDBC

THEORY COMPONENT

UNIT-I	**9 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

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 and Array, Creating Objects, Handling Events

Self Learning Topics (SLTs): *Basic Tags (Text2: topics 4.5.1), Form controls (Text2: topic 4.6.5), Inline style sheet (Text2: topic 5.3.4), Arrays in JavaScript (Text2: topic 13.5).*

UNIT-II	**9 Hrs**

JavaScript for React: Declaring Variables : The const Keyword, The let Keyword, Template Strings Creating Functions: Function Declarations, Function Expressions, Default Parameters, Arrow Functions, Compiling JavaScript, Objects and Arrays: Destructuring Objects, Destructuring Arrays, Object Literal Enhancement ,The Spread Operator Asynchronous JavaScript: Simple Promises with Fetch, Async/Await, Building Promises Classes, ES6 Modules, CommonJS, Functional programming with JavaScript, Case study: Designing and building the Blog's user interface with real-world UI/UX designs and component architecture

Self Learning Topics (SLTs): *Declaring variables (Text3: topic 3.1) , Compiling JavaScript (Text3: topic 3.5), Recursion (Text3: topic 4.4)*

UNIT-III	**9 Hrs**

Fundamentals of React: Hello React, Requirements, Setting up a React Project, Meet the React, Component, React JSX, Lists in React, React Component Instantiation, React DOM, Handler Function in JSX, Callback Handlers in JSX, React Controlled Components, React Custom Hooks (Advanced), React Fragments, React Asynchronous Data, React Class Components, Styling in React: CSS in React, CSS Modules in React, SVGs in React, Case

study on designing blogs user interface with standard templates.

Self Learning Topics (SLTs): *Lists in React (Text4: topic-1.3) , React Controlled Components (Text4: topic 1.5), CSS in React (Text4: topic: 3)*

UNIT-IV	**9 Hrs**

JSP: Syntax and Semantics, JSP Development Model, Components of JSP page: Directives, Comments,Expressions, Scriptlets, Declarations, Implicit Objects, Standard Actions, Tag Extensions, A Complete JSP Example. Session and Thread Management: Session Tracking, Session API, Thread Management. Application Event Listeners

JDBC: Database access with JDBC, Overview, JDBC drivers, connecting to database with Driver Manager, Statement Interfaces: Statement, Prepared statement, Callable statement, Result Sets

Self Learning Topics (SLTs): *Scriptlets (Text2: topic 21.8.4), Standard Actions (Text2: topic 21.8.9), Prepared statement (Text2: topic 21.19).*

LABORATORY COMPONENT

List of Experiments

Experiment-I (Unit-1)

1. Design the following static web pages with the following attributes:
   a) Basic Tags.
   b) Heading Tags.
   c) List (Ordered and Un-Ordered).
   d) Textbox, Buttons.

Experiment-II (Unit-1)

2. HTML

AIM: Design the following static web pages required for an online book store web site.
   a) HOMEPAGE:
   b) LOGINPAGE
   c) CATALOGUE PAGE

DESCRIPTION:

a. HOME PAGE

The static home page must contain three frames.

•*Top frame:* Logo and the college name and links to Home page, Login page, Registration page,
Catalogue page and Cart page (the description of these pages will be given below).

•*Left frame:* At least four links for navigation, which will display the catalogue of respective links.
For e.g.: When you click the link "CSE" the catalogue for CSE Books should be displayed in the
Right frame.

•*Right frame:* The pages to the links in the left frame must be loaded here. Initially this page contains description of the website.

Logo	Website Name			
Home	Login	Registration	Catalogue	Cart
CSE ECE EEE	*Description of website*			

CIV	

b. LOGIN PAGE

Logo	Website Name			
Home	Login	Registration	Catalogue	Cart
CSE ECE EEE CIV	Username: Password: Submit Reset			

Experiment-III (Unit-1)

c. CATALOGUE PAGE:

The catalogue page should contain the details of all the books available in the web site in a table. The details should contain the following:

- Snap shot of Cover Page.
- Author Name and Publisher.
- Price and Add to cart button.

Logo	Website Name			
Home	Login	Registration	Catalogue	Cart
CSE ECE EEE CIV		Book: Web Technologies Author: Kogent Publication: Dreamtech Press	$50	Add to Cart
		Book: JSP Complete Reference Author: Phil Hanna Publication: McGraw Hill	$28.5	Add to Cart
		Book: Web Technologies Author: Uttam K. Roy Publication: Oxford Higher Ed	$40	Add to Cart

Experiment-IV (Unit-1)

3. VALIDATION

AIM: To do validation for registration page using JavaScript.

DESCRIPTION: Write JavaScript to validate the following fields of the above registration page.

a) Name (Name should contains alphabets and the length should not be less than 6 characters).
b) Password (Password should not be less than 6 characters length).

c) e-mailid (should not contain any invalid and must follow the standard pattern (name@domain.com)
d) Phone number (Phone number should contain 10 digit sonly).

Note: You can also validate the login page with these parameters.

4. CSS

AIM: Write a program illustrating various methods in cascading style sheets

a) Use different font, styles and set a background image
b) Control the repetition of the image
c) Define styles for links
d) Work with layers and add a customized cursor

DESCRIPTION: Design a web page using CSS (Cascading Style Sheets) which includes the following:

a) Use different font, styles: In the style definition you define how each selector should work (font, color etc.).Then, in the body of your pages, you refer to these selectors to activate the styles.
b) Set a background image for both the page and single elements on the page. You can define the background image for the page like this:
c) Control the repetition of the image with the background-repeat property. As background-repeat: repeat
d) Define styles for links
e) Work with layers:
f) Add a customized cursor:

```
Selector {cursor: value}
.xlink {cursor: crosshair}
.hlink {cursor: help}
```

5. Write a program to embed JavaScript in HTML pages.
6. Design a registration form and validate its field by using JavaScript.
7. Write a program to create popup boxes in JavaScript

Experiment-V (Unit-2)

1. Declare Variables using const, let, and var; observe scope and reassignment
2. Create a Template String that includes dynamic expressions
3. Write a Function Declaration and call it
4. Create a Function Expression and compare it with a Function Declaration
5. Use Default Parameters in a function
6. Convert a Function to Arrow Function with and without parameters
7. Build and Run a JavaScript File with Babel (Compiling JS)

Experiment-VI (Unit-2)

1. Destructure an Object and log each variable
2. Destructure an Array with element skipping
3. Use Object Literal Enhancement to simplify object creation
4. Use the Spread Operator to clone and merge objects and arrays
5. Create and Resolve a Simple Promise
6. Use fetch() to make an API call and handle the response with .then()
7. Refactor the fetch() example using async/await
8. Chain Multiple Promises to simulate asynchronous steps
9. Define a JavaScript Class and Create Instances

Experiment-VII (Unit-2)

1. Use a Constructor and add Methods to the Class

2. Export and Import modules using ES6 export/import
3. Demonstrate CommonJS Module Syntax with require() and module.exports
4. Create a Higher-Order Function (HOF) and pass a function as an argument
5. Use map(), filter(), and reduce() on arrays to demonstrate functional programming
6. Implement a small functional utility like compose() or pipe()
7. Compare traditional function and arrow function with this context

Experiment-VIII (Unit-3)

1. Create a Simple "Hello React" Application
2. Check and Install Node.js and npm on Your System
3. Set up a React Project using Create React App
4. Create Your First React Component
5. Use JSX to Display a Dynamic Message
6. Create a List of Items using .map() in JSX
7. Pass Props to Components and Render Dynamic Data
8. Use useState Hook to Create a Counter App
9. Implement a Controlled Component for Input Field
10. Create a Custom Hook for Form Validation

Experiment-IX (Unit-3)

1. Use Callback Functions in JSX for Button Click Events
2. Use Fragment to Avoid Extra DOM Elements
3. Fetch Data from API using useEffect (Asynchronous Data)
4. Convert a Function Component to a Class Component
5. Use Multiple Components to Create a To-Do List
6. Style Components Using CSS File and ClassNames
7. Use CSS Modules to Apply Scoped Styles
8. Embed an SVG Image in a React Component
9. Use Conditional Rendering in JSX
10. Create a Theme Toggle App using Custom Hooks
11. Form Submission and Validation using Controlled Components
12. Implement a React Clock using setInterval in useEffect
13. Create a Responsive Layout with CSS in React

Experiment-X (Unit-4)

1. JSP program to print current date &time
2. JSP program to auto refresh a page
3. JSP program to count no. of visitors on website
4. JSP program for error handling
5. JSP program to demonstrate expression tag
6. JSP program to Detect locale, language settings & local specific time

Experiment-XI (Unit-4)

1. Create Database Connectivity with JSP page with different JDBC Drivers.
2. JSP Program to Select record from database
3. JSP Program to Insert a record into the database
4. Create a CRUD operation for JSP Page using MySQL
5. JSP Program to upload file into server

Experiment-XII (Unit-4)

1. Demonstrate JSP implicit object
2. JSP Program to display given number in words
3. Write a HTML file to create a simple form with 5 input fields (Name, Password, Email, Pin code, Phone No. and a Submit button) and demonstrate required field validations to validate that all input fields are required and display error messages if the above

validations do not hold using JSP
4. Create a JSP Page with and run in JSP Engines
5. Demonstrate Session Tracking in JSP
6. JSP Program to validate username and password using JDBC.

Textbook(s):

1. Kogent, *Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML*, 1st ed., New Delhi: Dreamtech Press (Black Book), 2013. (Chapters 2, 3, 4, 5, 6, 7, 8, 12, 13)
2. P. Hanna, *JSP: The Complete Reference*, 2nd ed. New York: McGraw-Hill, 2001. (Chapters 5, 6, 7, 8, 9, 10, 13, 14)
3. A. Banks and E. Porcello, *Learning React: Modern Patterns for Developing React Apps*, 2nd ed. New Delhi: Greyscale Indian Edition, O'Reilly Media, 2020. (Chapters 3, 4)
4. R. Weiruch, *The Road to React*, 1st ed. Leanpub Press, 2020. (Chapters 1, 2, 3)

Reference Book(s):

1. I. Bayross, *Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP*, 4th ed. New Delhi: BPB Publications, 2009.
2. U. K. Roy, *Web Technologies*, 7th ed. New Delhi: Oxford Higher Education, 2010.
3. N. 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. AVA Publisher, 2021.

Web and Video link(s):

1. https://onlinecourses.swayam2.ac.in/aic20_sp15/preview___*NPTEL Video Lecture on Joomla CMS By Prof Kannan Moudgalya - Principal Investigator of Spoken Tutorial Project | Indian Institute of Technology Bombay*

Laboratory Manual (for laboratory component):

1.Web Programming 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: design static web pages using HTML and CSS with proper document structure and style

CO2: develop client-side interactivity using JavaScript including ES6 features and asynchronous programming concepts

CO3: develop and manage modular web applications using ReactJS and modern frontend development practices

CO4: apply debugging, version control, and deployment strategies to publish responsive and data-driven web applications

(based on psychomotor skills acquired from laboratory component)

CO5: create and validate web forms, apply layout and styling through CSS, and demonstrate DOM manipulation via JavaScript

CO6: build interactive UI components using ReactJS, including hooks and functional programming practices

CO7: implement and test full-stack applications with React as frontend and JSP/JDBC as backend, showcasing complete web flow

CO8: create server-side dynamic web pages using JSP and manage data persistence with JDBC

Course Articulation Matrix (CAM):		**U24CS402 Web Programming**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	**U24CS402.1**	3	2	2	2	3	1	-	-	-	1	1	3	3
CO2	**U24CS402.2**	2	2	3	2	3	1	-	-	-	1	1	3	2
CO3	**U24CS402.3**	2	3	3	2	3	1	-	-	-	1	1	3	2
CO4	**U24CS402.4**	2	2	2	3	3	1	-	-	-	1	1	3	3
CO5	**U24CS402.5**	2	2	2	2	2	1	1	1	1	1	2	2	3
CO6	**U24CS402.6**	2	2	2	2	2	1	1	1	1	1	2	3	3
CO7	**U24CS402.7**	1	2	2	2	3	1	1	1	1	1	2	2	1
CO8	**U24CS402.8**	2	2	2	2	3	1	1	1	1	1	2	1	2
U24CS402		**2**	**2.12**	**2.25**	**2.12**	**2.75**	**1**	**1**	**1**	**1**	**1**	**1.5**	**2.5**	**2.4**

DATABASE MANAGEMENT SYSTEMS			
Class: B.Tech. IV–Semester		**Branch:** CSE	
Course Code:	**U24CS403**	**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:** database system concepts, architecture and RDBMS
- **LO2:** data modeling using the entity-relationship model, relational data model, relational database constraints
- **LO3:** normalization techniques on database systems and query optimization technique
- **LO4:** transaction processing, concurrency control, database recovery techniques

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, When not to use a DBMS
Database System Concepts and Architecture: Data models, Schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, Classification of database management systems.
The Relational Data Model, Relational Database Constraints: Relational model concepts, Relational constraints and the Relational database schemas, Update operations and dealing with constraint violations

Self Learning Topics (SLTs): *The database system environment (Text1: Topic2.4), The Enhanced Entity–Relationship (EER) Model (Text1: chapter 8)*

UNIT-II	**9 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
Relational Database Design by ER-to-Relational Mapping: Relational database design using ER-to-Relational mapping
The Relational Algebra and Relational Calculus: Basic relational algebra operations, Examples of queries in relational algebra, The tuple relational calculus

Self Learning Topics (SLTs): *Enhanced Entity-Relationship (Text1: chapter 8), Domain relational calculus (Text1: chapter 8), No SQL Databases (Text1: chapter 24.1)*

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

Self Learning Topics (SLTs): *Multivalued dependency and fourth normal form(Text1: Topic15.6), Join dependencies and fifth normal form(Text1: Topic15.7)*

UNIT-IV	9 Hrs

Introduction to Transaction Processing Concepts and Theory: Introduction to transaction processing, Transaction and system concepts, Desirable properties of transactions, 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.

Self Learning Topics (SLTs): *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 (Text1: chapter 24)*

LABORATORY COMPONENT

List of Experiments

Experiment-I

1. Queries on DDL and DML statements.

Experiment-II

2. Queries on TCL and DCL commands.

Experiment-III

3. Queries on column level and table level constraints.

Experiment-IV

4. Queries using built-in functions of NUMBER, CHARACTER, DATE Data types.

Experiment-V

5. Queries on single row functions and operators and aggregate functions.

Experiment-VI

6.Queries on joins and nested queries.

Experiment-VII

7. Write SQL statements to create simple, composite indexes, user-defined data types, views, sequences.

Experiment-VIII

8. Write sample PL/SQL programs using conditional and iterative statements.

Experiment-IX

9. Write PL/SQL programs using cursors and parameterized cursors.

Experiment-X

10. Write PL/SQL programs to handle exceptions.

Experiment-XI

11. Write PL/SQL programs using stored procedures and functions.

Experiment-XII

12. Write PL/SQL programs for creating triggers**.**

Text Book:

1. Ramez Elmasri and Shamkanth B. Navathe, *Fundamentals of Database Systems*, 6th ed., Pearson Education, 2010.

Reference Book(s):

1. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, 3rd ed., McGraw-Hill Education, 2002.
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, *Database System Concepts*, 3rd ed., McGrawHill Education, 1997.
3. Thomas Connolly and Carolyn Begg, *Database Systems*, 3rd ed., Pearson Education, 2003.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc22_cs91/preview ;*NPTEL Video Lecture: Data Base Management System by Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay, IIT Kharagpur.*

Laboratory Manual (for laboratory component):

1. *Database Management Systems 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: apply relational data models and constraints for designing effective database
CO2: design the databases using ER model
CO3: design the database by using normalization techniques to reduce redundancy
CO4: apply locking techniques for concurrent transactions and to recover the data base from failures

(based on psychomotor skills acquired from laboratory component)

CO5: implement and test SQL queries using DDL/DML/TCL/DCL commands to create and manipulate data in database by enforcing constraints
CO6: implement and test database objects, tables, views, indexes, stored procedures, functions, triggers and constraints using SQL queries
CO7: implement and test block structured programming with cursors to enable traversal over the records of the database redundancy and maintain the performance of database.
CO8: Implement and test pre-compiled stored programs, run-time errors checking, database objects collection in PL/SQL high-level security using triggers

Course Articulation Matrix (CAM):		**U24CS403 DATABASE MANAGEMENT SYSTEMS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CS403.1**	2	1	2	1	-	-	-	-	-	1	1	2	1
CO2	**U24CS403.2**	2	1	2	1	-	-	-	-	-	1	1	2	1
CO3	**U24CS403.3**	2	1	2	2	-	-	-	-	-	1	1	2	1
CO4	**U24CS403.4**	2	1	1	1	-	-	-	-	-	1	1	1	1
CO5	**U24CS403.5**	2	1	2	1	1	1	1	1	1	1	1	2	1
CO6	**U24CS403.6**	2	1	2	1	1	1	1	1	1	1	1	2	1
CO7	**U24CS403.7**	1	1	1	1	1	1	1	1	1	1	1	1	1
CO8	**U24CS403.8**	2	1	2	1	1	1	1	1	1	1	1	2	2
U24CS403		**1.87**	**1**	**1.75**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.75**	**1.12**

ARTIFICIAL INTELLIGENCE

Class: B.Tech. IV -Semester		**Branch:** CSE	
Course Code:	**U24CS404**	**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: agents, problem solving approaches and searching techniques
LO2: local search algorithms, game playing, solution searching using alpha-beta and CSP problems
LO3: propositional logic, 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 (Text book: Chapter 2.4)*

UNIT-II	**9 Hrs**

Search in Complex Environments: Local search and optimization problems, Local search in continuous space, searching with 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, 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

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: analyze effectiveness of AI algorithms for search optimization, game playing and constraint satisfying solutions

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

Textbook(s):

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed. New Delhi: Prentice Hall Series in AI, 2022. (Chapters 1-9, 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*, 2nd 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):

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):		**U24CS404 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**	**PS O1**	**PSO 2**
CO1	**U24CS404.1**	2	2	2	2	1	1	-	1	1	1	-	1	1
CO2	**U24CS404.2**	2	3	3	2	1	1	-	1	1	1	-	1	1
CO3	**U24CS404.3**	2	3	3	2	1	1	-	1	1	1	-	1	1
CO4	**U24CS404.4**	2	2	2	3	1	1	-	1	1	1	-	1	1
U24CS404		2	2.5	2.5	2.25	1	1	-	1	1	1	-	2.75	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

PYTHON PROGRAMMING

Class: B.Tech. IV -Semester		**Branch:** Common to All	
Course Code:	**U24CS405**	**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: operators, control statements, functions and iterators of Python programming

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

LO3: object-oriented programming, files and database connectivity

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

Self Learning Topics (SLTs): *Installing Python, Testing and Debugging (Text1: Chapter 3 Anexure-1&2), Operator Precedence and Associativity (Text1: topic 3.12.10),* The else statement used with loops *(Text1: topic 4.8), Document Strings(Text1: topic 5.8)*

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, Comprehensions, High order functions

Self Learning Topics (SLTs): Standard library modules *(Text1: topic 5.13), in & not in operator (Text1: topic 6.7), Variable-length Argument Tuples(Text1: topic 8.4.13), The zip() Function (Text1: topic 8.4.14), String formatting with Dictionaries (Text1: topic 8.6.10)*

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, Class methods, Static methods, Inheritance, Meat classes, Polymorphism, Operator overloading, Magic Methods
Error and Exception handling: Introduction to errors and exceptions, Handling exceptions, Multiple except blocks, Raising exception, Instantiating exceptions, Built-in and User-defined Exceptions, The finally Block, Re-raising exceptions, Assertions, *Multi threading*
File Handling: Opening and closing files, Reading and writing files, File positions, Renaming and deleting files, Directory methods
Database Connectivity: SQLite, creating a database table, Insert and retrieve data from database

Self Learning Topics (SLTs): *Calling class method from another class method (Text1: topics 9.10), Built in*

class variables (Text1: topic 9.12), Garbage Collection (Text1: topic 9.13), Complex objects (Text1: topic 10.4), Multiple Exceptions in a Single Block (Text1: topic 12.4), Handling exceptions in Invoked Function(Text1: topic 12.9)

UNIT-IV	9 Hrs

NumPy: The basics of NumPy arrays, Array indexing, Array slicing, Reshaping of array, Concatenation and splitting arrays, Aggregations, Universal Functions, Broad casting of Arrays

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, Vectorized String Operations, Working with Time Series

Visualization with Matplotlib: Importing Matplotlib, Saving figures to files, Simple line plots, Simple scatter plots, Histograms, Binnings, and density, Three-Dimensional Plotting in Matplotlib, Geographic Data with Basemap

Self Learning Topics (SLTs): *Sorting array, Structured array operations (Text2: Chapter 2 topics), Rearranging Multi-Indices, Pivoting table (Text2: Chapter 3 topics),* Visualizing errors, Density and Contour plots, Customizing color bars*(Text2: Chapter 4 topics)*

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. Develop a Python program to demonstrate importance of indentations. Purposefully raise indentation error and correct it
4. Develop a Python program to take input text as command line argument and display it on screen

Experiment-II

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

Experiment-III

1. Develop a Python program to find the Factorial of a given number
2. Develop a Python program to find the Armstrong for a given number
3. Develop a Python program to take a number as input, and print countdown from that number to zero (use while loop)
4. Develop a Python program to demonstrate Iterators
5. Develop a Python program to demonstrate Decorators
6. Develop a Python program to demonstrate Generators

Experiment-IV

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

Experiment-V

1. Develop a Python 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
2. Develop a Python program to demonstrate use of slicing in strings
3. Develop a Python program to compare two strings
4. Reverse string and call this function for performing the operation)
5. Develop a Python program to demonstrate regular expression functions
6. Develop a Python program to demonstrate regular expressions using Meta characters

Experiment-VI

1. Develop a Python program to demonstrate list and related functions
2. Develop a Python program to demonstrate tuple and related functions
3. Develop a Python program to demonstrate set and related functions
4. Develop a Python program to demonstrate dictionaries
5. Develop a Python program to demonstrate comprehensions
6. Develop a Python program to demonstrate high order functions

Experiment-VII

1. Develop a python program to demonstrate classes and objects
2. Develop a python program to demonstrate class method
3. Develop a python program to demonstrate static method
4. Develop a python program to demonstrate inheritance
5. Develop a python program to demonstrate polymorphism
6. Develop a python program to demonstrate magic methods.

Experiment-VIII

1. Develop a python program to demonstrate multiple exception handling
2. Develop a python program to demonstrate multiple exception rising
3. Develop a python program to demonstrate multiple finally block
4. Develop a python program to demonstrate Assertions
5. Develop a 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. Develop a 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. Develop a Python program to demonstrate NumPy array
2. Develop a Python program to demonstrate Slice operation
3. Develop a Python program to demonstrate Reshaping of an array
4. Develop a Python program to demonstrate Ufunctions
5. Develop a Python program to demonstrate Broadcasting of numpy arrays
6. Develop a Python program to demonstrate Aggregate operations

Experiment-XI

1. Develop a Python pandas program to create a series from a ndarray
2. Develop a Python pandas program to create a series from input files
3. Develop a Python pandas program to demonstrate indexing and slicing data frames
4. Develop a Python pandas program to demonstrate handling missing values
5. Develop a Python pandas program to demonstrate vectorized string operations,
6. Develop a Python pandas program to demonstrate handling time series data

Experiment-XII

1. Develop a Python program to draw a simple line plot
2. Develop a Python program to draw a scatter plots
3. Develop a Python program to draw a histogram plot
4. Develop a Python program to draw a binning and density
5. Develop a Python program to demonstrate a three dimensional plotting
6. Develop a Python program to demonstrate a geographic basemap

Textbook(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, 2016 (*Chapter 2 to 4*)

Reference Book(s):

1. Dr. Charles R. Severance, *Python for Everybody-Exploring Data Using Python*, 1st ed. New Delhi: Shroff Publishers, 2016
2. David Beazley, *Python Cookbook*, 3rd ed. California: O'Reilly Media, Inc., 2013
3. Caleb Hattingh, *20 Python Libraries You Aren't Using*, 2nd ed. California: O'Reilly Media, 2016
4. Magnus Lie Hetland, *Beginning Python: from Novice to Professional*, 1st ed. New York: Apress, 2005

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc23_cs99/ *NPTEL Video Lecture on Python For Data Science by By Prof. Ragunathan Rengasamy, IIT Madras.*

https://onlinecourses.nptel.ac.in/noc25_cs17 *NPTEL Video Lecture on Data Analytics with Python By Prof. A Ramesh, IIT Roorkee.*

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, 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 control statements, operators and functions

CO2: apply collections, namespaces, packages, strings and regular expressions in application development

CO3: apply object-oriented programming principles in real-time problem solving

CO4: develop visualization graphs with Matplotlib and apply Numpy and Pandas libraries for data analysis

(based on psychomotor skills acquired from laboratory component)

CO5: implement and test python programs using operators, control statements &functions

CO6: Implement and test python packages using string handling methods, regular expressions, and collections

CO7: implement and test object oriented paradigms and database operations in Python programming

CO8: build visualization graphs with Matplotlib and adapt packages like Numpy, Pandas for data analysis

Course Articulation Matrix (CAM):		**U24CS405: 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	**U24CS405.1**	1	2	2	2	2	1	-	-	-	1	1	2	2
CO2	**U24CS405.2**	2	2	2	2	2	1	-	-	-	1	1	2	2
CO3	**U24CS405.3**	2	2	2	2	3	1	-	-	-	1	1	2	2
CO4	**U24CS405.4**	2	2	2	2	3	1	-	-	-	1	1	2	2
CO5	**U24 CS405.5**	1	2	2	2	2	1	1	1	1	1	2	2	2
CO6	**U24 CS405.6**	2	2	2	2	2	1	1	1	1	1	2	2	2
CO7	**U24 CS405.7**	2	2	2	2	3	1	1	1	1	1	2	2	2
CO8	**U24CS405.8**	2	2	2	2	3	1	1	1	1	1	2	2	2
U24 CS 405		**1.75**	2	**2**	2	**2**	1	1	1	1	1	1.5	2	2

SOFT AND INTERPERSONAL SKILLS

Class: B.Tech. III -Semester & IV-Semester		**Branch:** Common to all Branches	
Course Code:	**U24VA406B**	**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: self and learning to overcome possible threats
LO2: group dynamics to demonstrate respect for the opinions and beliefs of group
LO3: preparation of effective presentations using visual aids
LO4: professional communication, preparation of resume in line with industry expectations

LIST OF ACTIVITIES

Activity 1 Reading Comprehension
Activity 2 Listening & Observation (Video Source)
Activity 3 Group Discussion
Activity 4 Presentations through PPTs
Activity 5 Self-Introduction
Activity 6 JAM
Activity 7 Email Etiquette
Activity 8 Resume Writing
Activity 9 Interview Etiquette
Activity 10 "My Career Plan" SWOT Analysis

Course Learning Outcomes (COs):

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

CO1: introspect to convert strengths into opportunities, identify weaknesses, and bypass threats
CO2: present views on various issues confidently in a group
CO3: make effective PPT presentations
CO4: prepare a professional resume, communicate effectively to attain better opportunities

Textbook(s):

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

Course Articulation Matrix (CAM):		**U24VA406B 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**	**PS O1**	**PSO 2**
CO1	**U24VA406B .1**	-	-	-	-	-	-	-	-	2	3	-	1	1
CO2	**U24VA406B .2**	-	-	-	-	-	-	-	2	3	3	-	1	1
CO3	**U24VA406B .3**	-	-	-	-	-	-	-	-	2	3	-	1	1
CO4	**U24VA406B .4**	-	-	-	-	-	-	-	1	2	3	-	1	1
U24VA406B		-	-	-	-	-	-	-	**1.5**	**2.25**	**3**	-	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENVIRONMENTAL STUDIES

Class: B.Tech. IV Semester		**Branch:** Common to all branches	
Course Code:	**U24CH411**	**Credits:**	**0**
Hours/Week (L-T-P-O-E):	**2-0-0-5-7**	**CIE:**	**60%**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

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's control measures

LO4: environmental legislation and green methodology

UNIT-I	**6 Hrs**

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

Natural Resources: Forest Resources-Use and over exploitation of forests, Deforestation, Timber extraction, Mining, Dams and their effects on forests and tribal people**;** Water Resources-Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water**;** Mineral Resources-Environmental effects of extracting and using mineral resources**;** Energy Resources-Renewable and non-renewable energy sources, Use of alternate energy sources

Self Learning Topics (SLTs): *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	**6 Hrs**

Ecosystem and Biodiversity:

Ecosystem: Concepts of an ecosystem, Food chain, Food webs, Ecological pyramids, Energy flow in the ecosystem and ecological succession

Biodiversity and its Conservation: Introduction, Definition, Genetic, Species and ecosystem diversity, Value of biodiversity, Biodiversity in India, Hot spots of biodiversity, Man-wildlife conflicts, Endangered and endemic species of India; In-situ and Ex-situ conservation

Self Learning Topics (SLTs): *Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)*

UNIT-III	**6 Hrs**

Environmental Pollution: Global issues**-**Global climatic change, Greenhouse gases, Effects of global warming, Ozone layer depletion

International Conventions/Protocols: Earth summit, Kyoto protocol, Montreal protocol **Environmental Pollution-**Causes and effects of air, Water, Soil, Marine and noise pollution with case studies

Solid and Hazardous Waste Management: Introduction, Types, Effects of urban industrial and nuclear waste

Natural Disaster Management: Introduction to disaster, Management of disaster, Disaster management of flood, earthquake, cyclone and landslides

Role of information technology in environment and human health

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

UNIT-IV	6 Hrs

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

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

Green Methodology: Principles of green chemistry, Green methods in electronic production, Impact of electronic waste on public health and environment

The Sustainable Development Goals (SDGs): United Nations Sustainable Development Goals

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

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

1. https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ch27/ *video lecture on renewable energy resources by Prof. Vaibhav. V. Goud and Dr. R. Anandalakshmi, Dept. Of Chemical Engineering, Guwahati.*
2. https://sdgs.un.org/goals; UN's webpage on 17 sustainable Development Goals
3. **https://onlinecourses.nptel.ac.in/noc23_hs57/preview**

   United nations Sustainable Development Goals

Course Learning Outcomes (COs):

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

CO1: identify the natural resources and practice their usage more equitably
CO2: develop an action plan for sustainable alternatives and conserving biodiversity
CO3: examine and perceive the solutions for the environmental pollution
CO4: adapt issues involved in enforcement of environmental legislation and green methodology

Course Articulation Matrix (CAM):		U24CH411 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	U24CH411.1	2	1	2	1	-	2	1	1	1	-	-	-	-
CO2	U24CH411.2	-	-	2	-	-	1	1	1	1	1	-	-	-
CO3	U24CH411.3	1	2	1	-	-	1	1	1	1	1	1	-	-
CO4	U24CH2411.4	-	-	1	-	-	1	1	1	1	-	1	-	-
U24CH411		1.50	1.50	1.50	1.00	-	1.25	1.00	1.00	1.00	1.00	1.00	-	-

Bridge Courses for exit:

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

OR

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

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

(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: Any Two (02) Courses during the 2 - Months internship									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	**PCC**	**U24EC411X**	**Data Analytics**	**2**	**-**	**2**	**-**	**4**	**3**
2	**PCC**	**U24EC412X**	**Machine Learning Fundamentals**	**2**	**-**	**2**	**-**	**4**	**3**
3	**PCC**	**U24EC413X**	**Essentials of Network security**	**2**	**-**	**2**	**-**	**4**	**3**
4	**PCC**	**U24EC414X**	**Introduction to Internet of Things**	**2**	**-**	**2**	**-**	**4**	**3**
5	**PCC**	**U24EC415X**	**Compiler Design Fundamentals**	**2**	**-**	**2**	**-**	**4**	**3**
	PCC	**U24CS214X**	Any other course approved by BoS Chair and Dean AA	**2**	**-**	**2**	**-**	**4**	**3**

DATA ANALYTICS

Class: B.Tech. II Yr- (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS411X**	**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 analytics life cycle and big data

LO2: data preprocessing

LO3: statistical analytics of data

LO4: real time data analytics

THEORY COMPONENT

UNIT-I	**4 Hrs**

Data Analytics overview: Importance and applications of data analytics, Types of data, Data sources and formats, Data analytics lifecycle, Phases of data analytics, Introduction to tools (Excel, Python, R, Tableau), Basics of Big Data, Hadoop ecosystem overview

UNIT-II	**4 Hrs**

Data Preprocessing: Data cleaning techniques, Handling missing data, Handling outliers and inconsistencies, Data transformation methods, Normalization and standardization, Encoding categorical variables, Feature engineering, Descriptive statistics, Correlation analysis

UNIT-III	**4 Hrs**

Statistical Analysis: Basics of statistics for data analytics, Probability distributions, Hypothesis testing, t-test and chi-square test, ANOVA, Introduction to machine learning, Supervised learning vs unsupervised learning, Linear regression, Logistic regression, Decision trees, K-means clustering, Model evaluation techniques, Confusion matrix

UNIT-IV	**4 Hrs**

Real-time data analytics: Concepts of streaming data, Tools for real-time analytics (Apache Spark, Kafka overview), Applications of data analytics in various domains (Healthcare, Finance, Marketing, Agriculture), Case studies on data-driven decision making, Ethical issues in data analytics

LABORATORY COMPONENT

List of Experiments

1. Load and clean a real-world dataset using Pandas by handling missing values, duplicates, and inconsistencies.
2. Perform data transformation techniques such as normalization, standardization, and encoding of categorical variables.
3. Conduct exploratory data analysis by computing summary statistics and analyzing correlations.
4. Create various data visualizations using Matplotlib and Seaborn to interpret relationships between variables.
5. Apply statistical tests like t-test, chi-square, and ANOVA using Python's SciPy library.
6. Implement linear regression using Scikit-learn and evaluate the model using R^2 and RMSE.
7. Build classification models using logistic regression and decision trees with performance evaluation metrics.
8. Perform K-means clustering on multivariate data and visualize the resulting clusters.
9. Design interactive dashboards using Tableau or Power BI to present data-driven insights.

10. Complete a mini-project involving data preprocessing, analysis, modeling, and visualization on a real-world dataset

Textbook(s):

1. Anil Maheshwari, *Data Analytics*, 1st ed. New Delhi: McGraw-Hill Education, 2017

Reference Book(S):

1. V.K. Jain, Data Science and Analytics, 1st ed. New Delhi: Khanna Publishing House, 2019

Laboratory Manual (for laboratory component):

1. *Data Analytics manual and Record Book* Department of CSE

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 analytical algorithms for information retrieval
CO2: apply preprocessing techniques in data processing
CO3: analyse statistical techniques for data processing
CO4: analyse data stream processing applications

(based on psychomotor skills acquired from laboratory component)

CO5 : implement data analytics applications Hadoop
CO6 : implement data preprocessing applications
CO7 : develop statistical analytical applications
CO8 : implement data stream processing applications

Course Articulation Matrix (CAM):		**U24CS411X: Data Analytics**												
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	**U24CS411X.1**	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	**U24CS411X.2**	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	**U24CS411X.3**	2	2	3	2	1	-	-	-	-	-	1	2	2
CO4	**U24CS411X.4**	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	**U24CS411X.5**	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	**U24CS411X.6**	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	**U24CS411X.7**	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	**U24CS411X.8**	1	2	3	2	2	-	-	1	1	-	1	2	2
U24CS411X		**1.5**	**1.87**	**2.37**	**1.5**	**1.62**	**-**	**-**	**1**	**1**	**-**	**1**	**1.5**	**1.5**

MACHINE LEARNING FUNDAMENTALS

Class: B.Tech. II Yr- (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS412X**	**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 workflow and applications

LO2: supervised learning algorithms

LO3: unsupervised learning algorithms

LO4: model evaluation techniques

THEORY COMPONENT

UNIT-I	**4 Hrs**

Machine learning fundamentals: Definition and types of Machine Learning, Supervised vs Unsupervised vs Reinforcement Learning, Machine Learning workflow, Applications of ML in various domains, Basics of model training and testing, Overfitting and underfitting, Bias-variance trade-off, Introduction to Python libraries: NumPy, Pandas, Scikit-learn

UNIT-II	**4 Hrs**

Supervised learning algorithms: Linear regression, Logistic regression, Decision trees, Support Vector Machines (SVM), k-Nearest Neighbors (k-NN), Naïve Bayes classifier

UNIT-III	**4 Hrs**

Unsupervised learning algorithms: Clustering algorithms: k-Means, Hierarchical clustering, DBSCAN, Dimensionality reduction techniques: PCA, t-SNE, Applications of clustering, Evaluation of clustering results, Feature selection and extraction

UNIT-IV	**4 Hrs**

Model evaluation: Cross-validation techniques, Grid search and hyperparameter tuning, Ensemble methods: Bagging, Random Forest, Boosting (AdaBoost, Gradient Boosting), Introduction to neural networks and deep learning basics, Ethical considerations in ML, Case studies and project-based learning

LABORATORY COMPONENT

List of Experiments

1. Implement linear regression using Scikit-learn on a real-world dataset and evaluate the model using R^2 and RMSE.
2. Perform classification using logistic regression and analyze results using confusion matrix and ROC curve.
3. Build a decision tree classifier and visualize the decision tree structure and feature importance.
4. Apply k-Nearest Neighbors algorithm for classification and tune the value of k for optimal performance.
5. Train a Naïve Bayes classifier on a text dataset for spam detection and evaluate precision and recall.
6. Implement Support Vector Machine (SVM) for binary classification with kernel tricks.
7. Perform clustering using k-Means and visualize the clusters with appropriate plots.
8. Apply Principal Component Analysis (PCA) for dimensionality reduction and visualize

principal components.

9. Evaluate models using cross-validation techniques and perform grid search for hyperparameter tuning.
10. Develop a mini-project integrating supervised or unsupervised learning techniques with real-world data and present findings.

Textbook(s):

1. Ethem Alpaydin, Introduction to Machine Learning, 4th ed. Cambridge: MIT Press, 2020

Reference Book(S):

1. Tom M. Mitchell, Machine Learning, 1st ed. New Delhi: McGraw-Hill Education, 1997

Laboratory Manual (for laboratory component):

1. *Machine learning manual and Record Book,* Department of CSE

Course Learning Outcomes (COs)

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

(based on cognitive skills acquired from theory component)

CO1: analyse machine learning workflows and application
CO2: apply supervised learning algorithms in data processing
CO3: apply unsupervised learning algorithms in data processing
CO4: analyse model evaluation techniques

(based on psychomotor skills acquired from laboratory component)

CO5 : implement regression algorithms for data classification
CO6 : implement decision tree, naive bayes algorithms for data classification
CO7 : implement unsupervised algorithms for data clustering
CO8 : apply model evaluation techniques in classification

Course Articulation Matrix (CAM):		**U24CS412X: Machine Learning Fundamentals**												
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	**U24CS412X.1**	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	**U24CS412X.2**	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	**U24CS412X.3**	2	2	3	2	1	-	-	-	-	-	1	2	2
CO4	**U24CS412X.4**	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	**U24CS412X.5**	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	**U24CS412X.6**	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	**U24CS412X.7**	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	**U24CS412X.8**	1	2	3	2	2	-	-	1	1	-	1	2	2
U24CS412X		**1.5**	**1.87**	**2.37**	**1.5**	**1.62**	**-**	**-**	**1**	**1**	**-**	**1**	**1.5**	**1.5**

ESSENTIALS OF NETWORK SECURITY

Class: B.Tech.II Yr- (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS413X**	**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: network security goals, threats and attacks

LO2: cryptography algorithms

LO3: network security protocols

LO4: wireless network security techniques

THEORY COMPONENT

UNIT-I	**4 Hrs**

Network security fundamentals: Need for network security, Security goals: confidentiality, integrity, availability, Types of threats and attacks, Security services and mechanisms, OSI security architecture, Active and passive attacks, Authentication, Access control models

UNIT-II	**4 Hrs**

Cryptography algorithms: Introduction to cryptography, Symmetric key cryptography: DES, AES, Modes of operation (ECB, CBC), Asymmetric key cryptography: RSA, Key management and distribution, Hash functions: SHA, MD5, Digital signatures and certificates, Public Key Infrastructure (PKI)

UNIT-III	**4 Hrs**

Network Security Protocols: Secure Socket Layer (SSL), Transport Layer Security (TLS), HTTPS, Virtual Private Networks (VPN), IP Security (IPSec), Secure Email (PGP, S/MIME), Firewalls: types and architectures, Intrusion Detection Systems (IDS), Intrusion Prevention Systems (IPS)

UNIT-IV	**4 Hrs**

Wireless Network Security: Wireless security basics, Wi-Fi security protocols: WEP, WPA, WPA2, Attacks on wireless networks, Mobile device security, Security in cloud computing, Zero Trust Architecture, Security in IoT networks, Recent trends in cybersecurity, Case studies on network breache

LABORATORY COMPONENT

List of Experiments

1. Implement Caesar Cipher and Vigenère Cipher for basic encryption and decryption of text data.
2. Develop a program to simulate RSA algorithm for secure key exchange and encryption.
3. Perform hashing using MD5 and SHA algorithms on input messages and analyze the output.
4. Simulate Digital Signature generation and verification using hashing and RSA.
5. Configure and test firewall rules using IP tables or any firewall simulator tool.
6. Set up a Virtual Private Network (VPN) using open-source tools and analyze encrypted traffic.
7. Demonstrate the working of SSL/TLS protocol using Wireshark to capture and inspect packets.

8. Simulate an Intrusion Detection System (IDS) using tools like Snort and generate basic alerts.
9. Analyze wireless network security protocols (WEP, WPA, WPA2) using packet sniffing tools.

Textbook(s):

1. William Stallings, *Network Security Essentials: Applications and Standards*, , 6th ed. New Delhi: Pearson Education, 2017

Reference Book(S):

1. Behrouz A. Forouzan, *Cryptography and Network Security*, 1st ed. New Delhi: McGraw-Hill Education, 2007

Laboratory Manual (for laboratory component):

1. *Network security manual and Record Book* Department of CSE

Course Learning Outcomes (COs)

LO5: *After completion of this course, the students should be able to,*

(based on cognitive skills acquired from theory component)

CO1: analyse network security goals, threats and attacks
CO2: analyse crypt arithmetic algorithms
CO3: apply network security protocols
CO4: analyse wireless security threats

(based on psychomotor skills acquired from laboratory component)

CO5 : implement cipher algorithms for network security
CO6 : implement cryptography algorithms for network security
CO7 : implement network security protocols
CO8 : simulate wireless security threats

Course Articulation Matrix (CAM):		**U24CS413X: Network Security Essentials**												
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	**U24CS413X.1**	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	**U24CS413X.2**	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	**U24CS413X.3**	2	2	3	2	1	-	-	-	-	-	1	2	2
CO4	**U24CS413X.4**	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	**U24CS413X.5**	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	**U24CS413X.6**	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	**U24CS413X.7**	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	**U24CS413X.8**	1	2	3	2	2	-	-	1	1	-	1	2	2
U24CS413X		**1.5**	**1.87**	**2.37**	**1.5**	**1.62**	**-**	**-**	**1**	**1**	**-**	**1**	**1.5**	**1.5**

INTRODUCTION TO INTERNET OF THINGS

Class: B.Tech. II Yr- (Exit Course)		**Branch:** CSE	
Course Code:	**U24CS414X**	**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, architecture, and communication protocols of the IoT

LO2: IoT hardware platforms, sensors, and actuators

LO3: cloud platforms used in IoT for data transmission, storage, and remote monitoring

LO4: hardware and software components of IoT for real world problem solving

THEORY COMPONENT

UNIT-I	**4 Hrs**

Introduction to IoT: Definition of IoT, Evolution of IoT, Importance of IoT, Components of IoT, IoT Architecture, Applications of IoT, Perception Layer, Network Layer, Application Layer, IoT Protocols, MQTT, CoAP, HTTP, LoRa, ZigBee, Bluetooth

UNIT-II	**4 Hrs**

IoT Hardware and Sensors: Arduino, Raspberry Pi, ESP8266, ESP32, Types of Sensors, Temperature Sensor, Humidity Sensor, Infrared Sensor, Ultrasonic Sensor, Gas Sensor, Motion Sensor, Actuators, Sensor Interfacing, Microcontroller Basics, Reading Sensor Data, DHT11, Blinking LED

UNIT-III	**4 Hrs**

IoT Networking and Communication: Wired Communication, Wireless Communication, Wi-Fi, Bluetooth, RFID, ZigBee, LoRaWAN, Data Communication, MQTT Protocol, HTTP Protocol, Cloud Platforms, Thingspeak, Blynk, Google Firebase, Sending Data to Cloud, IoT Data Flow

UNIT-IV	**4 Hrs**

IoT Applications and Project Development: IoT System Design, Sensing Layer, Processing Layer, Communication Layer, Smart Irrigation System, Home Automation, Health Monitoring System, IoT Security, Data Privacy, Ethics in IoT, Mini Project Development, IoT Prototype Presentation

LABORATORY COMPONENT

List of Experiments

1. Implement a basic LED blink program using Arduino or ESP8266
2. Read temperature and humidity data from DHT11 sensor
3. Measure distance using an ultrasonic sensor and display output
4. Send sensor data to Thingspeak cloud using ESP8266 and DHT11\
5. Display real-time sensor data on a web dashboard using HTTP
6. Control an LED or relay using a mobile app with Blynk and ESP8266
7. Detect motion using a PIR sensor and trigger an alert system
8. Automate household appliances using IoT hardware and Blynk app
9. Build an IoT-based weather monitoring system using multiple sensors

Textbook(s):

1. Vijay Madisetti and Arshdeep Bahga, *Internet of Things: A Hands-On Approach*, 1st edition New Delhi: Orient Blackswan Publications, 2014

Reference Book(S):

1. Raj Kamal, *Internet of Things: Architecture and Design Principles*, 1st ed. New Delhi: McGraw Hill Education, 2017

Laboratory Manual (for laboratory component):

1. *IoT manual and Record Book* Department of CSE

Course Learning Outcomes (COs)

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

(based on cognitive skills acquired from theory component)

CO1: analyse IoT architecture, components, and applications across various domains
CO2: demonstrate sensor interfacing and data acquisition using microcontroller platforms
CO3: apply communication protocols and cloud platforms for IoT data transmission
CO4: develop basic IoT-based systems to address real-world problems with security

(based on psychomotor skills acquired from laboratory component)

CO5 : implement sensor interfacing and data acquisition using IoT hardware platforms
CO6 : develop IoT-based communication systems using protocols like MQTT
CO7 : implement cloud platforms for IoT data visualization and remote monitoring
CO8 : build and deploy basic IoT prototypes to solve real-world challenges

Course Articulation Matrix (CAM):		**U24CS414X: Introduction to Internet of Things**												
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	**U24CS414X.1**	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	**U24CS414X.2**	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	**U24CS414X.3**	2	2	3	2	1	-	-	-	-	-	1	2	2
CO4	**U24CS414X.4**	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	**U24CS414X.5**	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	**U24CS414X.6**	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	**U24CS414X.7**	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	**U24CS414X.8**	1	2	3	2	2	-	-	1	1	-	1	2	2
U24CS414X		**1.5**	**1.87**	**2.37**	**1.5**	**1.62**	**-**	**-**	**1**	**1**	**-**	**1**	**1.5**	**1.5**