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

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ 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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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B. TECH. CURRICULUM

ACADEMIC YEAR: 2024–25

DEPARTMENT OF ELECTRONICS & COMMUNICATION 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 and
Multiple Entry and Multiple Exit Options
with
Competency-Focused Outcome Based Curriculum (CF-OBC)

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

History:

PROGRAM	DESCRIPTION	
	INTAKE	NBA ACCREDITATION
UG in B.Tech. Electronics and Communication Engineering	• Started with 40 seats in 2000 • Intake increased to 60 in 2001 • Intake increased to 120 in 2008 • Intake increased to 180 in 2018	• First time accreditation: w.e.f 19.07.2008 • Reaccreditation-1: w.e.f 01.07.2014 • Reaccreditation-2: w.e.f 29.03.2018 • Reaccreditation-3: w.e.f 17.02.2022

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 ELECTRONICS AND COMMUNICATION ENGINEERING: VISION AND MISSION

VISION

Develop the department into a full-fledged center of learning in various fields of Electronics & Communication Engineering in pursuit of excellence in Education, Research, Entrepreneurship and Technological services to the society.

MISSION

M1:	Imparting quality education to develop innovative and entrepreneurial professionals fit for globally competitive environment
M2:	To nurture the students in the field of Electronics and Communication Engineering with an overall back-ground suitable for attaining a successful career in higher education, research and industry.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1:	**Technical Competence** apply the knowledge of core courses of electronics and communication engineering for development of effective and innovative solutions to engineering problems
PEO2:	**Successful Career** excel in profession, higher education and entrepreneurship with updated technologies in communication, signal processing, VLSI, embedded systems, domains
PEO3:	**Soft Skills and Life-long Learning** exhibit professional ethics, effective communication, and teamwork in solving engineering problems by adapting contemporary research towards sustainable development of society

PEOS TO MISSION MAPPING

	M1	M2
PEO1	3	3
PEO2	2	3
PEO3	3	3

PEO Statements	Mission Statements	Mapping Level	Justification
PEO1	**M1**	**3**	Mapped strongly: as the students will gain technical knowledge in the field of electronics and communication engineering that will enable them to have successful careers.
	M2	**3**	Mapped strongly: as with the interaction with the research organizations and industries, students will be exposed to state-of-art offerings in the field of ECE and will be motivated to pursue successful professional lives.
PEO2	**M1**	**2**	Mapped moderately: as the graduates will practice the various ethical and social responsibilities in their professional lives.

	M2	**3**	Mapped moderately: as the graduates will practice the various ethical and social responsibilities in their professional lives by being exposed to the working of the organizations.
PEO3	**M1**	**3**	Mapped strongly: as the graduates will be requiring state-of-the-art technical know-how for lifelong learning.
	M2	**3**	Mapped moderately: as graduates will be required to keep themselves updated with the latest technologies to be successful in their professional careers.

PROGRAM SPECIFIC OBJECTIVES

PSO1:	Apply the fundamentals of Electronics, Wireless Communications, Signal processing, VLSI, Embedded Systems in development of hardware and software prototypes and systems for complex engineering problems
PSO2:	An ability to use fundamental knowledge to investigate new and emerging technologies leading to innovations.

PO/PSO TO PEO MAPPING

PO's		**PEO1**	**PEO2**	**PEO3**
PO1	Engineering Knowledge	3	3	3
PO2	Problem Analysis	3	3	3
PO3	Design/Development of solutions	3	2	3
PO4	Conduct investigations of complex problems	3	2	3
PO5	Engineering tool usage	3	2	2
PO6	The engineer and the world	2	2	3
PO7	Ethics	3	3	3
PO8	Individual and Teamwork	3	3	3
PO9	Communication	2	2	3
PO10	Project management and finance	1	2	2

PO11	Lifelong Learning	3	3	3
PSO1	Apply the fundamentals of Electronics, Wireless Communications, Signal processing, VLSI, Embedded Systems in development of hardware and software prototypes and systems for complex engineering problems	3	3	2
PSO2	An ability to use fundamental knowledge to investigate new and emerging technologies leading to innovations.	2	3	2

Salient Features

- The URR24 regulations are in line with the National Education Policy 2020 (NEP2020) and the AICTE model curriculum to provide multidisciplinary holistic education to produce well-rounded engineering graduates.
- Multiple Entry Multiple Exit (MEME) option.
- Multidisciplinary four-year UG programme with award of following degrees
    - B. Tech
    - B. Tech with "Minor"
    - B. Tech "Honours"
    - B. Tech "Honours with Research"
- 170+ Credit Liberal Engineering Education.
- A strong program core of 16 courses and 6 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, ensure strong science, mathematics foundation and program core, develop expertise in domain vertical though sequel of electives, ensure significant exposure of additional discipline through "Minor" programme, challenge good learners through "Honours" programme and the research oriented students through "Honours with Research" programme.
- Along with Major and Minor disciplinary courses, students are expected to learn Multidisciplinary Open elective Courses (MOPEC), Skill Enhancement Courses (SEC), Ability Enhancement Courses (AEC), Value Added Courses (VAC), Activity Based Learning (AL) and Experiential Learning (EL) towards multidisciplinary holistic education and for increased employability.
- These regulations provide Competency-Focused Outcome Based Curriculum (CF-OBC) for skill development, multidisciplinary learning, wider access, inclusiveness and entrepreneurship.
- In our CF-OBC, each course has an additional component of "Contents for self-study", which is carefully designed to ensure additional hours of learners engagement. The learner thus is nurtured towards the "Self-Learning" and "lifelong learning" which are essential attributes of a 21st Century learner. The same is incorporated in the scheme of instructions in the form of (i) Outside the class work (self-study) hours, (ii) total engagement hours for every course.
- In summary, these regulations are expected to develop technical competencies through courses from programme core, programme electives, engineering science and basic science; and also develop generic competencies, soft skills, social, physical, mental and

spiritual personality through carefully articulated courses from MOPEC baskets, liberal learning and humanities sequels. Thus, offer 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 three slots of open electives with twenty baskets. This is planned to give exposure to interdisciplinary and cross disciplinary domains. The courses in these baskets are planned both at department and institute level. Students can choose any combination of these courses (not floated by the parent department) to get familiar with other domains of learning.

Practicum

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

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

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

1. *Standalone Rectifier with Filter*
2. *A Zener Diode based Regulator*
3. *Development of DC Power 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 sixteen 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 Elective Courses (PEC)

The curriculum offers six 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.

(*For example, the ECE programme shall offer verticals in "Embedded Systems & VLSI", "Signal Processing", "Communication", etc.)*

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 mini courses are offered as two sequels namely "SEA" (Social Empowerment Activities) and "SAA" (Self Accomplishment Activities).

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

The NEP-2020 quotes, "*Higher education must develop good, well-rounded and creative individuals, with intellectual curiosity, spirit of service and a strong ethical compass*". Moving towards a more liberal undergraduate education is one of the most important features 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, ethics of personal and social engagement. Activity based liberal learning courses covering life, literature, and culture are added. Every learner is expected to take one such course in first four semesters. We strongly believe that these four liberal learning modules will expose the learners to holistic education as envisaged in 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 completing the degree requirement is as per NEP2020/UGC/AICTE guidelines. Four years multidisciplinary undergraduate programme allows the opportunity to experience the full range of holistic and multidisciplinary education with a focus on major and minor subjects as per the student's preference. The four-year programme may also lead to a degree with Research, if the student completes a rigorous research project in the major area(s) of study. The undergraduate programmes shall extend over four academic years (eight semesters).

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

4. **Credit Requirements:**

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 four year Bachelor's degree).	72-80
7	**Master's Degree** (Programme duration: One year or two semesters after obtaining a four-year Bachelor's degree (Honours/Research).	36-40
8	**Doctoral Degree**	Minimum prescribed credits for course work and a thesis with published work

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

5. Commencement:

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

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

6. Eligibility Criteria:

(i) **Level 4.5:** The students who have successfully completed Grade 12 / Intermediate with MPC or its equivalent course shall be eligible for admission to the first year degree programme

(ii) **Level 5** : The students who have successfully completed Level 4.5 of the undergraduate programme at this Institute or any other HEIs registered on Academic Bank of Credits Portal

(iii) **Level 5.5** : The students who have successfully completed Level 5 of the undergraduate programme at this Institute or any other HEIs registered on Academic Bank of Credits Portal

(iv) **Level 6** : The students who have successfully completed Level 5.5 (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 higher educational institutes (HEIs) 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:

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

The ABC related operations shall be as follows:

(i) The MEME option for student is facilitated at the undergraduate and postgraduate levels.

(ii) It would facilitate credit accumulation through the facility created by the ABC scheme in the "Academic Bank Account" opened for students across the country to transfer and consolidate the credits earned by them by undergoing courses in any of the eligible HEIs. The eligibility of HEIs to offer courses shall be as per UGC (Establishment and Operationalization of ABC scheme in Higher Education) Regulations 2021 dated 28.7.2021 and changes therein notified by the UGC from time to time.

(iii) The ABC allows credit redemption through the process of commuting the accrued credits in the Academic Bank Account maintained in the ABC for the purpose of fulfilling the credits requirements for the award of certificate/ diploma/ PG diploma/ degree by the authorized HEIs

(iv) Upon collecting a certificate, diploma, PG diploma or degree, all the credits earned till then, in respect of that certificate, diploma, PG diploma or degree shall stand debited and redeemed from the account concerned.

(v) HEIs offering programmes with the MEME system need to register in the ABC to enable acceptance of multidisciplinary courses, credit transfer, and credit acceptance.

(vi) The validity of credits earned will be for a maximum period of seven years or as prescribed by the UGC

(vii) The procedure for depositing credits earned, its shelf life, redemption of credits, would be as per UGC (Establishment and Operationalization of ABC scheme in Higher Education) Regulations 2021 dated 28.7.2021 and changes therein notified by the UGC from time to time

7.2 Monitoring, Support and Quality by Universities and ABC:

(i) It shall be the responsibility of Registered HEIs, to monitor the development and operationalization of the ABC programme at the university level and at the level of their affiliated colleges

(ii) Registered HEIs shall offer teachers training, staff training, mentoring, academic and administrative audit and other measures for improving the quality of performance of the ABC facility and promotion of holistic and multidisciplinary education with the support of ABC

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

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

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

8. Building Competencies through Pedagogy:

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

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

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

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

(iv) Learning must be situated in the Indian context to ensure that there is no sense of

alienation from their context, country and culture

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

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

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

(viii) Pedagogy PBL (Problem/Project Based Learning) shall be brought into practice as part of curriculum. Experiential learning in the form of practicum, seminar, mini-project, major project and internship with a specified number of credits is made mandatory

(ix) The course faculty shall provide the "Contents for self-study", and motivate the learners to engage in outside the class work learning (self-learning). The learner thus is nurtured towards the "Self-Learning" and "lifelong learning" which are essential attributes of a 21st Century learner

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

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

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

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

(i) SWAYAM
(ii) 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 NEP 2020

10.1 MULTIPLE EXIT OPTIONS

Sl. No.	Exit Description	Exit Point	Degree/Certificate offered	Goal
1.	First Exit	After completion of First year.	UG Certificate in ECE	The student should be employable as Technical Assistant (ECE) in any industry/organization.
2.	Second Exit	After completion of Second year.	UG Diploma in ECE	The student should be employable as Technician (ECE) in any industry /organization.
3.	Third Exit	After completion of Third year.	B. Voc in ECE	The student should be employable as Technical Supervisor (ECE) in any industry/organization.
4.	Normal Exit	After completion of Fourth year.	B.Tech in ECE	The student should be employable as an Engineer (ECE) 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 TGCHE guidelines & through Common Entrance Examination TSEAPCET
2.	Second Entry	III-Sem. of the program	The successful completion of first year with UG certificate in ECE from our institute.
3.	Third Entry	V-Sem. of the program	The successful completion of UG Diploma in ECE from our institute.
4.	Fourth Entry	VII-Sem. of the program	The successful completion of B. Voc in ECE 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 168 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 offered by other departments / in identified cutting-edge technologies /external recognized organizations, can start the programme in either 3rd semester or in 5th semester as per their interest. The requirement for completion of Minor degree programme is that the students are,

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

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

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

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

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

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

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

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

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

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

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

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

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

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

	I	II	III	IV	V	VI	VII	VIII	Total
B. Tech	22	22	24	23	23	22	21	15	172
B. Tech with Minor	22	22	24	23	23	22	21	15	172(+18)*
B. Tech with Honours	22	22	24	23	23	22	21	15	172(+18)*
B. Tech. Honours with Research	22	22	24	23	23	22	21	15	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><th>Percentile</th><th>Points</th></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><th>Rank</th><th>Points</th></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><th>Percentile</th><th>Points</th></tr><tr><td>Above 95</td><td>6</td></tr><tr><td>Above 90</td><td>5</td></tr><tr><td>Above 80</td><td>4</td></tr></table></td><td>6 Points</td></tr>
<tr><td></td><td colspan="2">Total Points Restricted to a maximum of</td><td>8 Points</td></tr>
</table>

Note: As the activities mentioned in the above Table of 11.3 are aimed at an additional professional dimention to the professional personality of the learners, each Point earned is given 1 credit equivalency. Thus, Honours registered students are allowed to accumulate a maximum of 8 additional Points through these activities, equivalent to two courses (8 credits) of Honours curriculum requirement.

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

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

12. Distribution of Courses:

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

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	HSMC 01	U24MH205	English Communication and Report Writing	II	2
2.	HSMC 02	U24MH508	Technical English	V	1
3.	HSMC 03	U24MB605	Management Course Basket	VI	3
				Total:	6

(ii) Basic Science Courses (BSC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	BSC 01	U24MH101	Differential Calculus and Ordinary Differential Equations	I	3
2.	BSC 02	U24PY102E	Engineering Physics *(for ECE)*	I	4
3.	BSC 03	U24MH201	Matrix Theory and Vector Calculus	II	3
4.	BSC 04	U24CY202E	Engineering Chemistry *(for ECE)*	II	4
5.	BSC 05	U24MH301D	Applied Mathematics *(for ECE)*	III	3
				Total:	17

(iii) Engineering Science Courses (ESC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	ESC 01	U24EC104	Programming for Problem Solving with C	I	4
2.	ESC 02	U24EE105B	Basic Electrical Engineering *(Common to ECE and ECIE)*	I	4
3.	ESC 03	U24EC204	Data Structures through C	II	4
4.	ESC 04	U24ME207	Engineering Graphics through CAD	II	1
5.	ESC 05	U24EC305	OOP through Java#	III	4
6.	ESC 06	U24EC405	Python Programming	IV	4
7.	ESC 07	U24EC504	AI and ML	V	4
8.	ESC 08	U24EC604	Data Communication and Computer Networks	VI	3
				Total:	28

(iv) Programme Core Courses (PCC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	PCC 01	U24EC103	Switching Theory and Logic Design	I	3
2.	PCC 02	U24EC203	Electronic Circuits	II	3
3.	PCC 03	U24EC302	Electronic Circuits Analysis and Design	III	4
4.	PCC 04	U24EC303	Digital Design	III	4
5.	PCC 05	U24EC304	Signals and Systems	III	3
6.	PCC 06	U24EC401	Integrated Circuits Applications	IV	4
7.	PCC 07	U24EC402	Communication Systems	IV	4
8.	PCC 08	U24EC403	Electromagnetic Waves and Transmission Lines	IV	3
9.	PCC 09	U24EC404	Computer Organization & Microprocessors	IV	3
10.	PCC 10	U24EC502	Microcontrollers Based Embedded System with ARM processor	V	4
11.	PCC 11	U24EC503	Antennas and Wave Propagation	V	3
12.	PCC 12	U24EC602	Digital Signal Processing and Applications	VI	4
13.	PCC 13	U24EC603	VLSI Design	VI	4
14.	PCC 14	U24EC703	System Verilog for Design and Verification	VII	4
15.	PCC 15	U24EC704	Microwave and Optical Fiber Communications	VII	3
16.	PCC 16	U24EC705	Wireless and Mobile Communications	VII	3
				Total:	56

(v) Programme Elective Courses (PEC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	PEC 01	U24EC601A	Digital System Design	VI	3
		U24EC601B	Coding Techniques		
		U24EC601C	Biomedical Signal Processing		
		U24EC601D	Embedded Systems		
		U24EC601E	Generative Artificial Intelligence		
		U24EC601F	Fundamentals of Internet of Things		
		U24EC601M	MOOC course		
2.	PEC 02	U24EC702A	FPGA based VLSI System Design	VII	3
		U24EC702B	Radar Engineering		
		U24EC702C	Computer Vision and Image Processing		
		U24EC702D	Real-Time Operating Systems		

			(RTOS)		
		U24EC702E	Natural Language Processing		
		U24EC702F	IoT Architecture and Protocols		
		U24EC702M	MOOC course		
3.	PEC 03	U24EC802A	VLSI Physical Design	VIII	3
		U24EC802B	Satellite Communications		
		U24EC802C	Digital Speech Processing		
		U24EC802D	Embedded Linux Systems		
		U24EC802E	Deep Learning		
		U24EC802F	Cloud Computing with IoT		
		U24EC802M	MOOC course		
4.	PEC 04	U24EC803A	MEMS and NEMS	VIII	3
		U24EC803B	Wireless Sensor Networks		
		U24EC803C	Machine Learning for Signal Processing		
		U24EC803D	Embedded Automative Systems		
		U24EC803E	Data Science with Applications		
		U24EC803F	Industrial IoT		
		U24EC803M	MOOC course		
				Total:	12

(vi) Experiential Learning Courses (ELC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	ELC 01	U24EL108	Practicum-1	I	1
2.	ELC 02	U24EL209	Practicum-2	II	1
3.	ELC 03	U24EL308	Practicum-3	III	1
4.	ELC 04	U24EL408	Practicum-4	IV	1
5.	ELC 05	U24EC509	Seminar	V	1
6.	ELC 06	U24EC608	Mini Project	VI	1
7.	ELC 07	U24EC706	Internship Evaluation*	VII	1
8.	ELC 08	U24EC707	Major Project, Phase-1 / Industrial Internship - 1	VII	4
9.	ELC 09	U24EC804	Major Project, Phase – 2 / Industrial Internship - 2	VIII	6
				Total:	17

(vii) Indian Knowledge System Courses (IKSC)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values - I)	Student Induction Programme	-
2.	IKSC	U24IK506A	Essence of Indian Tradition Knowledge	V	2
3.	IKSC	U24IK606B	Universal Human	VI	2

			Values-II		
				Total:	4

(viii) Multidisciplinary Open Elective Courses (MOPEC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	MOPEC 01	U24OEX01YZA	MOPEC 01	V	3
2.	MOPEC 02	U24OEX01YZB	MOPEC 02	VII	3
3.	MOPEC 03	U24OEX01YZC	MOPEC 03	VIII	3
				Total:	9

(ix) Value Added Courses (VAC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	VAC 01	U24CY106	Environmental Science	I	0
2.	VAC 02	U24VA109XXXXX	SEA – I / SAA-1	I	1
3.	VAC 03	U24VA206	Sports and Yoga	II	1
4.	VAC 04	U24VA210XXXXX	SEA-2 / SAA -2	II	1
5.	VAC 05	U24VA306A	Quantitative Aptitude and Logical Reasoning	III	2
6.	VAC 06	U24VA309XXXXX	SEA-3 / SAA -3	III	1
7.	VAC 07	U24VA406B	Soft and Interpersonal Skills	IV	1
8.	VAC 08	U24VA409XXXXX	SEA - 4 / SAA – 4	IV	1
				Total:	8

(x) Skill Enhancement Courses (SEC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	SEC 01	U24SE208	Programming Skill Development (PSD) Lab - 1	II	1
2.	SEC 02	U24SE307	Programming Skill Development (PSD) Lab - 2	III	1
3.	SEC 03	U24SE407	Programming Skill Development (PSD) Lab - 3	IV	1
4.	SEC 04	U24SE507	Programming Skill Development (PSD) Lab - 4	V	1
5.	SEC 05	U24SE607	AIML Applications Lab	VI	1
				Total:	5

(xi) Ability Enhancement Courses (AEC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	AEC 01	U24AE107	IDEA Lab Makerspace	I	1
2.	AEC 02	U24AE110	Expert Talk Series-1	I	1
3.	AEC 03	U24AE211	Expert Talk Series-2	II	1

4.	AEC 04	U24AE310	Expert Talk Series-3	III	1
5.	AEC 05	U24AE410	Expert Talk Series-4	IV	1
6.	AEC 06	U24AE510	Expert Talk Series-5	V	1
7.	AEC 07	U24AE609	Expert Talk Series-6	VI	1
				Total:	7

(xii) Startups and Entrepreneurship Courses (STE)

Sr. No.	Course Type	Curse Code	Course Name	Semester	Credits
1.	STE 01	**U24ST505X**	**S&E Basket Basket***	V	3
				Total:	3

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

Activity Based Learning (ABL) @ Value Added Courses

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

Social Empowerment Activities - SEA

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

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

     The aim of activities under Shikshit Bharat is to ensure inclusive and equitable quality education for all, promoting lifelong learning

opportunities.

3. **Samruddha Bharat** (Prosperous India)

   The aim of activities under Samrudha Bharat is to promote economic growth, self-reliance, and prosperity for all citizens.

4. **Surakshit Bharat** (Safe India)

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

Self-Accomplishment Activities - SAA

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

1. **Socho Bharat** (Think India)

   The aim of activities under Socho Bharat is to foster critical thinking, innovation, and intellectual development among citizens.

2. **Sanskarit Bharat** (Cultured India)

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

3. **Saksham Bharat** (Empowered India)

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

4. **Sunder Bharat** (Beautiful India)

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

Table: SEA

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

SEA Group-4: Surakshit Bharat		**SE402**	Basics of fire safety/Community safety
		SE403	Disaster Management
		SE404	Environmental health & sustainability
		SE405	Road safety
		SE406	Pollution control
		SE410	Any other activity approved by Dean Academic Affairs

Code of each activity shall be: **U24VAYYY + activity code of SEA/SAA**
Example: **U24VAYYYSE101** ***(for the activity Clean India—Green India (River/Beach /Mohalla/School/Campus/Govt offices Cleaning) under SEA Group1 Swacch Bharath)***

Table: SAA

Group	Guiding club/ center	Code of activity (U24VAYYY) *	Title of activity
SAA Group-1: Socho Bharat	**Literary Club**	**SA101**	Study of Green & White Revolutions in India
		SA102	Study of any 2 Government Missions or National Policies
		SA103	Study of India's top 2 problems
		SA104	Study of World's top 2 problems
		SA105	Study of one department of the Central/ State Government
		SA106	Study of one of the identified Books on leadership or innovation
		SA110	Any other activity approved by Dean Academic Affairs
SAA Group-2: Sanskarit Bharat	**Team - UHV**	**SA201**	Values and Ethos of KITSW
		SA202	Philosophy of religion (any)
		SA203	Study of Life Management / Kindle Life / Life Empowerment and Enriching Program or any other book cited.
		SA204	Study of any of GREAT sons of INDIA (Ex. Gandhi, Ambedkar, Phule, Savarkar, Sardar Patel, Nehru, Shivaji, JRD Tata etc)
		SA205	Harmony in FAMILY & SOCIETY
		SA206	Harmony in NATURE
		SA210	Any other activity approved by Dean Academic Affairs
SAA Group-3: Saksham Bharat	**Sports Club**	**SA301**	Physical Fitness, Self-defence for Women, Target based Physical Exercise for example-Running (Test 5 kms in a stretch), Swimming (Test 1 km in a stretch), Walking (Test 20 kms in a stretch), Trekking (7days), Cycling
		SA302	Sports – Representation of Institute at University level/Inter college level and above in ANY sport
		SA303	Pran-vidya (Yoga & Pranayama), Jeevan-vidya (work-life balance)
	Technical club	**SA304**	Participation in National Tech Fest, AICTE-Hackathon, industry floated global and National competitions, Robocon, BAHA etc
		SA305	Participation in National level or State level bodies in professional bodies like ISTE/IEEE/CSI/IETE etc.
		SA306	Present research papers at National and international conferences
		SA310	Any other activity approved by Dean Academic Affairs

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

Code of each activity shall be: **U24VAYYY + activity code of SEA/SAA**
Example: **U24VAYYYSA101** ***(for the activity Study of Green & White Revolutions in India under SAA Group1 Socho Bharat)***

13. SUMMARY OF CURRICULUM COMPONENTS

S.NO.	CATEGORY	COURSE COMPONENT	TOTAL COURSES	TOTAL CREDITS	CURRICULUM CONTENT (%OF CREDITS)
1	HSMC	Humanity, Social Sciences and Management Courses	3	6	3.48
2	BSC	Basic Science Courses	5	17	9.88
3	ESC	Engineering Science Courses	8	28	16.27
4	PCC	Program Core Courses	16	56	32.55
5	PEC	Program Elective Courses	4	12	6.97
6	MOPEC	Multidisciplinary Open Elective Courses	3	9	5.23
7	ELC	Experiential Learning Courses	9	17	9.88
8	IKSC	Indian Knowledge System Courses	2	4	2.32
9	VAC	Value Added Courses	8	8	4.65
10	SEC	Skill Enhancement Courses	5	5	2.90
11	AEC	Ability Enhancement Courses	7	7	4.06
12	STE	Startups and Entrepreneurship Courses	1	3	1.74
Total			**71**	**172**	**100**

14. SEMESTER WISE COURSE / CREDIT DISTRIBUTION

Semester	Number of Courses / Number of Credits (*Course Category wise*)												
	BSC	**ESC**	**HSMC**	**PCC**	**MOPEC**	**PEC**	**SEC**	**VAC**	**ELC**	**AEC**	**IKSC**	**STE**	**TOTAL**
I	2/7	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	1/4		3/11			1/1	2/3	1/1	1/1			10/24
IV		1/4		4/14			1/1	2/2	1/1	1/1			10/23
V		1/4	1/1	2/7	1/3		1/1		1/1	1/1	1/2	1/3	10/23
VI		1/3	1/3	2/8		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**	**8/28**	**3/6**	**16/56**	**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)	16.27% (28/172)	3.48 % (6/172)	32.55 % (56/172)	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 Project- 1 C, Internship Evalution-1C, Major Project: 4 C + 6 C

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)
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SCHEME OF INSTRUCTIONS

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

Abbreviations

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

I SEMESTER

Stream – I

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
-	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values - I)						-
1	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	2	1	-	6	9	3
2	BSC	U24PY102E	Engineering Physics *(for ECE)*	2	1	2	5	10	4
3	PCC	U24EC103	Switching Theory and Logic Design	2	1	-	4	7	3
4	ESC	U24EC104	Programming for Problem Solving with C	2	1	2	5	10	4
5	ESC	U24EE105B	Basic Electrical Engineering *(Common to ECE and ECIE)*	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	U24VA109X XXXX	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)				-	-	-	-	-	-

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 ECIE)***
3.	U24EE105C	Basic Electrical Engineering ***(for CSE)***
4.	U24EE105D	Basic Electrical Engineering ***(for EEE)***

II SEMESTER

Stream – I

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24CY202E	Engineering Chemistry *(for ECE)*	2	1	2	5	10	4
3	PCC	U24EC203	Electronic Circuits	2	1	-	4	7	3
4	ESC	U24EC204	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 and 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	U24VA210X XXXX	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)				-	-	-	-	-	-

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 ECE)

(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 ECE: Any Two (02) Courses during the 2 - Months internship									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	PCC	U24EC212X	Industrial Electronics	2	-	2	-	4	3
2	PCC	U24EC213X	Electronic Measuring Instruments	2	-	2	-	4	3
3	PCC	U24EC214X	PCB Design and Fabrication	2	-	2	-	4	3
4	PCC	U24EC215X	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 ECE: Any Two (02) Skill based Courses -:									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	SEC	U24SE212X	Consumer Electronics	-	-	6	-	6	3
2	SEC	U24SE213X	DTH set-top-Box Installer and Service technician https://nsdcindia.org/dth-set-top-box-installation-service-technician	-	-	6	-	6	3
3	SEC	U24SE214X	CCTV Installation Technician –IT Hardware https://nsdcindia.org/cctv-installation-technician	-	-	6	-	6	3
4	SEC	U24SE215X	Electronics Servicing and Maintenance	-	-	6	-	6	3
5	SEC	U24SE216X	Any other skill-based course approved by BoS Chair and Dean AA	-	-	6	-	6	3

III SEMESTER

S. No	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH301D	Applied Mathematics *(for ECE)*	2	1	-	6	9	3
2	PCC	U24EC302	Electronic Circuits Analysis and Design	2	1	2	5	10	4
3	PCC	U24EC303	Digital Design	2	1	2	5	10	4
4	PCC	U24EC304	Signals and Systems	2	1	-	4	7	3
5	ESC	U24EC305	OOP 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	U24VA309XXXXX	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
			Total:	12	5	8	36	61	24
Summer/ Inter-Sem Mandatory Bridge Courses: 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24EC401	Integrated Circuits Applications	2	1	2	5	10	4
2	PCC	U24EC402	Communication Systems	2	1	2	5	10	4
3	PCC	U24EC403	Electromagnetic Waves and Transmission Lines	2	1	-	4	7	3
4	PCC	U24EC404	Computer Organization and Microprocessors	2	1	-	4	7	3
5	ESC	U24EC405	Python Programming	2	1	2	5	5	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	U24VA409XXXXX	SEA - 4 / SAA – 4	-	-	-	2	2	1
10	AEC	U24AE410	Expert Talk Series-4	-	-	-	1	1	1
11	VAC*	U24CY411*	Environmental Sciences*	2*	-	-	3*	5*	-
			Total:	10	5	10	34	54	23
Summer/ Inter-Sem Mandatory Bridge Courses: 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

For Lateral Entry Students Only

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 ECE)

(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 ECE: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24EC412X	Basic Embedded Systems	2	-	2	-	4	3
2	PCC	U24EC413X	Fundamentals of IoT (Internet of Things)	2	-	2	-	4	3
3	PCC	U24EC414X	VLSI Design, Tools & Technology	2	-	2	-	4	3
4	PCC	U24EC415X	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 ECE: Any Two (02) Skill based Courses -:									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	SEC	U24SE412X	Digital Cable TV Technician https://www.essc-india.org/images/QPs/Digital%20Cable%20Technician%20-%20Access%20-%20ELE_Q8106_v4.0.pdf	-	-	6	-	6	3
2	SEC	U24SE413X	Arduino Based Embedded System Design https://www.nielit.gov.in/sites/default/files/headquarter/Certificate%20Course%20in%20ARDUINO%20based%20Embedded%20System%20Design.pdf	-	-	6	-	6	3
3	SEC	U24SE414X	VLSI Design using EDA Tools https://www.nielit.gov.in/sites/default/files/Delhi/VLSI%20DESIGN%20AND%20TOOL.pdf	-	-	6	-	6	3
4	SEC	U24SE415X	Optical fiber Technician https://rajshaladarpan.nic.in/sd2/Home/Public2/VocationalSchool/Curriculum/11th_12th_Telecom.pdf	-	-	6	-	6	3
5	SEC	U24SE416X	Any other skill based 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.

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE501YYX	MOPEC Elective –I#	2	1	-	3	6	3
2	PCC	U24EC502	Microcontrollers Based Embedded System with ARM processor	2	1	2	5	10	4
3	PCC	U24EC503	Antennas and Wave Propagation	2	1	-	4	7	3
4	ESC	U24EC504	AI and ML	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	U24EC509	Seminar	-	-	-	2	2	1
10	AEC	U24AE510	Expert Talk Series-5	-	-	-	1	1	1
Total:				12	5	8	28	53	23
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	28
Summer/ Inter-sem Mandatory Bridge Courses : 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

#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

Startups & Entrepreneurship Basket		
S. No.	**Course Code**	**Course Title**
1.	U24ST505A / U24ST605A	Design Thinking
2.	U24ST505B / U24ST605B	Innovative Product Design and Development
3.	U24ST505C / U24ST605C	Entrepreneurship
4.	U24ST505D / U24ST605D	Design Studio
5.	U24ST505Z / U24ST605E	Any other course approved by BoS Chair and Dean AA

Management Courses Basket		
S. No.	**Course Code**	**Course Title**
1.	U24MB505A / U24MB605A	Management Economics and Accountancy
2.	U24MB505B / U24MB605B	Industrial Psychology
3.	U24MB505C / U24MB605C	E-Commerce and Digital Marketing
4.	U24MB505D / U24MB605D	Organizational Behaviour
5.	U24MB505E / U24MB605Z	Any other course approved by BoS Chair and Dean AA

VI SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PEC	U24EC601	Program Elective –I / MOOCs-I	2	1	-	4	7	3
2	PCC	U24EC602	Digital Signal Processing and Applications	2	1	2	5	10	4
3	PCC	U24EC603	VLSI Design	2	1	2	5	10	4
4	ESC	U24EC604	Data Communication and Computer Networks	2	1	-	4	7	3
5	HSMC	U24MB605X	Management Course Basket	2	1	-	2	5	3
6	IKSC	U24IK606B	Universal Human Values-II	2	-	-	2	4	2
7	SEC	U24SE607	AIML Applications Lab	-	-	2	2	4	1
8	ELC	U24EC608	Mini Project	-	-	2	2	4	1
9	AEC	U24AE609	Expert Talk Series-6	-	-	-	1	1	1
Total:				12	5	8	28	52	22
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	27
Summer/ Inter-sem Mandatory Bridge Courses : 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

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

B. Tech Honours with Research:

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

Startups & Entrepreneurship Basket		
S. No.	**Course Code**	**Course Title**
1.	U24ST505A / U24ST605A	Design Thinking
2.	U24ST505B / U24ST605B	Innovative Product Design and Development
3.	U24ST505C / U24ST605C	Entrepreneurship
4.	U24ST505D / U24ST605D	Design Studio
5.	U24ST505Z / U24ST605E	Any other course approved by BoS Chair and Dean AA

Management Courses Basket		
S. No.	**Course Code**	**Course Title**
1.	U24MB505A / U24MB605A	Management Economics and Accountancy
2.	U24MB505B / U24MB605B	Industrial Psychology
3.	U24MB505C / U24MB605C	E-Commerce and Digital Marketing

4.	U24MB505D / U24MB605D	Organizational Behaviour
5.	U24MB505E / U24MB605Z	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. Voc. in ECE)

(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 ECE: Any Two (02) Courses during the 2 - Months internship									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	PCC	U24EC610X	VLSI Design, Tools & Technology	2	-	2	-	4	3
2	PCC	U24EC611X	5G and beyond 5G communications	2	-	2	-	4	3
3	PCC	U24EC612X	Real-Time Operating Systems (RTOS)	2	-	2	-	4	3
4	PCC	U24EC613X	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 ECE Degree.

Exit Option to Qualify B. Voc in ECE: Any Two (02) Skill based Courses -:									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	SEC	U24SE610X	Internet of Things (IOT) using Arduino https://www.nitttrchd.ac.in/imee/Labmanuals/manual%20Internet%20of%20Things%20I.pdf	-	-	6	-	6	3
2	SEC	U24SE611X	Embedded System Design using ARM/Cortex Micro Controller https://www.nielit.gov.in/aurangabad/content/certificate-course-embedded-system-design-using-arm-cortex-microcontroller-0	-	-	6	-	6	3
3	SEC	U24SE612X	Embedded System using 8051 and Arduino https://www.nielit.gov.in/sites/default/files/PDF/Training/EmbeddedSystemusing8051andArduino.pdf	-	-	6	-	6	3
4	SEC	U24SE613X	Any other skill-based course approved by BoS Chair and Dean AA	-	-	6	-	6	3

VII SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE701YYX	MOPEC Elective –II	2	1	-	3	6	3
2	PEC	U24EC702	Program Elective - II/ MOOCs-II	2	1	-	4	7	3
3	PCC	U24EC703	System Verilog for Design and Verification	2	1	2	4	9	4
4	PCC	U24EC704	Microwave and Optical Fiber Communications	2	1	-	4	7	3
5	PCC	U24EC705	Wireless and Mobile Communications	2	1	-	4	7	3
6	ELC	U24EC706	Internship Evaluation*	-	-	2	-	2	1
7	ELC	U24EC707	Major Project, Phase-1 / Industrial Internship - 1	-	-	8	6	12	4
Total:				10	5	12	25	50	21
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	-	25
Summer/ Inter-Sem Mandatory Bridge Courses: 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

#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

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE801YYX	MOPEC Elective –III	2	1	-	3	6	3
2	PEC	U24EC802	Program Elective - III / MOOCs-III	2	1	-	4	7	3
3	PEC	U24EC803	Program Elective - IV / MOOCs-IV	2	1	-	4	7	3
4	ELC	U24EC804	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	24	23	23	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 20 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, Introduction to web programming, Introduction to Computer Networking, Introduction 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 Semester		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 Department under MOPEC basket to the students of other branches:

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

(IV) ECI: CI-MOPEC BASKET

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

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

(V) CSE: CS-MOPEC BASKET

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

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

(VI) IT ENGINEERING: IT-MOPEC BASKET

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

V/VII/VIII SEMESTER		
1	U24OEX01ITA	Computer Networks
2	U24OEX01ITB	Ethical hacking
3	U24OEX01ITC	Programming with C++
4	U24OEX01ITD	Web Design Technologies
5	U24OEX01ITE	Software Project Management
6	U24OEX01ITF	Java Full stack development
7	U24OEX01ITG	DevOps

8	U24OEX01ITH	NET Programming
9	U24OEX01ITI	Software Testing and Quality Assurance
10	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 & Utilization 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 (AM&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 Appreciation
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	Anthropology
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	Company Law
7	U24OEX01LWG	Administrative Law
8	U24OEX01LWH	Alternative Dispute Resolution
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 ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAM ELECTIVE COURSES (PEC)

There are six slots allotted to Program Elective Courses (PECs). An example for ECE is given below: Each major specialization of the B. Tech Programme is treated as a vertical.

VERTICAL/ PE	PE1	PE2	PE3	PE4
VERTICAL 1: VLSI	U24EC601A: Digital System Design	U24EC702A: FPGA based VLSI System Design	U24EC802A: VLSI Physical Design	U24EC803A: MEMS and NEMS
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 2: Advanced Communications	U24EC601B: Coding Techniques	U24EC702B: Radar Engineering	U24EC802B: Satellite Communications	U24EC803B: Wireless Sensor Networks
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL3: Signal Processing	U24EC601C: Biomedical Signal Processing	U24EC702C: Computer Vision & Image Processing	U24EC802C: Digital Speech Processing	U24EC803C: Machine Learning for Signal Processing
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 4: Embedded Systems	U24EC601D: Embedded Systems	U24EC702D: Real-Time Operating Systems (RTOS)	U24EC802D: Embedded Linux Systems	U24EC803D: Embedded Automative Systems
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 5: AIML	U24EC601E: Generative Artificial Intelligence	U24EC702E: Natural Language Processing	U24EC802E: Deep Learning	U24EC803E: Data Science with Applications
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 6: Internet of Things	U24EC601E: Fundamentals of Internet of Things	U24EC702E: IoT Architecture and Protocols	U24EC802E: Cloud Computing with IoT	U24EC803E: Industrial IoT
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			

1st Semester Syllabus

Abbreviations

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

I SEMESTER

Stream – I

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
-	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values - I)						-
1	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	2	1	-	6	9	3
2	BSC	U24PY102E	Engineering Physics *(for ECE)*	2	1	2	5	10	4
3	PCC	U24EC103	Switching Theory and Logic Design	2	1	-	4	7	3
4	ESC	U24EC104	Programming for Problem Solving with C	2	1	2	5	10	4
5	ESC	U24EE105B	Basic Electrical Engineering *(Common to ECE & ECIE)*	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	U24VA109X XXXX	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)				-	-	-	-	-	-

DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS

Class: B.Tech. I -Semester		**Branch:** Common to all branches	
Course Code:	**U24MH101**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-6-9**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: convergence of an infinite series and differential calculus
LO2: partial differentiation and its applications
LO3: differential equations of first order and first degree along with certain applications
LO4: higher order linear differential equations and applications

UNIT-I	**9 Hrs**

Infinite Series: Sequences, Series, General properties of series, Series of positive terms, Comparison Tests-Limit form, Integral test, D'Alembert's Ratio test, Cauchy's root test

Differential Calculus and its applications: Fundamental theorems-Rolle's theorem (Geometrical interpretation), Lagrange's mean value theorem (Geometrical interpretation), Cauchy's mean value theorem, Taylor's theorem (Generalized mean value theorem), Expansions of functions- Maclaurin's series, Taylor's series, Maxima and Minima-Conditions, Practical problems (rectangle, right circular cylinder, cone)

Self-Learning Topics (SLTs): *Review of basic concepts of limit, continuity and differentiability [Reference 1: topic (3.1,3.2,3.5,4.1)], Alternating series [(Text 1: topic 9.12,Solved problems: 9.16,9.17,Practice problems: exercise 9.7(1, 7)], Additional problems on fundamental theorems [(Text 1: topic 4.3, Solved problems: 4.13(i),4.14,4.17, Practice problems: exercise 4.4 (1(i),1(ii), 3(ii), 10(i), 10(ii))], Additional problems on Maclaurin's series [(Text 1: topic 4.4, Solved problems: 4.20, Practice problems: exercise 4.5 (3, 5)]*

UNIT-II	**9 Hrs**

Partial differentiation and its applications: Functions of two or more variables, Partial derivatives, Total derivative, Change of variables, Jacobians, Functional relationship, Geometrical interpretation-Tangent plane and Normal to a surface, Taylor's theorem for function of two variables (without proof), Errors and approximations, Total differential, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers, Differentiation under the integral sign

Self-Learning Topics (SLTs): *Leibnitz rule of Differentiation under the integral sign for variable limits [(Text 1: topic 5.13(2)), Solved problems: 5.54, Practice problems: exercise 5.11 (1)],Additional problems on maxima and minima of function of two variables [(Text 1: topic 5.11 (1), Solved problems: 5.42, 5.43, Practice problems: exercise 5.10 (1(i),1(ii),1(iii))],Additional problems on Lagrange's methods of undetermined multipliers [(Text 1: topic (5.12), Solved problems: 5.45, 5.48, Practice problems: exercise 5.10 (3(i) ,3(ii))]*

UNIT-III	9 Hrs

Differential equations of first order (DE): Reorientation of differential equation of first order and first degree (Formation a differential equation, variables separable method, homogeneous equations, Linear equations), Exact differential equations, Equations reducible to exact equations

Applications of differential equations of first order: Orthogonal trajectories - Orthogonal trajectories of the family of curves f (x, y, c) =0, Physical Applications-Motion of a boat across a stream, Resisted motion, Velocity of escape from the earth, Simple electric circuits - RL series circuit, Newton's law of cooling, Rate of decay of Radio-active materials, Rate of growth of population

Self-Learning Topics (SLTs): *Review of DEs of first order (Text 1: topic 11.1, 11.2, 11.3, 11.4,11.5), Solutions of Non-exact DEs by Inspection Method [(Text 1: topic 11.12(1), Solved Problems: 11.30, Practice problems: exercise 11.8 (1,3)], Additional problems on Non-exact DEs [(Text 1: topic 11.12(2,3,4,5), Solved problems: 11.33,11.35,11.36, Practice problems: exercise 11.8 (9,15)], Orthogonal Trajectories of family of curves in polar coordinates [(Text 1: topic 12.3(3), Solved problems :12.7,12.8 , Practice problems: exercise 12.2(9,10)].*

UNIT-IV	9 Hrs

Linear differential equations: Linear differential equations with constant coefficients, Rules for finding complementary function, Inverse operator, Rules for finding the particular integral ($Q=e^{ax}$, sin(ax+b) or cos(ax+b), x^m and $e^{ax}V(x)$), Method of variation of parameters, Linear dependence of solutions

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

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*, 44th ed. Khanna Publishers, Delhi, 2017

Reference Book(s):

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

Web and Video link(s):

1. https://youtu.be/4EYko9rdF7g?si=WUu12 *NPTEL Video Lecture on Infinite series by Prof. S.K.Ray, Professor of Mathematics, IITK Kanpur.*
2. https://youtu.be/0apMXhWG_W8?si=M-abw2Gq3buX5HLM *NPTEL Video Lecture on Fundamental mean value theorems by Prof. Jithedra Kumar, Professor of Mathematics, IITK Kharagpur.*
3. https://youtu.be/6r5jfT8xrXM?si=ryLXYVJr4-iUkdlV; *NPTEL Video Lecture on Exact Differential Equations, Prof. Jithedra Kumar, Professor of Mathematics, IIT Kharagpur.*
4. https://youtu.be/kbGhrqV9AOM?si=yGyK_V7kJKGa3OaR *NPTEL Video Lecture on Orthogonal Trajectories of family of curves by Prof. Aditya Sharma, Professor of Physics, IISE Bhopal.*
5. *https://youtu.be/btOCUmJkrrg?si=zq3nB00kplm7b5se; NPTEL Video Lecture on Higher Order Linear Differential Equations, Prof. Jithedra Kumar, Professor of Mathematics, IIT Kharagpur.*

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

ENGINEERING PHYSICS *(for ECE)*

Class: B.Tech. I -Semester		**Branch:** ECE	
Course Code:	**U24PY102E**	**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: properties of dielectric, magnetic and superconducting materials

LO3: semiconductor materials and semiconductor diode characteristics

LO4: bipolar junction transistors **(**BJTs) and operation of special diodes

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; 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; Attenuation losses in optical fibers; 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**

Dielectric materials: Introduction, Permittivity, Dielectric constant, Polarization, Dielectric polarization mechanisms- Electronic, Ionic, Orientational and Space charge polarization (qualitative); Dielectric breakdown

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, Applications of magnetic materials; Superconductivity, Meissner effect, Transition temperature, Isotope effect, Type-I and type-II superconductors, Applications of superconductors

Self-Learning Topics (SLTs): *Polarization (Text3: topic 5.3), properties of dielectric (Text3: topic 5.6), Eddy currents (Text3: topic 6.5), classification of dielectric materials (Text1: topic 40.22), 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**

Semiconductor Physics: Classification of solids- Insulator, Semiconductor and Metal using energy band diagram, Semiconductor- Mobility and Conductivity, Classification of semiconductors, Drift and diffusion currents, Charge densities in semiconductors, Fermi-dirac function, Fermi level in intrinsic and extrinsic semiconductor, Hall effect, Continuity equation

Semiconductor Diode Characteristics: Theory of PN Junction diode, Quantitative theory of PN

diode currents, Diode current equation, V-I characteristics- Temperature dependence of V-I characteristics of diodes, Diode resistance, Diode capacitance, Energy-band diagram of PN Junction diode, Zener diode, Breakdown mechanism, Zener diode applications, Varactor diode, Tunnel diode

Self-Learning Topics (SLTs): *solved problems (Text2: example 1.5, 1.6, 1.13, 2.2, 2.7, 2.13).*

UNIT-IV	**9 Hrs**

Bipolar Junction Transistors: Bipolar junction transistor, transistor current components, operation of NPN transistor, Operation of PNP transistor, Transistor configuration: common base, common emitter, common collector, transistor as an amplifier, large signal, d.c. and small signal CE values, Ebers-Moll model, breakdown in transistors

Special Diodes: Light emitting diode (LED) and its applications, Photodetectors- Photo diode, Photo transistor and its applications, P-I-N diode, Avalanche diode; Solar cell- structure, working principle and its I-V characteristics

Self-Learning Topics (SLTs): *solved problems (Text2: 4.11, 4.12, 4.20, 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. Numerical aperture and acceptance angle of an optical fiber
5. Determination of dielectric constant of materials using parallel plate capacitor
6. Magnetic hysteresis- B-H curve tracing using CRO
7. Study of V-I characteristics of PN junction diode
8. Study of V-I characteristics of Zener diode
9. Study of common emitter characteristics of NPN transistor
10. Study of common base characteristics of NPN transistor
11. Energy band gap of a semiconductor material
12. Determination of Hall coefficient, carrier density of given semiconducting material using Hall effect setup

Textbook(s):

1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, *A Text Book of Engineering Physics,* S. Chand & Company Ltd, 11th ed. ISBN- 978-93-528-3399-3, 2018
2. S Salivahanan, N Suresh Kumar, *Electronic devices and circuits,* Mc Graw Hill Education (India) private limited, ISBN-10: 93-392-1225-8, 2015
3. K.B.Raina, S.K.Bhattacharya, T. Joneja, *Electrical Engineering Materials and Electronic Components*, S.K.Kataria & Sons Publisher, ISBN-10: 81-85749-84-1, 2005

Reference Book(s):

1. Bhattacharya and Bhaskaran, *Engineering Physics*, Oxford University Press, 1st ed. ISBN-9780198065425, 2013
2. V. Rajendran, *Engineering Physics*, Mc Graw Hill, ISBN-13: 978-9-35-134295-3, 2013
3. R.K. Gaur and S.L.Gupta, *Engineering Physics*, Dhanpath Rai and Sons publications, ISBN-10: 8189928228, 2013

4. David Halliday, Robert Resnick & S Krane, *Physics Volume I&II*, Wiley India Limited, 5th ed. ISBN-10: 9788126510887, 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*

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 ed. ISBN- 978-81-265-7015-7, 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: determine the dielectric constant of a material and properties of magnetic & superconducting materials

CO3: analyze V-I characteristics of semiconductor diodes and suggest their applications in electronics engineering

CO4: Analyze transistor input/output characteristics in CB,CE,CC configuration and analyze I-V characteristics of LED, Photo diode, Solar cell

(based on psychomotor skills acquired from laboratory component)

CO5: measure diameter of wire and hollow tubes using Vernier calipers 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: determine forward voltage and currents from V-I characteristics of semiconductor diodes

CO8: identify cut-off, saturation and active regions of NPN transistor

Course Articulation Matrix (CAM):		U24PY102E ENGINEERING PHYSICS (*for ECE*)												
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	U24PY102E.1	2	1	-	-	-	1	1	1	1	-	1	1	1
CO2	U24PY102E.2	2	1	-	-	-	1	1	1	1	-	1	1	1
CO3	U24PY102E.3	2	1	-	-	-	1	1	1	1	-	1	1	1
CO4	U24PY102E.4	2	1	-	-	-	1	1	1	1	1	1	1	1
CO5	U24PY102E.5	2	1	-	-	1	1	1	1	2	-	1	1	1
CO6	U24PY102E.6	2	1	-	-	1	1	1	1	2	-	1	1	1
CO7	U24PY102E.7	2	1	-	-	1	1	1	1	2	-	1	1	1

CO8	**U24PY102E.8**	2	1	-	-	1	1	1	1	2	1	1	1	1
	U24PY102E	**2**	**1**	**-**	**-**	**1**	**1**	**1**	**1**	**1.5**	**1**	**1**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

SWITCHING THEORY AND LOGIC DESIGN

Class: B.Tech. I -Semester		**Branch:** ECE	
Course Code:	**U24EC103**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-6-9**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs.**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: number system and binary codes, minimization of switching functions

LO2: combinational circuits design and implementation using logic gates, adders/subtractors, multiplexer and decoders

LO3: implementation of sequential circuits, counters, registers using flip flops and logic gates

LO4: finite state machines and its minimization

UNIT-I	**9 Hrs**

Number Systems: Review of number systems, binary weighted and non-weighted codes, binary arithmetic, 1's &2's complement subtraction, error detecting and correcting codes, Hamming code

Boolean Algebra: Postulates and theorems, logic gates and truth tables, representation of switching functions using SOP & POS forms, Karnaugh map representation, minimization using K-Map

Self-Learning Topics (SLTs): *Solved problems (Text1: Prob 1.3), Solved problems (Text2: example problems 1.7, 1.18, 1. 25, 1.25, 1. 36, 1.84, 2.8, 2.28,2.38), Don't care conditions (Text1: topic 3.6), Other two-level implementations (Text1: topic 3.8).*

UNIT-II	**9 Hrs**

Combinational Circuits: Adders– half Adder, full Adder; subtractors-half subtractor, full Subtractor; parallel adder, Carry look ahead adder, Decoders, decoders - BCD to 7 segments, BCD to decimal. Encoders-priority encoder, Multiplexer and Demultiplexer, realization of switching functions using multiplexers and decoders

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

UNIT-III	**9 Hrs**

Sequential Circuits: Flip Flops - SR, JK, Race Around Condition in JK, JK Master Slave, D and T Flip Flops, Excitation Tables, Conversion from one type of Flip-Flop to another. Shift Registers, Bidirectional Shift Registers, Ring counter and Johnson Counter; Design of Asynchronous and Synchronous Counters (modulo-N)

Self-Learning Topics (SLTs): *latches (Text2: topic 6.4.1, 6.4.2), edge triggered Flip-flops (Text2: topic 6.4.3), master slave Flip Flops (Text2: topic 6.9)*

UNIT-IV	**9 Hrs**

State minimization: state table, state diagram, state assignment, state minimization, synthesis of synchronous, sequential circuits – sequence detectors

Finite State Machines: Mealy and Moore machines – capabilities and limitations of finite state machine, state equivalence and machine minimization- Merger graph and Merger table

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

Course Learning Outcomes (COs):

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

CO1: explain number system and binary codes; prove the given Boolean identity and apply minimization techniques to obtain minimal SOP/POS forms of logic functions

CO2: design switching functions using combinational circuits for given application

CO3: develop a sequential circuit using flip-flops and logic gates for given specifications

CO4: develop finite state machine with optimum states for given specifications

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

1. *https://www.youtube.com/watch?v=JmJWpX2ECfI NPTEL Video Lecture on Error Detection and Correction*
2. https://www.youtube.com/watch?v=BPBiyzc0OBw *NPTEL Video Lecture on K maps*
3. https://www.youtube.com/watch?v=NHydmByCsZQ&t=638s *NPTEL Video Lecture on logic design*
4. https://www.youtube.com/watch?v=5Zstl5d5Byc *NPTEL Video Lecture on Minimization of Finite State Machines.*

Course Articulation Matrix (CAM)		U24EC103 SWITCHING THEORY AND LOGIC DESIGN												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24EC103.1	3	2	1	-	-	1	1	1	1	1	1	1	1
CO2	U24EC103.2	3	2	1	-	-	1	1	1	1	1	1	2	1
CO3	U24EC103.3	3	2	2	1	-	2	1	1	1	1	1	2	1
CO4	U24EC103.4	3	2	3	3	-	3	1	1	1	1	1	3	1
U24EC103		**3**	**2**	**1.75**	**2**	**-**	**1.75**	**1**	**1**	**1**	**1**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

PROGRAMMING FOR PROBLEM SOLVING WITH C

Class: B.Tech. I -Semester		**Branch:** ECE	
Course Code:	**U24EC104**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60%**
Total Number of Teaching Hours:	**60 Hrs.**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: algorithms, flow charts and develop programs with basic constructs

LO2: control structures and array operations

LO3: string operations and modular programming concepts with functions and recursion

LO4: structures, unions, pointers and files in C programming

THEORY COMPONENT

UNIT-I	**9 Hrs**

Introduction to Programming: Art of programming through algorithms and flowcharts

Overview of C: History of C, Importance of C, Basic structure of C programs

Constants, Variables and Data Types: Character set, C tokens, declaration of variables, defining symbolic constants

Managing Input and Output Operations: Reading a character, writing a character**,** formatted input, formatted output

Operators and Expressions: Arithmetic, Relational, Increment, Decrement, Conditional, Logical, Bit-wise, Special operators, Arithmetic expressions, Evaluation of expressions, Operator precedence and associativity

Self-Learning Topics (SLTs): *Components of a computer, concept of hardware and software (Text1: chapter 1), Executing a C program (Text1: chapter 2), Type conversions in expression (Text1: chapter 4) Solved problems (Text1: chapter 2 to chapter 5), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 2 to chapter 5)*

UNIT-II	**9 Hrs**

Decision Making and Branching: Simple if statement, if-else statement, Nesting of if-else statements, else if ladder, switch statement, Conditional operator, goto statement

Decision Making and Looping: while statement, do-while statement, for statement, Nested loops, Jumps in loops

Arrays: One-dimensional arrays, Declaration of one-dimensional arrays, Initialization of one-dimensional arrays, Linear search, Two-dimensional arrays, Initializing two dimensional arrays, multi-dimensional arrays

Self-Learning Topics (SLTs): *Concise test expressions (Text1: chapter 7) Dynamic arrays (Text1: chapter 8), Solved problems (Text1: chapter 6 to chapter 8), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 6 to chapter 8)*

UNIT-III	**9 Hrs**

Character Arrays and Strings: Declaring and initializing string variable, reading strings from terminal, Writing strings to screen, String handling functions, Table of strings

Modular Programming with User Defined Functions: Need for user-defined functions, Elements of user-defined functions, Definition of functions, Return values and their types,

Function calls, Function declaration, Category of functions, Recursion, The scope, visibility and lifetime of variables (storage classes)

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

UNIT-IV	**9 Hrs**

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

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

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

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

LABORATORY COMPONENT

List of Experiments

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

Textbook(s):

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

Reference Book(s):

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

4. Yashavant Kanetkar, *Let Us C,* BPB Publications, 19th ed. 2022
5. A. K. Sharma, *Computer Fundamentals and Programming in C,* Universities Press, 2nd ed. 2018

Web and Video link(s):

1. https://nptel.ac.in/courses/106105171 *NPTEL Video Lecture on Problem Solving through Programming in C by Prof. Anupam Basu, Professor of CSE, IIT Kharagpur.*
2. https://nptel.ac.in/courses/106104128 *NPTEL Video Lecture on Introduction to Programming in C by Prof. Satyadev Nandakumar, Professor of CSE, IIT Kanpur*

Laboratory Manual (for laboratory component):

1. *Programming for Problem Solving with C Laboratory Manual and Record Book,* Department of ECE, 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):		U24EC104: 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	U24EC104.1	2	1	1	1	-	-	1	1	1	1	2	1	2
CO2	U24EC104.2	2	2	2	1	-	-	1	1	1	1	2	2	2
CO3	U24EC104.3	2	2	3	1	-	-	1	1	1	1	2	2	2
CO4	U24EC104.4	2	2	3	2	-	-	1	1	1	1	2	2	2
CO5	U24EC104.5	1	1	1	1	1	-	1	1	1	1	2	1	2
CO6	U24EC104.6	1	2	2	2	1	-	1	1	1	1	2	2	2
CO7	U24EC104.7	1	2	3	2	1	-	1	1	1	1	2	2	2
CO8	U24EC104.8	1	2	3	2	1	-	1	1	1	1	2	2	2
U24EC104		**1.5**	**1.75**	**2.25**	**1.5**	**1**	**-**	**1**	**1**	**1**	**1**	**2**	**1.75**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

BASIC ELECTRICAL ENGINEERING

Class: B.Tech. I -Semester		**Branch:** Common to ECE & ECIE	
Course Code:	U24EE105B	**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 circuits, 3-Ø AC circuits, and series resonance
LO4: construction, principles, and applications of DC & AC machines, concepts of earthing, fuses, and MCB

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 & Reciprocity theorem.
(T and 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, Parallel RL, RC & RLC circuits, Concept of reactance, Impedance, Susceptance, Admittance, Complex power, Real power, Reactive power and Power factor & Series Resonance

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 Earthing (Qualitative treatment):

Electrical Machines: Construction, Principle of operation, Characteristics & applications of 1-Ø transformer, 1- Ø induction motor, DC motor, Stepper motor and BLDC motor

Electrical earthing, Fuses: Basic concepts of electric shock, Earthing, Fuses, Miniature Circuit Breaker (MCB)

***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):

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

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

1. *Basic Electrical 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 the 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, power in 1- Ø & 3- Ø AC circuits and bandwidth & quality factor of series resonant circuit

CO4: select a suitable electrical machine for a given application and analyze the essential roles of electrical earthing, fuses, and MCBs in electrical systems

(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 using load test and verify Kirchhoff's laws using PSPICE

Course Articulation Matrix (CAM):		**U24EE105B BASIC ELECTRICAL ENGINEERING**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24EE105B.1**	2	1	-	-	-	-	1	1	1	1	1	2	1
CO2	**U24EE105B.2**	2	2	-	-	-	-	1	1	1	1	1	2	1
CO3	**U24EE105B.3**	3	3	1	1	1	1	1	1	1	1	1	2	1
CO4	**U24EE105B.4**	3	3	1	1	1	1	1	1	1	1	1	2	1
CO5	**U24EE105B.5**	2	1	-	-	-	-	1	1	1	1	1	2	1
CO6	**U24EE105B.6**	2	2	-	-	-	-	1	1	1	1	1	2	1
CO7	**U24EE105B.7**	3	3	1	1	1	1	1	1	1	1	1	2	1
CO8	**U24EE105B.8**	3	3	1	1	1	1	1	1	1	1	1	2	1
U24EE105B		**2.5**	**2.25**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**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):	**2-0-0-3-5**	**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; United nations goals of sustainable development

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

Course Learning Outcomes (COs):

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

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

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

CO3: examine and perceive the solutions for the environmental pollution

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

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Course Articulation Matrix (CAM):		U24CY106 ENVIRONMENTAL STUDIES												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CY106.1	2	1	2	1	-	2	1	1	1	1	1	1	1
CO2	U24CY106.2	-	-	2	1	-	1	1	1	1	1	1	1	1
CO3	U24CY106.3	1	2	1	1	-	1	1	1	1	1	1	1	1
CO4	U24CY106.4	-	-	1	1	-	2	1	1	1	1	1	1	1
	U24CY106	0.75	0.75	1.50	1	-	1.5	1	1	1	1	1	1	1
3 – HIGH, 2 – MEDIUM, 1 – LOW														

IDEA LAB MAKERSPACE

Class: B.Tech. I Semester		**Branch:** Common to all branches	
Course Code:	**U24AE107**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-2-2-4**	**CIE:**	**100%**
Total Number of Lab Hours:	**36 Hrs.**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: carpentry and CNC wood router

LO2: mould for sand casting and arc welding joints

LO3: laser engraving, 3D printing and robots in manufacturing

LO4: Printed Circuit Board (PCB) and Internet of Things (IoT)

LABORATORY COMPONENT

S. No.	Creative Fabrication Technology	List of Experiments
1.	Carpentry	Prepare a half lap dovetail joint
2.	CNC Wood Router	Perform wood carving using CNC Wood Router
3.	Foundry	Prepare a sand mould using single piece pattern
4.	Welding	Prepare a single V-butt joint on mild steel plates using AC arc welding machine
5.	Injection Moulding	Prepare a plastic product using Injection moulding machine
6.	Laser Engraving	Perform key chain by using CO_2 laser cutting machine
7.	3D Printing	Prepare a key chain on 3D printer with the given dimensions
8.		Prepare a Spur Gear on 3D printer with the given dimensions
9.	Robotics	Perform basic pick-and-place operation using robot
10.	Printed Circuit Board (PCB)	Design and fabricate a PCB for a given application
11.	Internet of Things (IoT)	Measure the temperature and humidity by using DHT11 sensor and Arduino UNO
12.		Create a smart plant watering system using IoT
Course Project		• Students are required to create an affordable prototype as their course project, based on the knowledge and skills acquired during the course. • Students have to present and submit their prototypes to demonstrate their ability to apply classroom learning practically, showcasing their creativity and technical aptitude.

Laboratory Manual:

- ***IDEA Lab Makerspace*** *Laboratory Manual & Record Book (LMRB) prepared by the faculty of department of Mechanical Engineering, KITSW, Revised version 4, August-2024*

Text/ Reference Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy., *Elements of Workshop Technology*, Media Promoters and publishers Pvt. Ltd, India, Vol-I-2008 &Vol-II-2010.
2. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, *Additive Manufacturing Technologies-3D Printing, Rapid Prototyping, and Direct Digital Manufacturing*, Springer Nature, 2nd ed. 2021
3. R.S. Khandpur, *Printed Circuit Boards: Design, Fabrication, Assembly and Testing*, New Delhi Tata Mc Graw Hill-2008.
4. Sudeep Mishra, Anandarupmukherjee and Arijit Roy, *Introduction to IoT*, New Delhi: University Cambridge Press, 2021.

Course Learning Outcomes (COs):

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

(based on psychomotor skills acquired from laboratory component)

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

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

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

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

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

PRACTICUM - 1

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

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: literature review and identifying research gaps

LO2: implementing a project independently by applying knowledge to practice

LO3: preparing well-documented report and informative PPT

LO4: effective technical presentation and creating video pitch

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

(i). Practicum is a mandatory semester project work.

(ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)

(iii). Allotment of Practicum topics for students:

- **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	U24MH101	U24PY102E	U24EC103	U24EC104	U24EE105B	U24CY106
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

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

****

CIRCULAR

Allotment of Practicum topics to students

Section : …….

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

Note:

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

(Signature of class teacher)

****

(iv). ***To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.***

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

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

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

viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course

(ix). A sample rubric for assessment and evaluation of practicum is as follows:

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

Total	100 marks

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

(a) **Practicum Topic**: Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.

(b) **Working Model**: Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.

(c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.

- What was the objective of the practicum assigned?
- What are the main responsibilities and tasks for practicum?
- What knowledge and skills from the coursework are applied in the practicum?
- What new knowledge and skills are acquired during the practicum?
- In what ways, can the practicum be helpful for the professional career?
- What gaps are identified in your practicum work?
- What improvements or changes you suggest for addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(g) The student has to register for the Practicum as a supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce
ii) he/she fails to submit the report in prescribed format
iii) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

Course Learning Outcomes (COs):

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

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

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

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

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

Course Articulation Matrix (CAM):		**U24EL108 PRACTICUM-1**												
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	**U24EL108.1**	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	**U24EL108.2**	2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	**U24EL108.3**	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	**U24EL108.4**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
U24EL108		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY (SEA /SAA) – 1			
Class: B.Tech. I semester	**Branch:** Common to all branches		
Course Code:	**U24VA109XXXXX**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

- **LO1: holistic development** through activity-based learning to gain real-life experience which effectively help individuals deal appropriately with problems/challenges
- **LO2: positive mindset** by actively adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity and handling rejection in life
- **LO3: skills for effective fieldwork practice**, which include ethics, observation, communication, interviewing, problem solving, time management, organisation and documentation
- **LO4: making a well-documented report and an effective oral presentation** through PPTs portraying knowledge, skills, qualities acquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building **generic competencies** in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the **physical, emotional, cognitive, spiritual and social aspects**. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.

It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely **SEA** (Social Empowerment Activities) and **SAA** (Self Accomplishment Activities)

These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.

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

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

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

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

(e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enroll in the forthcoming semesters.

Monitoring SEA/SAA:

(a) **Nodal units:** The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA.

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

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

i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity

ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyses the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.

iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

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

i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.

ii. Fieldwork consists of three phases: preparation, the actual activity and feedback

iii. As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.

iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.

v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more

vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and

culture of the place.

vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

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

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

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

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

x. **Ethics of fieldwork**: Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged

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

xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.

xiii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practice sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.

xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.

- During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.

(e) **Demonstration / Presentation and Report**: Student after presentation/demonstration

of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.

(f) **Flow process for completion of SEA/SAA course**:

i. ***Faculty counsellor approval***: In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal center. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

ii. ***Identification of goals and preparation of action plan:*** In week (1), the respective faculty coordinator(s) of nodal centers shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal center, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.

iii. ***Field work:*** Under the guidance of nodal center, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal center.

iv. ***Demonstration/ Presentation:*** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal center in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal center shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.

v. ***Report writing:*** After successful demonstration/presentation, student shall write a 2–3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

(g) ***Assessment & Evaluation:*** There shall be *only Continuous Internal Evaluation (CIE) for SEA/SAA.* The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centers and faculty counsellors, consolidate them, and submit the final grades to the

examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

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

Note:

(a) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal center. In case of demonstration, student must take timeslot from the nodal center and demonstrate the skills learnt/improved during the allotted timeslot.

- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.

(b) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator.*

(c) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.

(d) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she

a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal center, **and**
b. scores a minimum of 40 marks in the CIE of the course

(e) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Course Learning Outcomes (COs):

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

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

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

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

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

Text / Reference book(s):

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

Course Articulation Matrix (CAM):		U24VA109XXXXX **- Courses listed under SEA/ SAA**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VA109XXXXX.1**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO2	**U24VA109XXXXX.2**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO3	**U24VA109XXXXX.3**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO4	**U24VA109XXXXX.4**	-	-	-	-	-	2	2	2	2	2	2	-	-
U24VA109XXXXX		-	-	-	-	-	2	2	2	2	2	2	**-**	**-**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

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

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

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

EXPERT TALK SERIES – 1

Class: B.Tech. I semester	**Branch:** Common to all branches		
Course Code:	**U24AE110**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-1-1**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: 21st century skills needed for industry, current industry trends, challenges and innovations
LO2: latest technology in practice and applying knowledge to solve real-world problems

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

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

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

(a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.

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

(c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximized if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.

(d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".

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

(e) The answer is Industry **Expert Talk Series (ETS)**. Through ETS, we invite industry experts in different fields to deliver talks and interact with students.

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

(g) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond

theoretical concepts.

(h) Our competency-focused curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses

(i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.

(j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.

(k) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.

(l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.

(m) ETS enhances your learning in many ways for global opportunities for your career.

(n) All in all, learning from industry experts**,** is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.

(o) Salient features of ETS are hereunder:

(i) ETS is offered from I semester to VI semester.

(ii) ETS, in any given semester, is treated as one credit course

(iii) Students are required to earn six credits (from I to VI semester)

(iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**

(v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.

(vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs; *duration: 10-15 mins*), on the contents covered in the expert talk.

(vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators.**

(viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.

(ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented

report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.

(x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks

(xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).

(p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

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

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

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

ii. Supplementary Exam:

(a) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE

(b) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs; *duration: 2Hrs*) on the content covered in ETS lectures.

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

(d) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

Course Learning Outcomes (COs):

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

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

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

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

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

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

Course code U24AE1YY: ***X represents semester, YY represents ETA course serial number***

2nd Semester Syllabus

II SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24CY202E	Engineering Chemistry *(for ECE)*	2	1	2	5	10	4
3	PCC	U24EC203	Electronic Circuits	2	1	-	4	7	3
4	ESC	U24EC204	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 and Yoga	-	-	2	2	4	-
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	U24VA210XX XXX	SEA-2 / SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
			Total:	10	4	10	36	60	21
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)				-	-	-	-	-	-

Exit Option to Qualify UG Certificate in ECE: Any Two (02) Courses during the 2 - Months internship									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	**PCC**	**U24EC212X**	Industrial Electronics	**2**	**-**	**2**	**-**	**4**	**3**
2	**PCC**	**U24EC213X**	Electronic Measuring Instruments	**2**	**-**	**2**	**-**	**4**	**3**
3	**PCC**	**U24EC214X**	PCB Design and Fabrication	**2**	**-**	**2**	**-**	**4**	**3**
4	**PCC**	**U24EC215X**	Any other course approved by BoS Chair and Dean AA	**2**	**-**	**2**	**-**	**4**	**3**

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, Vectors-Linear dependence and independence, 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: - 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

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 ed. 2017 (Chapters 2,7,8)
2. Kreyszig E, *Advanced Engineering Mathematics*, Inc, U.K, John Wiley &sons, 10th ed. 2020 (Chapter 8(8.2))

Reference Book(s):

1. Spiegel M, Vector *Analysis* -Schaum's Serie", McGraw Hill, 2nd ed. 2017
2. S.S. Sastry, *Engineering Mathematics, Vol.II,* Prentice Hall of India, 3rd ed. 2014

Web and Video link(s):

1. https://youtu.be/L4crGhtEX14?si=hyjAPgDheJOhXtYZ : *NPTEL Video Lecture on Matrix Analysis with Applications/Dr.S.K.Gupta and Dr.Sanjeev Kumar/IIT Roorkee*
2. https://youtu.be/ksS_yOK1vtk?si=CNNA58OIuszubPiX : *NPTEL Video Lecture on Integral and Vector Calculus./Prof.Hari Shankar Mahato / IIT Kharagpur*

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

ENGINEERING CHEMISTRY (*for ECE*)

Class: B.Tech. II-Semester		Branch: ECE	
Course Code:	**U24CY202E**	**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: spectroscopic techniques and polymers
LO4: synthesis, properties and applications of nanomaterials

THEORY COMPONENT

UNIT-I **9 Hrs**

Electrochemical Energy Systems: Specific conductance, Equivalent conductance, Effect of dilution; Conductometric titrations-Acid base titrations-Strong acid vs strong base, Weak acid vs strong base, Strong acid vs weak base and weak acid vs weak base; Electrode potential, pH meter, Principle of pH measurements, Electrodes, Nernst equation, Potentiometric titrations-Acid base titrations

Batteries: Primary and secondary batteries-Lead-acid battery, Li-ion battery

Fuel cells: Hydrogen-oxygen fuel cell

Self-Learning Topics (SLTs): *Types of conductors (Text1: chapter 5 topic 1), Ohms law (Text 1: chapter 5 topic 5)*

UNIT-II **9 Hrs**

Water Technology: Introduction**,** Hardness of water, Estimation of hardness of water by complexometry, Alkalinity, Determination of alkalinity, Numerical problems, Determination of fluoride by spectrophotometry, Ion-exchange method, Desalination of brackish water, Reverse osmosis (RO), Electro dialysis, Quality parameters of potable water (BIS and WHO)

Corrosion: Introduction, Dry corrosion, Wet corrosion, Pilling-Bedworth rule, Effect of purity, Relative areas of anodic and cathodic parts, Nature of surface film, Humidity, pH and temperature on corrosion, Cathodic protection, Impressed current cathodic protection, Sacrificial anodic protection, Electroplating

Self-Learning Topics (SLTs): *Units of hardness (Text1: chapter 1 topic 5), Introduction to corrosion (Text1: chapter 7 topic 1), Galvanic series (Text1: chapter 7 topic 12)*

UNIT-III **9 Hrs**

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
Polymers: Polymer, Monomer, Condensation polymerization, Thermo-setting and thermo plastic resins, Applications of bakelite and poly vinyl chloride (PVC)

Self-Learning Topics (SLTs): *Electromagnetic spectrum (Text1: chapter 35 topic 1), Atomic absorption spectroscopy (Text1: chapter 35 topic 28) mechanism of addition Polymerization (Text1: chapter 3 topic 6)*

UNIT-IV	9 Hrs

Engineering Materials

Nanomaterials: Introduction, Size dependent properties-Surface area, Electrical, Optical and catalytic properties; Synthesis of nanomaterials-Top down and bottom-up approaches, Synthesis by sol-gel and precipitation method

Nanoscale materials: Fullerenes, Carbon nanotubes, 2D nanomaterials-graphene, Properties and applications; Biosensors

Self-Learning Topics (SLTs): *Introduction to nanotechnology* ***(****Text1: chapter 37 topic 1)*

LABORATORY COMPONENT

List of Experiments

1. Estimation of hydroxide ion [OH^-] 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)

Textbook(s):

1. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Company, 17th ed. 2019

Reference Book(S):

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

Web and Video link(s):

1. *https://elearn.nptel.ac.in/shop/iit-workshops/completed/battery-cell-technology-materials-and-industrial-applications/?v=c86ee0d9d7ed NPTEL Video Lecture on Battery technology by Dr. Kothandaraman, Professor of Chemistry, IIT Madras & Dr. Raghunathan, Professor of Chemical engineering, IIT Madras*

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs)

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

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: appraise spectroscopic techniques of chemical analysis and applications of polymers
CO4: summarize the synthesis of nanomaterials and their applications

(based on psychomotor skills acquired from laboratory component)

CO5: estimate hydroxide ion and alkalinity of water sample
CO6: determine total hardness and oxygen dissolved in water
CO7: calculate molarities of acids and bases
CO8: prepare nano materials and polymers

Course Articulation Matrix (CAM):		**U24CY202E ENGINEERING CHEMISTRY (*for ECE*)**												
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	**U24CY202E.1**	2	-	-	-	1	1	1	-	1	-	1	1	-
CO2	**U24CY202E.2**	2	-	-	-	1	1	1	-	1	-	1	1	-
CO3	**U24CY202E.3**	2	2	2	2	1	1	1	1	-	-	-	1	-
CO4	**U24CY202E.4**	2	2	1	1	1	1	1	1	-	-	-	1	-
CO5	**U24CY202E.5**	2	1	-	-	-	1	1	-	1	-	1	1	-
CO6	**U24CY202E.6**	2	1	-	-	2	1	1	-	1	-	1	1	-
CO7	**U24CY202E.7**	2	1	-	-	-	1	1	-	1	-	1	1	-
CO8	**U24CY202E.8**	2	1	-	-	-	1	1	-	1	-	1	1	-
U24CY202E		2	1	1.5	1.5	1.2	1	1	1	1	-	1	1	**-**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

ELECTRONIC CIRCUITS

Class: B.Tech. II -Semester		**Branch:** ECE	
Course Code:	**U24EC203**	**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: half wave, full wave rectifiers and non-linear wave shaping
LO2: transistor biasing and thermal stabilization
LO3: FET characteristics, its operation, biasing
LO4: Small signal low frequency transistor amplifier circuits

UNIT-I	**9 Hrs**

Review of conduction in semiconductors and PN Junction Diode

Rectifiers: Half Wave Rectifier, Full wave Rectifier, Harmonic Components in Rectifier Circuits, Inductor Filter, Capacitor Filter, L - Section Filter, and π - Section Filter

Non-Linear Wave Shaping Circuits: Clipping Circuits - Diode Clippers, Shunt Clippers, Series Clippers, clipping at two Independent Levels; The Clamping Operation, Clamping Circuits with source and diode Resistances and Clamping Circuit Theorem

Self-Learning Topics (SLTs): *solved problems (Text1: Prob 2.10, 2.14, 2.16, 2.19, 2.30), Clipping circuits (Text2: topic 7.2)*

UNIT-II	**9 Hrs**

Review of BJT characteristics in CB, CE and CC configurations

Transistor Biasing & Thermal Stabilization: The Operating Point (Q-point), Bias stability, stability of operating point, stability factor (S), fixed bias, Collector to Base Bias, Self-Bias, Stabilization against variations in V_{BE} and β for the Self Bias Circuit (S'&S''), Bias Compensation using diode, thermal runaway, thermal Stability

Self-Learning Topics (SLTs): *Solved problems (Text1: Prob 4.12, 4.14, 4.15), Solved problems (Text1: Prob 4.30, 4.31)*

UNIT-III	**9 Hrs**

Field Effect Transistors: Construction and operation of Junction Field Effect Transistor (JFET), Volt-Ampere characteristics- Drain and Transfer Characteristics, Comparison of BJT and FET, FET as Voltage Variable Resistor, Construction and operation of MOSFET, MOSFET characteristics in Enhancement and Depletion modes, MOSTET as a capacitor

FET Biasing: Fixed Bias Configuration, Self-Bias Configuration, Common Gate Configuration, Common Drain Configuration

Self-Learning Topics (SLTs): *Drain saturation current (Text1: topic 5.5), Solved problems (Text1: Prob 5.5, 5.6,), Voltage divider bias (Text1: topic 5.22.3), Solved problems (Text1: Prob 5.16, 5.17)*

UNIT-IV	**9 Hrs**

Small Signal Low Frequency Transistor Amplifier Circuits: Transistor Hybrid model, Typical values of h- parameters in CE, CB and CC configurations, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT

Amplifiers, effect of coupling and bypass capacitors on CE Amplifier

Self-Learning Topics (SLTs): *Simplified calculations for the common collector configuration (Ref Text1: topic 12.5), Simplified calculations for the common emitter configuration with emitter resistance (Ref Text1: topic 12.7)*

Course Learning Outcomes (COs):

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

CO1: design rectifiers and non-linear wave shaping circuits

CO2: calculate the stability factor for a given biasing circuit

CO3: explain the operation of different types of FETs and FET biasing

CO4: design single stage amplifiers using BJT

Textbook(s):

1. S. Salivahanan and N Suresh Kumar., *Electronic Devices and Circuits*, 2nd ed. Mc GrawHill, New Delhi, 2011
2. Jacob Milliman and Hilbert Taub., *Pulse, Digital and switching Waveforms*, 2nd ed. McGraw Hill, 2007

Reference Book(s):

1. Jacob Milliman and Christos Halkias, *Electronic Devices and Circuits*, 3rd ed. Mc Graw Hill, New Delhi, 1991
2. A.Anand kumar, *Pulse and Digital Circuits*, 2nd ed. PHI, 2008

Web and Video link(s):

1. https://www.youtube.com/watch?v=h0Y9jDKqScQ&list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP; *NPTEL Video Lecture on fundamentals of semiconductor devices by Prof. Digbijoy.N.Nath, IISC Bangalore.*
2. https://www.youtube.com/watch?v=pkIxCmaxWFg&list=PLbRMhDVUMngehqNF2w_UbAi94qIycZOTG; *NPTEL Video Lecture on analog electronic circuits by Prof. Pradip Mandal, IIT Kharagpur.*

Course Articulation Matrix (CAM):		**U24EC203 ELECTRONIC CIRCUITS**											
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	**U24EC203.1**	2	2	1	-	-	-	1	1	1	1	1	1	1
CO2	**U24EC203.2**	2	2	1	-	-	-	1	1	1	1	1	1	1
CO3	**U24EC203.3**	2	2	1	-	-	-	1	1	1	1	1	1	1
CO4	**U24EC203.4**	2	2	1	-	-	-	1	1	1	1	1	1	1
U24EC203		**2**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

DATA STRUCTURES THROUGH C

Class: B.Tech. II –Semester		**Branch:** ECE	
Course Code:	**U24EC204**	**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), Skip list (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 ed. 2009

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

1. *Data Structures using C Laboratory Manual and Record Book,* Department of ECE, 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: analyse 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):		**U24EC204 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	**U24EC204.1**	2	2	2	1	-	-	1	1	1	1	1	2	1
CO2	**U24EC204.2**	2	2	2	2	-	-	1	1	1	1	2	2	2
CO3	**U24EC204.3**	2	2	2	2	-	-	1	1	1	1	2	2	2
CO4	**U24EC204.4**	2	2	2	2	-	-	1	1	1	1	2	2	2
CO5	**U24EC204.5**	2	2	2	1	-	-	1	1	1	-	1	2	1
CO6	**U24EC204.6**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO7	**U24EC204.7**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO8	**U24EC204.8**	2	2	2	2	-	-	1	1	1	-	2	2	2
	U24EC204	**2**	**2**	**2**	**1.75**	**-**	**-**	**1**	**1**	**1**	**1**	**1.75**	**2**	**1.75**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

ENGLISH COMMUNICATION AND REPORT WRITING

Class: B.Tech. II –Semester		**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 them 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	**9 Hrs**

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,* 1st ed. As per the latest AICTE syllabus, Oxford University Press, 2018.
2. *Language and Life: A Skill's Approach,* 2nd ed. Based on the latest AICTE model curriculum Orient Blackswan Private Limited 2019.

Reference Book(s):

1. Thomson A.J., Martinet A.V., *A Practical English Grammar*, 3rd ed. Oxford University Press, 1997
2. Thomson A.J., Martinet A.V, *A Practical English Grammar*, 3rd ed. Exercise 2, Oxford University Press, 1997
3. Standard Allen W., *Living English Structure*, 5th ed. Pearson India Education Pvt Ltd. 2009

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc20_hs56/preview Technical English for Engineers by Aisha Icbal, IIT madras.
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	1	-
CO2	U24MH205.2	-	-	-	-	-	1	2	2	2	-	2	1	-
CO3	U24MH205.3	-	-	-	-	-	1	2	2	2	-	2	1	-
CO4	U24MH205.4	-	-	-	-	-	1	2	2	2	-	2	1	-
	U24MH205	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**2**	**-**	**2**	**1**	**-**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

SPORTS and YOGA

Class: B. Tech.II-Semester		**Branch:** Common to all 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:	**24Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: Yoga and its benefits

LO2: various sports & games

LO3: sportsman spirit

LO4: all round development

Sports and Games

List of Sports and Games

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

ReferenceBook(s):

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

Web and Video link(s):

1. Badminton game Video Link: https://www.youtube.com/watch?v=HucIqi8Lw3E&t=22s
2. Basket Ball game Video Link: https://www.youtube.com/watch?v=-tkE2lJoR58
3. Chess Video Link: https://www.youtube.com/watch?v=mDw7lgM8ePo
4. Carrom game Video Link: https://www.youtube.com/watch?v=z8vvJpNceeg
5. Football game Video Link: https://www.youtube.com/watch?v=mXjW78AgGu4
6. Table Tennis game Video Link: https://www.youtube.com/watch?v=bLrJGWvWI4U

7. Volleyball game Video Link:
   https://www.youtube.com/watch?v=BJJb3-O0Q1U
8. Cricket game Video Link:
   https://www.youtube.com/watch?v=87hO_Vs3-wQ
9. Handball game Video Link:
   https://www.youtube.com/watch?v=VCa_0USaq8k
10. Kabaddi game Video Link:
    https://www.youtube.com/watch?v=ai1m7ARNyNI
11. Kho-Kho game Video Link:
    https://www.youtube.com/watch?v=P3_z3LKdLdg
12. Yoga Asanas 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 aasanas

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

CO3: demonstrate Sportsman spirit and ethics

CO4: demonstrate Physical, Psychological, Social and Emotional balance

Course Articulation Matrix (CAM):		**U24VA206 SPORTS AND YOGA**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VA206.1**	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	**U24VA206.2**	-	-	-	-	-	-	-	1	-	-	-	-	-
CO3	**U24VA206.3**	-	-	-	-	-	-	2	-	-	-	-	-	-
CO4	**U24VA206.4**	-	-	-	-	-	-	-	-	1	-	1	-	-
U24VA206		-	-	-	-	-	-	2	1	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 center 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):

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

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs)

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

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

CO2: develop the 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		**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24ME207.1**	2	1	1	-	2	-	1	-	2	-	1	1	1
CO2	**U24ME207.2**	2	1	1	-	2	-	1	-	2	-	1	1	1
CO3	**U24ME207.3**	2	1	1	-	2	-	1	-	2	-	1	1	1
CO4	**U24ME207.4**	2	1	1	-	2	-	1	-	2	-	1	1	1
U24ME207		**2**	**1**	**1**	**-**	**2**	**-**	**1**		**2**	**-**	**1**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

PRACTICUM – 2

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

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: literature review and identifying research gaps
LO2: implementing a project independently by applying knowledge to practice
LO3: preparing well-documented report and informative PPT
LO4: effective technical presentation and creating video pitch

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

(i). Practicum is a mandatory semester project work.

(ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)

(iii). Allotment of Practicum topics for students:

- **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	U24MH201	U24CY202E	U24EC203	U24EC204	U24MH205	U24VA206
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

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

****

CIRCULAR

Allotment of Practicum topics to students

Section: …….

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

Note:

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

(Signature of class teacher)

****

(iv). ***To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.***

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

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

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

viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course

(ix). A sample rubric for assessment and evaluation of practicum is as follows:

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

Note: It is mandatory for the student to appear for oral presentation and viva-voce to

qualify for course evaluation of Practicum.

(a) **Practicum Topic**: Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.

(b) **Working Model**: Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.

(c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.

- What was the objective of the practicum assigned?
- What are the main responsibilities and tasks for practicum?
- What knowledge and skills from the coursework are applied in the practicum?
- What new knowledge and skills are acquired during the practicum?
- In what ways, can the practicum be helpful for the professional career?
- What gaps are identified in your practicum work?
- What improvements or changes you suggest for addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(g) The student has to register for the Practicum as a supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce
ii) he/she fails to submit the report in prescribed format
iii) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

Course Learning Outcomes (COs):

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

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

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

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

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

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

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY (SEA /SAA) - 2			
Class: B.Tech. II semester	**Branch:** Common to all branches		
Course Code:	**U24VA210XXXXX**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: **holistic development** through activity-based learning to gain real-life experience which effectively help individuals deal appropriately with problems/challenges

LO2: **positive mindset** by actively adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity and handling rejection in life

LO3: **skills for effective fieldwork practice,** which include ethics, observation, communication, interviewing, problem solving, time management, organisation and documentation

LO4: **making a well-documented report and an effective oral presentation** through PPTs portraying knowledge, skills, qualities acquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building **generic competencies** in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the **physical, emotional, cognitive, spiritual and social aspects**. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.

It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely **SEA** (Social Empowerment Activities) and **SAA** (Self Accomplishment Activities)

These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.

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

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

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

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

(e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enroll in the forthcoming semesters.

Monitoring SEA/SAA:

(a) **Nodal units:** The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA.

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

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

i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity

ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.

iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

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

i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.

ii. Fieldwork consists of three phases: preparation, the actual activity and feedback

iii. As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.

iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.

v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more

vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.

vii. **Eminent personalities/achievers/renowned persons/inspiring and great**

personalities

Eminent personalities/ Achievers / Renowned personalities:

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

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

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

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

x. **Ethics of fieldwork**: Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged

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

xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.

xiii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practice sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.

xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.

- During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.

(e) **Demonstration / Presentation and Report**: Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of

grade.

(f) **Flow process for completion of SEA/SAA course**:

i. ***Faculty counsellor approval***: In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal center. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

ii. ***Identification of goals and preparation of action plan:*** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.

iii. ***Field work:*** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal centre.

iv. ***Demonstration/ Presentation:*** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.

v. ***Report writing:*** After successful demonstration/presentation, student shall write a 2–3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

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

The CIE for SEA/SAA is as follows:

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

Note:

(a) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.

- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.

(b) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator.*

(c) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.

(d) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she

a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal centre, **and**
b. scores a minimum of 40 marks in the CIE of the course

(e) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Course Learning Outcomes (COs):

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

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

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

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

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

Text / Reference book(s):

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

Course Articulation Matrix (CAM):		**U24VA210XXXXX - Courses listed under SEA/ SAA**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VA210XXXXX.1**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO2	**U24VA210XXXXX.2**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO3	**U24VA210XXXXX.3**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO4	**U24VA210XXXXX.4**	-	-	-	-	-	2	2	2	2	2	2	-	-
U24VA 210XXXXX		-	-	-	-	-	2	2	2	2	2	2	**-**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

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

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

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

EXPERT TALK SERIES - 2

Class: B. Tech.II -Semester	**Branch:** Common to all branches		
Course Code:	**U24AE211**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-1-1**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

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

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

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

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

(a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.

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

(c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximized if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.

(d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".

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

(e) The answer is Industry **Expert Talk Series (ETS)**. Through ETS, we invite industry experts in different fields to deliver talks and interact with students.

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

(g) Students have the opportunity to learn from professionals who have achieved success in their

respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.

(h) Our competency-focused curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses

(i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.

(j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.

(k) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.

(l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.

(m) ETS enhances your learning in many ways for global opportunities for your career.

(n) All in all, learning from industry experts**,** is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.

(o) Salient features of ETS are hereunder:

(i) ETS is offered from I semester to VI semester.

(ii) ETS, in any given semester, is treated as one credit course

(iii) Students are required to earn six credits (from I to VI semester)

(iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**

(v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.

(vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs; *duration: 10-15 mins*), on the contents covered in the expert talk.

(vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators.**

(viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding

quizzes/ tests conducted at the end of the talks.

(ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.

(x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks

(xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).

(p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

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

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

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

ii. Supplementary Exam:

(a) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE

(b) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs; *duration: 2Hrs*) on the content covered in ETS lectures.

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

(d) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

Course Learning Outcomes (COs):

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

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

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

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

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

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

Course code U24AE2YY: ***X represents semester, YY represents ETA course serial number***

1st Year
Exit Courses
Syllabus

INDUSTRIAL ELECTRONICS

Class: B.Tech. II –Semester (Exit course)		**Branch:** ECE	
Course Code:	**U24EC212X**	**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: the operation of SCRs, TRIACs, DIAC, UJTs, power Transistors and their applications

LO2: various sensors, thermocouples, actuators and their applications

LO3: programmable controllers and their operation

LO4: types of robots, i/o signals & circuits for robots

THEORY COMPONENT

UNIT-I	**4 Hrs**

Introduction to Industrial Electronics: Introduction, Relay logic**.**

Solid State Devices in Industrial Applications: Introduction, SCRs, TRIACs, DIAC, UJTs, power Transistors and applications.

UNIT-II	**4 Hrs**

Input transducers and Sensors: Overview, temperature, pressure, flow, density and viscosity, level, position, motion, ph, humidity and gas detection sensors (one example each). Thermocouples, Actuators, servo motor and stepper motors.

UNIT-III	**4 Hrs**

Programmable controllers: Overview, programmable controller application, scanning a PLC program, features of the programmable controller, and operation of programmable controllers.

UNIT-IV	**4 Hrs**

Robots and other motion control systems: Types of Robots, types of robot control and programs, basic parts of a robot system, other types of robot actuators, input and output signals & circuits for robots.

LABORATORY COMPONENT

List of Experiments

1. V-I characteristics of Silicon Controlled Rectifier (SCR)
2. SCR Applications: AC & DC Power Control Circuit
3. TRIAC Performance Characteristic
4. V-I characteristics of DIAC
5. UJT Relaxation Oscillator
6. Motion detection using Ultrasonic Sensor
7. Temperature and Humidity measurement using sensors
8. Controlling a stepper motor

Textbook(s):

1. M.D. Singh and K.B. Kanchandani, *Power Electronics*, 2nd ed. McGraw Hill education, New Delhi, 2007
2. Thomas. E. Kissell, *Industrial Electronics*, 3rd ed. PHI, New Delhi, 2003

Reference Book(S):

1. M.H. Rashid, *Power Electronics*, Prentice Hall of India, New Delhi, 3rd ed. 2012
2. P.S. Bhimbra,*Power Electronics*, Khanna Publishers, New Delhi, 5th ed. 2012
3. P.C. Sen, *Power Electronics*, Tata McGraw Hill, New Delhi, 24th reprint, 2005

Laboratory Manual (for laboratory component):

1. *Industrial Electronics laboratory manual and Record Book,* Department of ECE, 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 performance characteristics and applications of semiconductor devices such as SCRs, TRIACs, DIACs, UJTs, and power transistors

CO2: Explain the principles, functions, and applications of various sensors, thermocouples, and actuators, including servo motors and stepper motors

CO3: explain features and operation of programmable controllers

CO4: describe robot controls, input-output signals & circuits for robots

(based on psychomotor skills acquired from laboratory component)

CO5: analyze the V-I characteristics of SCR and TRIAC

CO6: evaluate the performance of DIAC

CO7: design UJT Relaxation Oscillator

CO8: Develop and implement real-time applications using sensors and actuators to solve practical problems in industrial electronics

Course Articulation Matrix (CAM):		**U24EC212X INDUSTRIAL ELECTRONICS**												
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	**U24EC212X.1**	3	3	3	3	--	2	--	--	--	--	2	2	1
CO2	**U24EC212X.2**	2	2	2	2	--	2	--	--	--	--	2	2	1
CO3	**U24EC212X.3**	2	2	2	2	--	2	--	--	--	--	2	2	1
CO4	**U24EC212X.4**	3	2	3	2	--	2	--	--	--	--	2	2	1
CO5	**U24EC212X.5**	3	3	3	3	-	2	-	3	3	2	3	1	2
CO6	**U24EC212X.6**	3	3	3	3	-	2	-	3	3	2	3	1	2
CO7	**U24EC212X.7**	3	3	3	3	-	2	-	3	3	2	3	1	2
CO8	**U24EC212X .8**	3	3	3	3	3	2	-	3	3	2	3	3	3
U24EC212X		**2.75**	**2.625**	**2.75**	**2.75**	**3**	**2**	**-**	**3**	**3**	**2**	**2.5**	**1.75**	**1.625**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

ELECTRONIC MEASURING INSTRUMENTS

Class: B.Tech. II –Semester (Exit course)		**Branch:** ECE	
Course Code:	**U24EC213X**	**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*:* Various measuring systems functioning and metrics for performance analysis

LO2*:* Operation and working of different electronic instruments such as voltmeters, current meters and CRO

LO3: Different AC and DC bridges for the measurement of R, L and C

LO4: Use of various techniques for measurement of different physical parameters using different classes of transducers

THEORY COMPONENT

UNIT-I	**4 Hrs**

Block Schematics of Measuring Systems and Performance Metrics: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics

UNIT-II	**4 Hrs**

Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Multimeters, Meter Protection, Extension of Range, Specifications of Instruments. CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes

UNIT-III	**4 Hrs**

Bridges: DC Bridge- Wheat Stone Bridge, AC Bridges-measurement of inductance: -Maxwell's bridge, measurement of capacitance: -Schering bridge

UNIT-IV	**4 Hrs**

Transducers: Classification, Strain Gauges, Force and Displacement Transducers, Resistance Thermometers, LVDT, Thermocouples, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers

LABORATORY COMPONENT

List of Experiments

1. Conversion of PMMC type ammeter to voltmeter
2. Measurement of A.C. voltage using PMMC meter
3. Measurement of frequency & phase using Lissajous patterns in CRO
4. Measurement of resistance using Wheatstone bridge circuit setup
5. Measurement of strain using Strain gauge transducer setup
6. Measurement of linear displacement using LVDT type inductive Transducer setup
7. Measurement of temperature using RTD & Thermistor transducer setups

8. Measurement of pressure using Hall transducer setup

Textbook(s):

1. A.K.Sawhney, *Electrical, Electronic measurement & Instrumentation*, Dhanpat Rai & sons, 18th ed. 2012

Reference Book(S):

1. David A. Bell, *Electronic Instrumentation and Measurements*, Oxford Univ. Press, 1997
2. A.D. Helbincs, W.D. Cooper, *Modern Electronic Instrumentation and Measurement Techniques*, PHI,5th ed. 2003
3. K. Lal Kishore, *Electronic Measurements and Instrumentation*, Pearson Education, 2010

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_ee117/preview; *NPTEL Video Lecture on Electrical Measurement and Electronic instruments by By Prof. Avishek Chatterjee | IIT Kharagpur*

Laboratory Manual (for laboratory component):

1. *Electronic Measuring Instruments Laboratory manual and Record Book,* Department of ECE, 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: analyse the performance characteristics of a measuring system

CO2: identify the various electronic instruments based on their specifications for carrying out a particular task of measurement

CO3: design bridge circuits for the measurement of unknown R, L and C

CO4: measure various physical parameters by appropriately selecting the transducer

(based on psychomotor skills acquired from laboratory component)

CO5: demonstrate the use of PMMC meter for conversion of ammeter to voltmeter & for A.C. voltage measurement and determine resistance & frequency using Wheatstone & Wien's bridge circuits

CO6: interpret the operation of CRO for measurement of frequency & phase using Lissajous patterns and examine Strain gauge transducer for strain measurement

CO7: utilize LVDT & capacitive transducers to measure displacement and examine RTD &thermocouple transducers for temperature measurement

CO8: examine Hall transducer for pressure

Course Articulation Matrix (CAM):		U24EC213X ELECTRONIC MEASURING INSTRUMENTS												
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	U24EC213X.1	2	1	1	1	-	-	-	-	-	-	1	1	2
CO2	U24EC213X.2	2	1	1	1	-	-	-	-	-	-	1	1	2
CO3	U24EC213X.3	2	1	1	1	-	-	-	-	-	-	1	1	2
CO4	U24EC213X.4	2	1	1	1	-	-	-	-	-	-	1	1	2
CO5	U24EC213X.5	1	1	1	-	-	-	-	1	1	-	-	1	-
CO6	U24EC213X.6	1	1	1	-	-	-	-	1	1	-	1	1	1
CO7	U24EC213X.7	1	1	1	-	1	-	-	1	1	-	1	1	1
CO8	U24EC213X.8	1	1	1	-	-	-	-	1	1	-	1	1	1
U24EC213X		**1.5**	**1**	**1**	**1**	**1**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1.5**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

PCB DESIGN AND FABRICATION

Class: B.Tech. II –Semester (Exit course)		**Branch:** ECE	
Course Code:	**U24EC214X**	**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: Familiarization of the various types of devices/components that may be mounted on PCB

LO2: PCB layout techniques for optimized component density and power saving.

LO3: Design and printing of PCB with etching and soldering techniques.

LO4: The current trends and scope of the PCB industry.

THEORY COMPONENT

UNIT-I	**4 Hrs**

PCB Fundamentals:

PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD). Classification of PCB - single, double, multilayer, and flexible boards, Manufacturing of PCB, PCB standards

UNIT-II	**4 Hrs**

Schematic & Layout Design:

Schematic diagram, General, Mechanical, and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net list, creating components for a library, Tracks, Pads, Vias, power plane, grounding.

UNIT-III	**4 Hrs**

PCB Design Processes:

Design automation, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper-clad laminates materials of copper clad laminates, properties of laminates (electrical & physical), Etching techniques, Lead cutting and Soldering Techniques.

UNIT-IV	**4 Hrs**

PCB Technology:

Introduction of PCB prototyping machines, Schematic Entry, PCB Parts creation, Auto Routing, Post Design, Brief overview of various models available, Recent Trends, and environmental concerns in the PCB industry.

LABORATORY COMPONENT

List of Experiments

A. Analog Electronic Circuits

1. To study current-Voltage characteristics of a p-n junction diode (forward bias and reverse bias)
2. Simple circuit to glow an LED.
3. Design Half Wave rectifier without Filter
4. Design Full Wave rectifier without Filter.
5. Design, fabrication, and testing of a 9 V power supply with Zener regulator

B. Digital Electronic Circuits

6. To verify and design AND, OR, NOT and XOR using NAND gates
7. Design a Half adder and Full Adder

PCB Design Softwares recommended

1. KiCAD (Open-Source Electronics Design Automation Suite) https://www.kicad.org/
2. EasyEDA (Online PCB Design Tool) https://easyeda.com/
3. PADS - Siemens EDA (PCB Design Software) https://eda.sw.siemens.com/en-US/pcb/pads/

Textbook(s):

1. Walter C. Bosshart, *Printed Circuit Board – Design & Technology*, Tata McGraw-Hill,2008.

Reference Book(S):

1. R.S. Khandpur, *Printed Circuit Board –Design, Fabrication, Assembly & Testing,* Tata McGraw-Hill, 1st edition,2005.
2. Chris Schroeder, *Printed Circuit Board Design Using Autocad*, Newnes Publisher, 1998.
3. Clyde F. Coombs, Jr, Happy T. Holden, *Printed Circuits Handbook*, McGraw Hill,6th edition, 2016

Web and Video link(s):

1. https://youtube.com/playlist?list=PL_UUrUkFMWRXeJ2mKt5jidU5hId4gwY&si=VotSJBjFbp3LWMaV.

Laboratory Manual (for laboratory component):

1. *PCB Design and Fabrication laboratory manual and record book,* Department of ECE, 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: illustrate the fundamentals of PCB.
CO2: discuss the Schematic and layout techniques of PCB.
CO3: develop the concepts of PCB design automation and design process.
CO4: discuss current trends and scope of PCB industry.

(based on psychomotor skills acquired from laboratory component)

CO5: design and test the functionality of rectifiers
CO6: design a LED circuit Zener regulator.
CO7: implement Boolean functions using logic gates.
CO8: design combinational circuits and test the functionality.

Course Articulation Matrix (CAM):		U24EC214X PCB DESIGN AND FABRICATION												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24EC214X.1	2	2	1	1	-	-		-	-	-	-	1	1	1
CO2	U24EC214X.2	2	2	2	1	-	-		-	-	-	-	1	1	1
CO3	U24EC214X.3	2	2	2	1	-	-		-	-	-	-	1	1	1
CO4	U24EC214X.4	2	2	2	1	-	-		-	-	-	-	1	1	1
CO5	U24EC214X.5	2	2	2	1	2	1		1	2	1	2	1	1	1
CO6	U24EC214X.6	2	2	2	1	2	1		-	2	1	2	1	1	1
CO7	U24EC214X.7	2	2	2	1	2	1		-	2	1	2	1	1	1
CO8	U24EC214X.8	2	2	2	1	2	1		1	2	1	2	1	1	1
	U24EC214X	**2.5**	**2.25**	**2.66**	**1**	**2**	**1**		**1**	**2**	**1**	**2**	**1**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW															

3rd Semester Syllabus

III SEMESTER

S. No	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH301D	Applied Mathematics (for ECE)	2	1	-	6	9	3
2	PCC	U24EC302	Electronic Circuits Analysis and Design	2	1	2	5	10	4
3	PCC	U24EC303	Digital Design	2	1	2	5	10	4
4	PCC	U24EC304	Signals and Systems	2	1	-	4	7	3
5	ESC	U24EC305	OOP 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	U24VA309XXXXX	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
Total:				12	5	8	36	61	24
Summer/ Inter-Sem Mandatory Bridge Courses: 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

APPLIED MATHEMATICS *(for ECE)*

Class: B.Tech. III -Semester		**Branch:** ECE	
Course Code:	**U24MH301D**	**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: Laplace transforms
LO2: complex integration
LO3: distribution function, density function and statistical parameters of a random variable
LO4: multiple random variables and random processes

UNIT-I	**9 Hrs**

Laplace Transforms: Integral transforms, Kernel of a transform, Laplace transform of a function; Laplace Inverse Transform, Existence and uniqueness of Laplace Transforms, S- plane and region of convergence (ROC); Laplace Transform of some commonly used signals-Dirac-delta (impulse) function ,Step ,Ramp ,Parabolic ,Real exponential , Complex exponential Sine & cosine functions, Damped sine & cosine functions, Hyperbolic sine & cosine functions, Damped hyperbolic sine & cosine functions, Rectangular pulse & triangle; Properties of Laplace Transforms- Linearity, First shifting theorem (Frequency shift property),Multiplication by 't' and division by _t', Laplace transforms of derivatives and integrals, Time scaling property, Time reversal property, Laplace transform of Heaviside unit step function, Second shifting theorem (time shift property), Laplace transform of periodic functions, Convolution theorem.

Operational Calculus: Transfer functions, Solution of ordinary differential equations with constant coefficients and system of ordinary differential equations with constant coefficients using Laplace transforms, Application of Laplace transforms to the first order and second order systems subjected to impulse, Step, Periodic, Rectangular, Square, Ramp, Triangular and Sinusoidal functions

Z-Transforms: Some standard z-transforms, Damping rule, Some standard results, Multiplication by 'n', Inverse z-transforms, Convolution theorem, Convergence of z-transforms.

Self-Learning Topics (SLTs): *Transforms of periodic functions [Text : topic 21.5,Solved problem: 21.9,21.10 Practice problems: exercise 21.2 (2,3,4)], Evaluation of integrals by Laplace transforms[Text 1: topic 21.11, Solved problem: 21.16 Practice problems: exercise 21.3 (19)],Additional problems on convolution theorem Text : topic 21.14, Solved problem: 21.26 Practice problems: exercise 21.5 (18,19,20)]*

UNIT-II	**9 Hrs**

Complex Integration: Analytic Functions, Cauchy-Riemann Equations in Cartesian and Polar coordinates. Line integration in complex plane, Integral of a non analytic function, Dependence on path of integration, *ML*-Inequality, Cauchy's integral theorem, Cauchy's integral formula, Series expansion of complex functions: Taylor's series and Laurent's series, Zeros and singularities, residues, Residue Theorem- Applications of Residue theorem to the properly chosen integrals around a unit circle and semi circle.

Self-Learning Topics (SLTs): *Additional problems on Cauchy's integral formula [Text 1: topic 20.14, Solved problem: 20.22, Practice problems: exercise 20.6 (4)], Additional problems on Taylor's series and Laurent's series [Text 1: topic 20.16, Solved problem: 20.27, 20.29 Practice problems: exercise 20.7 (7)]*

UNIT-III	9 Hrs

Random Variable: Introduction; Random variable concept - Discrete and Continuous random variables; Cumulative Distribution function, Probability density function and their Properties; Binomial, Poisson, Uniform and Gaussian Distribution functions; Conditional distribution function, Conditional density function and their properties.

Operations on One Random Variable– Expectation: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Conditional expected value, Moments- moments about the origin, central moments, variance and skew.

Self-Learning Topics (SLTs): *Other Distribution and Density Examples [Text 2: topic 2.5], Functions that give moments [Text 2: topics 3.3], Computer generation of one random variable [Text 2: topic 3.5]*

UNIT-IV	9 Hrs

Multiple Random Variables: Vector random variables, Joint distribution function – properties Marginal distribution functions, Joint density function – properties, Marginal density functions, Conditional distribution and density function, Statistical independence, Distribution and density of a sum of random Variables, Central Limit Theorem.

Operations on Multiple Random Variables: Expected value of a function of Random Variables, Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions; Jointly Gaussian Random Variables.

Random Processes: Random Process Concept – Classification, Distribution and density functions, Concept of stationarity and statistical independence, Poisson random process.

Self-Learning Topics (SLTs): *Additional problems on Transformations of Multiple Random Variables [Text 2: topic 5.4, Linear Transformations of Gaussian Random Variables [Text 2: topic 5.5, Computer generation of one random variable [Text 2: topic 5.6], Additional problems on Random Process, [Text 2: topic 6.8, Practice problems: exercise 6.1-6 and 6.1-7]*

Course Learning Outcomes (COs):

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

CO1: apply Laplace transforms to solve differential equations

CO2: represent a given function in Taylor's and Laurent's series and evaluate integrals using integral theorems

CO3: evaluate various statistical parameters of a random variable

CO4: perform various operations on multiple random variables

Textbook(s):

1. Grewal, B.S., *Higher Engineering Mathematics*, Khanna Publishers, Delhi, 44th ed. 2017 (Chapters 20, 21, 23).
2. Peyton Z. Peebles, *Probability, Random Variables and Random Signal Principles*, 4th ed. *TMH*, 2001 (Chapters 2,3,4,5,6)

Reference Book(s):

1. Alan V. Oppenheim, Alan S. Willsky, Syed Hamid Nawab, *Signals & Systems* Prentice-Hall signal processing series, ISSN 1050-2769
2. Churchill R.V., *Complex Variable and its Applications*, 9th ed. McGraw Hill, New York, 2013
3. R.P. Singh and S.D. Sapre, *Communication Systems Analog and Digita*l, 2nd ed. *TMH*, 2008
4. Randolph Nelson, *Probability, Stochastic process, and Queueing theory Springer-Verlog*
5. Henry Stark and John W. Woods, *Probability and Random Processes with Application to Signal Processing*, 3rd ed. *Prentice Hall*, 2002
6. Athanasios Papoulis and S. Unnikrishnan Pillai, *Probability, Random Variables and Stochastic Processes*, 4th ed. *PHI*, 2002.

Web and Video link(s):

1. https://www.youtube.com/watch?v=T6jHXD78dBI : *NPTEL Video Lecture on Complex Integration/Dr.T. Srivastava /Department of Mathes, IIT Roorkee*
2. https://archive.nptel.ac.in/courses/111/102/111102111/: *NPTEL Video Lecture on Probability Theory and Stochastic Processes ./Prof. S. Raja / IIT Delhi*

Course Articulation Matrix (CAM):		**U24MH301D APPLIED MATHEMATICS** *(for ECE)*												
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	**U24MH301D.1**	2	2	1	1	-	-	-	1	1		1	2	-
CO2	**U24MH301D.2**	2	2	1	1	-	-	-	1	1		1	2	-
CO3	**U24MH301D.3**	2	2	1	1	-	-	-	1	1		1	2	-
CO4	**U24MH301D.4**	2	2	1	1	-	-	-	1	1		1	2	-
U24MH301D		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**		**1**	**2**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ELECTRONIC CIRCUITS ANALYSIS AND DESIGN

Class: B.Tech. III -Semester		**Branch:** ECE	
Course Code:	**U24EC302**	**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: biasing and operating point, analysis of transistor at high frequency

LO2: analysis of multistage amplifiers and FET at low frequencies

LO3: concept of Positive and Negative feedback and their applications

LO4: fundamentals of large signal amplifiers and tuned amplifiers

THEORY COMPONENT

UNIT-I	**9 Hrs**

High Frequency Transistor Amplifier Circuits: Review of BJT biasing, operating point, **s**mall signal analysis of BJT, The Hybrid-π (pi) common emitter transistor model, Hybrid-π conductances, CE short circuit current gain, High frequency model of a transistor α and β cut-off frequencies, Frequency response analysis of single stage amplifier at mid band gain, Gains at low and high frequency, Calculation of gain-bandwidth product

Self Learning Topics (SLTs): *(Text1: topics 8.1, 8.6, 8.13), Solved problems (Text1: Prob 8.6, Prob 8.14) (Text1: Prob 11.2, 11.4), Practice problems (Text2: Prob 7.8), Evaluation of Expression (Review question page 370-371)*

UNIT-II	**9 Hrs**

Multistage Amplifiers: Classification of multistage amplifiers based on coupling, RC coupled amplifier, Direct and transformer coupled amplifiers, Cut-off frequencies for n^{th} stage, Effect of cascading on gain and bandwidth, Darlington pair, Cascode amplifier, Differential amplifiers, Bootstrap amplifier

FET Amplifiers: Review - Biasing of FET, FET low frequency models, Low frequency response of amplifier circuits, Analysis of single stage amplifier

Self Learning Topics (SLTs): *(Text1: topics 12.2, 12.3), Solved problems (Text1:sec12.8, Prob 3.5, Prob 3.7), Practice problems (Text2: Prob 11.10)*

UNIT-III	**9 Hrs**

Feedback Amplifiers: Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of negative feedback on amplifier characteristics, Analysis of voltage series, Voltage shunt, Current series and Current shunt Feedback amplifiers

Oscillators: Conditions for oscillations, RC and LC oscillators, Generalized analysis of LC oscillators, Crystal oscillator, Frequency and amplitude stability of oscillations

Self Learning Topics (SLTs): *transfer gain in feedback (Text1: topic 13.3), methods of analysis of feedback amplifier (text 1:topic13.7) Solved problems (Text1: sec 13.9, sec 13.10,sec 13.11,13.12), Practice problems (Text2: Prob 12.12)*

UNIT-IV	**9 Hrs**

Large Signal Amplifiers: Classification, Series fed and transformer coupled Class A, Class B power amplifier, Push-Pull amplifiers and complementary symmetry, Class AB power

amplifiers, Cross over and harmonic distortion, Heat sinks

Tuned Amplifiers: Introduction, Q-factor, Class C tuned amplifiers, Single tuned, Double tuned and Stagger tuned voltage amplifier, Effect of cascading double tuned amplifiers on bandwidth, Stability of tuned amplifiers

Self Learning Topics (SLTs): *Operations on pointers (Text2: topics 8.1, 8.2,), Solved problems (Text2: Prob 8.5, Prob 8.6, Prob 8.8, Prob 8.9, Prob 8.10), Practice problems (Text2: , Prob 8.9 , Prob 8.13, 8.14, 8.16)*

LABORATORY COMPONENT

List of Experiments

I. Hardware Experiments

1. Design and testing of Common Emitter (CE) amplifier
2. Design and testing of two stage RC coupled amplifier
3. Design and testing of voltage series feedback amplifier
4. Design and testing of RC phase shift oscillator
5. Design and testing of Hartley oscillator
6. Design and testing of Colpit's oscillator
7. Design and testing of single tuned voltage Amplifier
8. Design and testing of Class A power amplifier (with transformer load)
9. Design and testing of Class B complementary symmetry amplifier

II. Simulation Based Experiments

1. Design and simulation of Common Emitter (CE) Amplifier
2. Design and simulation of common source amplifier
3. Design and simulation of Two Stage RC coupled amplifier
4. Design and simulation of voltage series feedback amplifier
5. Design and simulation of RC phase shift oscillator
6. Design and simulation of Hartley and Colpit's oscillators
7. Design and simulation of single tuned voltage amplifier
8. Design and simulation of Class A power amplifier (transformer less)
9. Design and simulation of Class B complementary symmetry amplifier

Textbook(s):

1. Jacob Millman and C.C.Halkias, *Integrated Electronics*, 2nd ed. TMH, New Delhi, 1991
2. Donald A Neamen, *Electronic Circuits Analysis and Design*, 3rd ed. Tata McGraw-Hill, 2009

Reference Book(s):

1. Robert L.Boylestad, Louis Nashelsky, *Electronic Devices and Circuit Theory*, 9th ed. Pearson Education, 2008
2. Sedra, Kenneth, Smith, *Microelectric circuits*, 5th ed. Oxford University Press, 2011
3. Mohammad H. Rashid, *Electronic Circuit and Applications*, CENGAGE Learning

Web and Video link(s):

1. https://archive.nptel.ac.in/courses/108/102/108102095/; *NPTEL Video Lecture on analog and digital electronics by Prof. S.C Dattu Roy Basu, Professor of ECE, IIT Delhi.*

Laboratory Manual (for laboratory component):

1. ELECTRONIC CIRCUITS ANALYSIS AND DESIGN *Laboratory Manual,* Department of ECE, 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: analyse the given circuit by drawing relevant h-parameter, hybrid-π equivalents and design single stage BJT amplifier for given specification

CO2: analyse the frequency response of multistage transistor amplifiers and FET amplifiers at low frequencies.

CO3: design the negative feedback amplifiers and oscillator circuits

CO4: evaluate the efficiencies of large signal amplifiers and calculate the Q-factor various tuned amplifiers

(based on psychomotor skills acquired from laboratory component)

CO5 : analyze the frequency response of single stage and multistage amplifiers

CO6 : design and test the functionality of BJT amplifiers and oscillators

CO7 : design and test single tuned amplifier

CO8 : design and test efficiency and distortions present in power amplifiers

Course Articulation Matrix (CAM):		**U24EC302 ELECTRONIC CIRCUITS ANALYSIS AND DESIGN**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24EC302.1**	3	2	2	1	1	1	1	1	1	--	2	3	2
CO2	**U24EC302.2**	2	3	3	1	1	1	1	1	1	--	2	3	2
CO3	**U24EC302.3**	2	2	3	1	1	1	1	1	1	--	2	3	2
CO4	**U24EC302.4**	2	3	3	1	1	2	1	1	1	--	2	3	2
CO5	**U24EC302.5**	3	2	2	1	2	1	1	2	2	1	2	3	2
CO6	**U24EC302.6**	2	3	3	1	2	2	1	2	2	1	2	3	2
CO7	**U24EC302.7**	2	2	3	1	2	2	1	2	2	1	2	3	2
CO8	**U24EC302.8**	2	3	3	1	2	2	1	2	2	1	2	3	2
U24EC302		**2.25**	**2.5**	**2.75**	**1**	**1.5**	**1.5**	**1**	**1.5**	**1.5**	**1**	**2**	**3**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

DIGITAL DESIGN

Class: B.Tech. III -Semester		**Branch:** ECE	
Course Code:	**U24EC303**	**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: characteristics of digital ICs and design concepts of various logic families

LO2: classification of memories and programmable logic devices

LO3: basic terminology in Verilog HDL and gate-level modeling

LO4: data flow modeling, behavioral modeling, tasks and functions

THEORY COMPONENT

UNIT-I	**9 Hrs**

Digital Logic Families: Introduction to digital logic families, Characteristics of digital ICs – speed of operation, Power dissipation, Figure of merit, Fan-out, Current and voltage parameters and noise immunity, RTL, DCTL, DTL, TTL-open collector, Totem pole and tristate output, Schottky TTL, ECL, MOS logic and CMOS logic

Self Learning Topics (SLTs): *Classification of logic families and digital ICs, characteristics of digital ICs – operating temperature range, power supply requirements and flexibilities available, I^2L and HTL (Text1: chapter 4)*

UNIT-II	**9 Hrs**

Memory Devices: Introduction to memory devices, Memory organization and operation, classification of memories, Types of ROM and methods of programming PROM, EPROM and EEPROM, RAM – Types, Read and write operations

Programmable Logic Devices: Introduction to PLDs, Design of ROM as a PLD, PLA, PAL, CPLD and FPGA

Self Learning Topics (SLTs): *Expanding memory size, flash memory and content addressable memory (Text1: chapter 11)*

UNIT-III	**9 Hrs**

Verilog HDL Programming: Evolution of CAD, Typical HDL flow, Top-down vs bottom-up design approaches, Module instantiation and design partitioning, Lexical conventions, Data types, Vectors and arrays, Classification of modeling styles in Verilog HDL

Gate-Level Modeling: Modeling using basic Verilog gate primitives, Description of and/or and buf/not type gates, Rise, Fall and turn-off delays, Min, Max, and Typical delays

Self Learning Topics (SLTs): *Popularity of Verilog HDL (Text2: chapter 1), basic concepts - memories (Text2: chapter 3)*

UNIT-IV	**9 Hrs**

Dataflow Modeling: Continuous assignments, Delay specification, Expressions, Operators, Operands and operator types

BehavioralModeling: Structured procedures, Initial and always, Blocking and non blocking statements, Delay control, Generate statement, Event control, Conditional statements, multiway branching, Loops, Sequential and parallel blocks

Tasks and Functions: Differences between tasks and functions, Declaration, Invocation,

Automatic tasks and functions

Self Learning Topics (SLTs): *Generate blocks and generate conditional (Text2: chapter 7) and procedural continuous assignments (Text2: chapter 9)*

LABORATORY COMPONENT

List of Experiments

Part – I : To be performed on Digital IC Trainer board

1. Functional verification of logic gates
2. Implementation and functional verification of adders and subtractors using logic gates
3. Functional verification of 4x1 Multiplexer and 1x4 Demultiplexer
4. Functional verification of Flip-flops
5. Implementation and functional verification of shift registers
6. Implementation and functional verification of Ring counter and Johnson Counter

Part – II : To be performed on ECAD tool

7. Implementation of all logic gates using Verilog HDL
8. Implementation of half-adder & full-adder using Verilog HDL
9. Implementation of 4x1 mux and 1x4 de-mux using Verilog HDL
10. Implementation of all flip-flops using Verilog HDL
11. Implementation of 4-bit binary counter (synchronous & asynchronous) using Verilog HDL
12. Implementation of simple ROM and RAM using Verilog HDL

Textbook(s):

1. R P. Jain, Kishor Sarawadekar, "*Modern Digital Electronics*", 5th ed. Mc Graw Hill, 2022
2. Samir Palnitkar, "*Verilog HDL–Guide To Digital Design And Synthesis*", 3rd ed. Pearson Education, 2003

Reference Book(s):

1. M. Moris Mano, M.D.Cilletti, "*Digital Design*", PHI, India, 4th ed. 2006

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_cs61/previewNPTEL *Video Lecture onDigital Design with Verilog by Prof. Chandan Karfa and Prof. Aryabartta Sahu, IIT Guwahati.*

Laboratory Manual (for laboratory component):

1. *Digital Design Laboratory Manual and Record Book,*Department of ECE, 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: justify the selection of a logic family for a given application based on Figure of Merit
CO2: build a memory system using ROM/RAM hierarchy and propose PLD-based solutions for given constraints
CO3: examine the functional violations using gate-level modeling in Verilog HDL
CO4: design the Verilog module using generate blocks and automate testbenches for functional verification.

(based on psychomotor skills acquired from laboratory component)

CO5: build and test logic gates/adders on IC trainer boards
CO6: develop Verilog code for combinational and sequential circuits
CO7: examine memory functionality through HDL simulation
CO8: design a complete digital system using Verilog HDL

Course Articulation Matrix (CAM):		**U24EC303 DIGITAL DESIGN**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24EC303.1**	3	2	1	1	1	1	1	1	1	-	-	2	1
CO2	**U24EC303.2**	3	3	2	2	1	1	1	1	1	-	-	2	2
CO3	**U24EC303.3**	3	3	3	1	2	1	1	1	1	-	-	2	3
CO4	**U24EC303.4**	3	3	3	1	3	1	1	1	1	-	-	2	3
CO5	**U24EC303.5**	1	2	2	1	3	1	1	2	2	-	-	3	2
CO6	**U24EC303.6**	2	3	3	1	3	1	1	2	2	-	-	3	3
CO7	**U24EC303.7**	2	3	3	2	3	1	1	2	2	-	-	3	3
CO8	**U24EC303.8**	2	3	3	2	3	1	1	3	2	-	-	3	3
U24EC303		**2.4**	**2.8**	**2.5**	**1.4**	**2.4**	**1**	**1**	**2.25**	**1.5**	**-**	**-**	**2.5**	**2.5**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

SIGNALS AND SYSTEMS

Class: B.Tech. III -Semester		**Branch:** ECE	
Course Code:	**U24EC304**	**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: continuous-time (CT) and discrete-Time (DT) signals and systems and convolution
LO2: continuous-time Fourier Series and continuous time Fourier transform (CTFT)
LO3: discrete-time Fourier series(DTFS) and discrete-time Fourier transform (DTFT) and its applications
LO4: z-Transform, and realizations of IIR systems

UNIT-I	**9 Hrs**

Signals and Systems: Continuous-time (CT) and Discrete-Time (DT) signals, Sampling theorem (statement only), Transformations of independent variable, Exponential and sinusoidal signals, Singularity functions, CT & DT Systems, Basic system properties

Linear Time–Invariant (LTI) Systems: DT-LTI systems: Convolution sum, CT-LTI systems: Convolution integral

Self-Learning Topics (SLTs): *Text1: Basic Problems 1.3,1.9, 1.21, Text 1: Simple examples of systems (Ex:1.8,1.9), System properties (Ex: 1.14, 1.16, 1.20), Prob: 1.19, 1.28,* Properties of LTI systems *(Text 1: topic 2.3)* ,LTI systems described by differential and difference equations *(Text 1:topic 2.4)*

UNIT-II	**9 Hrs**

Continuous-Time Fourier Series (CTFS): Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions

Continuous-Time Fourier Transform (CTFT): CTFT for representation of aperiodic signals, Convergence of Fourier transform-Dirichlet conditions, CTFT for periodic signals; Properties of the CTFT - Convolution property, Multiplication property; Systems characterized by linear constant–coefficient differential equations (LCCDE)

Self Learning Topics (SLTs):*Text 1: Ex:4.12, 4.13, 4.19, 4.26, Ref Text 4: Solved probs: 5.23, 5.25, 5.26*

UNIT-III	**9 Hrs**

Discrete-Time Fourier Series (DTFS): Fourier series representation of DT periodic signals, Properties of DTFS

Discrete-Time Fourier Transform (DTFT): DTFT for aperiodic signals, DTFT for periodic signal, properties for the DTFT, Convolution property, Multiplication property, Systems characterized by linear constant-coefficient difference equations (LCCDE).

Self Learning Topics (SLTs):Fourier series and LTI systems (*Text 1: topic 3.8*), *ex: 5.3, 5.4, 5.13, Ref Text 4: Solved probs: 6.11, 6.18*

UNIT-IV	**9 Hrs**

***z*-Transform:** *z*-transform, Region of convergence (ROC), Inverse *z*-transform, Properties of *z*-transform, *z*-transform of some common signals, Analysis and characterization of LTI system using *z*-transform

Block Diagram Representations: Structures for IIR systems - Direct form I & Direct form II realizations of IIR systems

Self Learning Topics (SLTs): *Cascade and parallel form realizations of IIR systems(text 1: Ex 10.30).Ref Text 4: Topic-Review of complex numbers: Appendix C: C.1 Solved prob: 4.3, 4.16*

Course Learning Outcomes (COs):

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

CO1: Classify CT and DT signals and systems, apply signal transformations, and evaluate LTI system responses using convolution

CO2: apply the Continuous-Time Fourier Transform (CTFT) for analyzing aperiodic and periodic signals, and analyze systems described by linear constant-coefficient differential equations

CO3: analyze DT signals using Fourier Series and Fourier Transform, apply their properties, and evaluate LCCDE-based systems

CO4: represent LTI systems in Z-domain, including system stability, causality, and realize IIR systems using block diagram

Textbook(s):

1. Alan V. Oppenheim and Alan S.Willsky with S. Hamid Nawab, "Signals & Systems", PHI, 2nd ed. 2010

Reference Book(s):

1. Simon Haykin and Barry Van Veen, "Signals & Systems", 2nd Edition, Wiley India, 2008
2. Mrinal Mandal and Amir Asif, "Continuous and Discrete Time Signals and Systems", Cambridge University Press, 1st Edition, 2008
3. M.J.Roberts and Govind Sharma, "Fundamentals of Signals and Systems", 2nd ed. McGraw Hill, 2010
4. H.P. Hsu, "Signals & Systems", 2nd ed. Schaum's Outlines (McGraw Hill), 2009

Web and Video link(s):

1. https://www.youtube.com/watch?v=879pXoml0XI&list=PLuv3GM6gsE0WgB_q3tI2Gat_PEjQhF8o&index=1; *NPTEL Video Lecture on Introduction to Signals and Systems, Signal Classification*
2. https://www.youtube.com/watch?v=VDy8nwyKaAw&list=PLuv3GM6gsE0WgB_q3tI2Gat_PEjQhF8o&index=6 ;*NPTEL Video Lecture on Properties of Linear Systems*
3. https://www.youtube.com/watch?v=Y33shcL7ydE&list=PLuv3GM6gsE0WgB_q3tI2Gat_PEjQhF8o&index=36 ;*NPTEL Video Lecture on Fourier Transform (FT) Introduction*
4. https://www.youtube.com/watch?v=nXDq6K35a_k&list=PLuv3GM6gsE0WgB_q3tI2Gat_PEjQhF8o&index=24;*NPTEL Video Lecture on Z-Transform*

Course Articulation Matrix (CAM):		U24EC304 SIGNALS AND SYSTEMS												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24EC304.1	2	2	1	1	--	1	--	1	1	1	1	1	2
CO2	U24EC304.2	2	2	1	1	--	1	--	1	1	1	1	1	2
CO3	U24EC304.3	2	2	1	1	--	1	--	**1**	1	1	1	1	2
CO4	U24EC304.4	2	2	1	1	--	1	--	1	1	1	1	1	2
U24EC304		**2**	**2**	**1**	**1**	**--**	**1**	**--**	**1**	**1**	**1**	**1**	**1**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Class: B.Tech.III –Semester		**Branch:** ECE	
Course Code:	**U24EC305**	**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 *civilized form* of *break* statement
3. Develop a java program to define a two-dimensional (2D) array where each row contains different number of columns. Display the 2D-array using *for-each*

Experiment-III:

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 behaviour 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 *Inter-thread communication*

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):

1. 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 (AI & ML), KITSW

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: analyze 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):		**U24EC305 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	**U24EC305.1**	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	**U24EC305.2**	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	**U24EC305.3**	2	2	3	2	1	-	-	-	-	-	1	2	2
CO4	**U24EC305.4**	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	**U24EC305.5**	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	**U24EC305.6**	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	**U24EC305.7**	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	**U24EC305.8**	1	2	3	2	2	-	-	1	1	-	1	2	2
U24EC305		**1.5**	**1.5**	**1.87**	**2.37**	**1.5**	**1.62**	**-**	**-**	**1**	**-**	**1**	**1.5**	**1.5**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

QUANTITATIVE APTITUDE AND LOGICAL REASONING

Class: B.Tech. III -Semester		**Branch:** Common to all Branches	
Course Code:	**U24VA306A**	**Credits:**	**2**
Hours/Week (L-T-P-O-E):	**2-0-0-2-4**	**CIE**	**60 %**
Total Number of Teaching Hours:	**24 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	**6 Hrs**

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

UNIT-II	**6 Hrs**

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

UNIT-III	**6 Hrs**

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

UNIT-IV	**6 Hrs**

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

Course Learning Outcomes (COs):

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

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

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

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

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

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

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

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 - for Unit I & II)*

2. **R S Agarwal**, *A Modern Approach to Verbal and Non-Verbal Reasoning*, 3rd ed., New Delhi: S. Chand Publications, 2019. *(Chapters Section I: 1,3,4,5,6,8,16, Section II: 2,3 - for Unit III & IV)*

Reference Book(s):

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

Course Articulation Matrix (CAM):		**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**	**PSO 1**	**PSO 2**
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														

PRACTICUM - 3

Class: B.Tech. III semester	**Branch:** Common to all branches		
Course Code:	**U24EL308**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-4-4**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: literature review and identifying research gaps

LO2: implementing a project independently by applying knowledge to practice

LO3: preparing well-documented report and informative PPT

LO4: effective technical presentation and creating video pitch

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

(i). Practicum is a mandatory semester project work.

(ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)

(iii). Allotment of Practicum topics for students:

a. **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	U24MH301D	U24EC302	U24EC303	U24EC304	U24EC305	U24VA306A
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

b. In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.

c. The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

****

CIRCULAR

Allotment of Practicum topics to students

Section : …….

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

Note:

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

(Signature of class teacher)

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(iv). ***To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.***

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

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

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

viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course

(ix). A sample rubric for assessment and evaluation of practicum is as follows:

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

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

(a) **Practicum Topic**: Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.

(b) **Working Model**: Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.

(c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.

i. What was the objective of the practicum assigned?
ii. What are the main responsibilities and tasks for practicum?
iii. What knowledge and skills from the coursework are applied in the practicum?
iv. What new knowledge and skills are acquired during the practicum?
v. In what ways, can the practicum be helpful for the professional career?
vi. What gaps are identified in your practicum work?
vii. What improvements or changes you suggest for addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(g) The student has to register for the Practicum as a supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce
ii) he/she fails to submit the report in prescribed format
iii) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

Course Learning Outcomes (COs):

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

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

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

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

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

Course Articulation Matrix (CAM):		U24EL308 PRACTICUM-3											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24EL308.1	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	U24EL308.2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	U24EL308.3	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	U24EL308.4	2	2	2	2	2	2	2	2	2	2	2	2	2
U24EL308		2	2	2	2	2	2	2	2	2	2	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

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

Class: B.Tech. III semester	**Branch:** Common to all branches		
Course Code:	**U24VA309XXXXX**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

- **LO1:** **holistic development** through activity-based learning to gain real-life experience which effectively help individuals deal appropriately with problems/challenges
- **LO2:** **positive mindset** by actively adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity and handling rejection in life
- **LO3:** **skills for effective fieldwork practice**, which include ethics, observation, communication, interviewing, problem solving, time management, organisation and documentation
- **LO4:** **making a well-documented report and an effective oral presentation** through PPTs portraying knowledge, skills, qualities acquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building **generic competencies** in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the **physical, emotional, cognitive, spiritual and social aspects**. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.

It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely **SEA** (Social Empowerment Activities) and **SAA** (Self Accomplishment Activities)

These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.

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

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

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

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

(e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enroll in the forthcoming semesters.

Monitoring SEA/SAA:

(f) **Nodal units:** The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed

under SEA/SAA.

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

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

i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity

ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyses the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.

iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

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

i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.

ii. Fieldwork consists of three phases: preparation, the actual activity and feedback

iii. As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.

iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.

v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more

vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.

vii. Eminent personalities/achievers/renowned persons/inspiring and great personalities

Eminent personalities/ Achievers / Renowned personalities:

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

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

i. **For appointment to interact eminent personalities**: Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for

getting appointment and time for interaction

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

iii. **Ethics of fieldwork**: Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged

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

v. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.

vi. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practice sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.

vii. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.

viii. During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.

(j) **Demonstration / Presentation and Report**: Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.

(k) **Flow process for completion of SEA/SAA course**:

vi. ***Faculty counsellor approval***: In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal center. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

vii. ***Identification of goals and preparation of action plan:*** In week (1), the respective faculty coordinator(s) of nodal centers shall address the students allotted to them to educate them on fixing goals, plan of action for completion

and evaluation. In consultation with nodal center, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.

viii. ***Field work:*** Under the guidance of nodal center, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal center.

ix. ***Demonstration/ Presentation:*** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal center in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal center shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.

x. ***Report writing:*** After successful demonstration/presentation, student shall write a 2–3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

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

The CIE for SEA/SAA is as follows:

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

Note:

(f) **<u>Presentation/ Demonstration:</u>** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative

slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal center. In case of demonstration, student must take timeslot from the nodal center and demonstrate the skills learnt/improved during the allotted timeslot.

- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.

(g) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator.*

(h) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.

(i) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she

a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal center, **and**
b. scores a minimum of 40 marks in the CIE of the course

(j) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Course Learning Outcomes (COs):

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

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

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

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

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

Text / Reference book(s):

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

Course Articulation Matrix (CAM):		U24VA309XXXXX - **Courses listed under SEA/ SAA**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VA309XXXXX.1**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO2	**U24VA309XXXXX.2**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO3	**U24VA309XXXXX.3**	-	-	-	-	-	2	2	2	2	2	2	-	-
CO4	**U24VA309XXXXX.4**	-	-	-	-	-	2	2	2	2	2	2	-	-
U24VA309XXXXX		-	-	-	-	-	2	2	2	2	2	2	**-**	**-**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

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

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

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

EXPERT TALK SERIES – 3

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

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

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

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

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

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

(a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.

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

(c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximized if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.

(d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".

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

(e) The answer is Industry **Expert Talk Series (ETS)**. Through ETS, we invite industry experts in different fields to deliver talks and interact with students.

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

(g) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.

(h) Our competency-focused curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses

(i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.

(j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.

(k) Through ETS sessions, students get the chance to interact with industry regularly which

helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.

(l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.

(m) ETS enhances your learning in many ways for global opportunities for your career.

(n) All in all, learning from industry experts**,** is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.

(o) Salient features of ETS are hereunder:

(i) ETS is offered from I semester to VI semester.

(ii) ETS, in any given semester, is treated as one credit course

(iii) Students are required to earn six credits (from I to VI semester)

(iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**

(v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.

(vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs; *duration: 10-15 mins*), on the contents covered in the expert talk.

(vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators.**

(viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.

(ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.

(x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks

(xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).

(p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

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

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

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

iii. Supplementary Exam:

(a) Student has to register for ETS supplementary examination if he/she scores less

than 40 marks in CIE

(b) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs; *duration: 2Hrs*) on the content covered in ETS lectures.

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

(d) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

Course Learning Outcomes (COs):

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

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

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

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

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

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

Course code U24AE3YY: ***X represents semester, YY represents ETA course serial number***

4th Semester Syllabus

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24EC401	Integrated Circuits Applications	2	1	2	5	10	4
2	PCC	U24EC402	Communication Systems	2	1	2	5	10	4
3	PCC	U24EC403	Electromagnetic Waves and Transmission Lines	2	1	-	4	7	3
4	PCC	U24EC404	Computer Organization & Microprocessors	2	1	-	4	7	3
5	ESC	U24EC405	Python Programming	2	1	2	5	5	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	U24VA409XXXXX	SEA - 4 / SAA – 4	-	-	-	2	2	1
10	AEC	U24AE410	Expert Talk Series-4	-	-	-	1	1	1
11	VAC*	U24CY411*	Environmental Sciences*	2*	-	-	3*	5*	-
			Total:	10	5	10	34	59	23
Summer/ Inter-Sem Mandatory Bridge Courses: 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

For Lateral Entry Students Only

INTEGRATED CIRCUITS APPLICATIONS

Class: B.Tech. IV -Semester		**Branch:** ECE	
Course Code:	**U24EC401**	**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: building blocks & characteristics of Op-Amp

LO2: linear and non-linear applications of Op-Amps

LO3: active filters using Op-Amps and operation of IC 555 timer & its applications

LO4: operation of PLL, voltage regulators and data converters

THEORY COMPONENT

UNIT-I — 9 Hrs

Integrated Circuits (ICs): Introduction, Classification of ICs

Operational Amplifier (Op-Amp): Differential Amplifiers, Dual input balanced output differential amplifier, Dual input unbalanced output differential amplifier; Building blocks of Operational Amplifier (Op-Amp); Analysis of Basic Inverting & Non-Inverting Amplifier configurations and voltage follower

DC Characteristics of Op-Amp: Input offset voltage, Input bias current, Input offset current, Total output offset voltage, Thermal drift, Supply Voltage Rejection Ratio (SVRR), Common Mode Rejection Ratio (CMRR)

AC Characteristics of Op-Amp: Open loop and closed loop frequency response, stability of Op- Amp, slewrate, Ideal&PracticalcharacteristicsofICμA741

***Self Learning Topics (SLTs)**: Integrated Circuits (ICs): Introduction, Classification of IC's (Text1: chapter 1)*

UNIT-II — 9 Hrs

Linear Applications of Operational Amplifiers: Summing and difference amplifiers, Integrator and Differentiator, Current-to-Voltage and Voltage-to-Current converters, Instrumentation amplifier, Sample and Hold circuit

Non-Linear Applications: Precision Rectifiers – Half wave and Full wave, Logarithmic amplifier

Comparators and Wave form generators: Op-Amp comparators, Regenerative Comparator (Schmitt Trigger), and Wien's bridge oscillator

***Self Learning Topics (SLTs)**: Anti-log amplifier (Text1: topic 4.8), Solved problems (Text1: Problems 4.14)*

UNIT-III — 9 Hrs

Active Filters: First order, Second order filters-Analysis and design of V.C.V.S configured Lowpass, high pass, Band pass and Band Stop filters, I.G.M.F. configured narrow band pass and narrow band reject filter, Twin T-notch filter

Monolithic Timers and their applications: Functional Diagram of timer, Design of Astable and Monostable multivibrators using 555 timer, Applications of Astable Multivibrator – FSK Generator, Pulse-Position Modulation, Schmitt Trigger, Applications of Monostable Multivibrator- Linear Ramp Generator, Pulse-Width

Modulation

Self Learning Topics (SLTs): *Second order low & high pass filters (Text1: topic 7.2), Applications of IC 555 Timer: Missing pulse detector, Pulse-width modulation (Text1: topics 8.3, 8.4), Solved problems (Text1: Prob 8.5)*

UNIT-IV	**9 Hrs**

Voltage Regulators: Basic voltage regulator using Op-Amps, General purpose IC regulator, µA723 - Functional diagram, Specifications, Three terminal voltage (fixed) regulators- General features and IC series of three terminal regulators

Data Converters: DAC types - R-2R ladder; ADC types - Flash, Successive approximation & Dual slope

Phase Locked Loops (PLLs) (Qualitative treatment only): Voltage controlled oscillator, Basic PLL operation, Definitions related to PLL, PLL application – FSK and AM detectors

Self-Learning Topics (SLTs): *Design of low & high voltage regulators (Text1: topics 6.2, 6.3), Weighted resistor (Text1: topics 10.2)*

LABORATORY COMPONENT

List of Experiments

1. Design an inverting and non inverting amplifier using Op-Amp IC 741
2. Design and testing of Adder and Subtractor circuits using IC 741
3. Design and testing of differentiator using IC 741
4. Design and testing of integrator using IC 741
5. Design and testing of Instrumentation Amplifier using 3-Op-Amps IC 741
6. Design and testing of log amplifier using Op-Amp IC 741
7. Design and testing precision rectifier using Op-Amp IC 741
8. Design and testing of Wien's bridge oscillator using IC 741
9. Design and testing of astable multivibrator using IC 555
10. Design and testing of monosatble multivibrator using IC 555
11. Design and testing of second order active low pass filter using IC 741
12. Design a voltage regulator using IC723

Textbook(s):

1. D.Roy Choudhury and Shail B Jain, "*Linear Integrated Circuits*", 4th ed. *New Age International*, 2010

Reference Book(s):

1. Ramakant Gayakwad, "*Op-Amps and Linear Integrated Circuits*", 4th ed. Pearson Education, New Delhi, 2015
2. George B. Clayton, "*Linear Integrated Circuits and Applications*", The Macmillan Press Ltd., London, 1975
3. Rodert F.Coughlin and Frederick F.Driscoll, "*Operational Amplifiers and Linear Integrated Circuits*", 6th ed. Pearson Education, New Delhi, 2000

4. S. Salivahanan and V S Kanchana Bhaaskaran,"*Linear Integrated Circuits*", 3rd ed. Chennai: McGraw Hill Education (India) Pvt. Ltd., 2019

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_ee73/previewNPTEL *Video Lecture on Integrated Circuits and Applications by Prof. Shaik rafi Ahamed, IIT Guwahati*

Laboratory Manual (for laboratory component):

1. *Integrated Circuits Applications Laboratory Manual and Record Book,*Department of ECE, 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 characteristics of Op-Amp IC741 using fundamental concepts
CO2: design Op-amp based simple linear & non-linear circuits for the given specifications
CO3: analyze Op-amp based active filters and IC 555 timer-based multivibrator circuits
CO4: design IC PLL based application circuits, IC 723 based voltage regulators for the given specifications and choose suitable data converter for given design specifications

(based on psychomotor skills acquired from laboratory component)

CO5: design and test the functionality of Op-amp circuits for linear applications such as differentiators and integrators
CO6: design and test the functionality of Op-amp circuits non-linear applications such as log amplifier and precision rectifier
CO7: examine the active filters using IC741
CO8: build and test the multivibrators using IC 555

Course Articulation Matrix (CAM):		U24EC401 INTEGRATED CIRCUITS APPLICATIONS												
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	U24EC401.1	2	2	1	1	1	1	1	1	1	-	1	2	3
CO2	U24EC401.2	2	2	1	1	1	1	1	1	1	-	1	3	3
CO3	U24EC401.3	2	2	1	1	1	1	1	1	1	-	1	2	3
CO4	U24EC401.4	2	2	1	1	2	2	1	1	1	-	1	3	3
CO5	U24EC401.5	2	2	1	1	3	1	1	2	2	1	1	2	2
CO6	U24EC401.6	2	2	1	1	2	2	1	2	2	1	1	3	2
CO7	U24EC401.7	2	2	1	1	1	2	1	2	2	1	1	2	2
CO8	U24EC401.8	2	2	1	1	1	2	1	2	2	1	1	3	2
U24EC401		**2**	**2**	**1**	**1**	**1.5**	**1.5**	**1**	**1.5**	**1.5**	**1**	**1**	**2.50**	**2.5**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

COMMUNICATION SYSTEMS

Class: B.Tech. IV -Semester		**Branch:** ECE	
Course Code:	**U24EC402**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE Marks (%):**	**60**
Total Number of Teaching Hours:	**60 Hrs**	**ESE Marks (%):**	**40**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: different amplitude modulation techniques
LO2: angle modulation & analog pulse modulation
LO3: source coding & digital pulse modulation techniques
LO4: bandpass data transmission systems

THEORY COMPONENT

UNIT-I	**9 Hrs**

Amplitude Modulation: Introduction, Elements of communication system, Amplitude modulation, Double sideband-suppressed carrier modulation, Single sideband modulation, Vestigial sideband modulation, Noise in communication systems, Sources of noise-shot noise, White noise, Super heterodyne receiver, Intermediate frequency, AGC

Self-Learning Topics (SLTs): *Review on Fourier Representation of Signals and Systems (Text1: topics 2.5),* Costas receiver *(Text1: 3.4)*

UNIT-II	**9 Hrs**

Angle Modulation: Frequency modulation, Phase modulation, Relationship between PM and FM waves, Narrow-band frequency modulation, Wide-band frequency modulation, Transmission bandwidth of FM waves, Generation of FM waves, Demodulation of FM signals-phase discriminator, Noise in FM

Pulse Modulation: Pulse amplitude modulation, Pulse width modulation, Pulse position modulation

Self-Learning Topics (SLTs): *Pre-emphasis and de-emphasis. (Text1: 9.8), Practice problems (Text1: Problems 3.17 to 3.28)*

UNIT-III	**9 Hrs**

Digital Modulation: Elements of digital communication system, Source coding, Measure of information, Entropy, Information rate, Source coding- Shannon Fano, Huffman coding, Gaussian channel capacity, Shannon bound, Pulse code modulation (PCM), Quantization, quantization error, Signal to quantization noise ratio, Delta modulation (DM), Comparison of PCM and DM

Self-Learning Topics (SLTs): *Line Codes (Text1: topics 5.9), Solved problems (Text1: Problems 5.13, 5.14, 5.15), Differential pulse code modulation (Text1: topics 5.8)*

UNIT-IV	**9 Hrs**

Band-pass Data Transmission: Band pass data transmission system, Optimum receiver for binary digital modulation schemes, Coherent binary phase shift keying (BPSK), Differential phase shift keying (DPSK), Coherent binary frequency shift keying (BFSK), Quadrature phase shift keying (QPSK), Power and bandwidth requirements of above schemes

Self-Learning Topics (SLTs): *Solved problems (Text1: Prob 6.4, Prob 6.5, Prob 6.7), Probability of*

error of keying techniques (Text1: 10.4)

LABORATORY COMPONENT

List of Experiments

1. Generation of AM Signal, find the modulation index and percentage of modulation with different modulation signals
2. Study of Modulation and demodulation of DSB-SC signal
3. Calculate the modulation index, frequency deviation of FM signal
4. Study the characteristics of PLL
5. Generation and demodulation of Pulse Amplitude Modulation
6. Generation and demodulation of Pulse Width modulation & Pulse Position Modulation
7. Interpretation of modulated and demodulated waveforms of a PCM system for different sampling frequencies
8. Study of Delta Modulation & Demodulation and observe the effect of slope overload
9. Study of Amplitude Shift Keying
10. Study of Phase Shift Keying
11. Study of Frequency Shift Keying
12. Modulation and demodulation of Differential Phase Shift Keying (DPSK) signal
13. Study of QPSK modulation and demodulation for different data rates

Textbook(s):

1. Simon Haykin and Michael Moher, *Introduction to Analog and Digital Communications*, 2nd ed. USA: John Wiley & sons, Inc., 2007 (Chapters: 3,4,5,7,9)

Reference Book(s):

1. Herbart Taub, Donald L Schilling, *Principles of Communication Systems*, 4th ed. Tata McGraw-Hill Education, 2017.
2. Sanjay Sharma, *Analog and Digital Communication Systems*, 2nd ed. McGraw-Hill Education, 2008.
3. Bhattacharya, *Digital Communication*, Tata McGraw-Hill Education, 2017
4. K. Sam Shanmugam, *Digital and Analog Communication Systems*, New Delhi: John Wiley & Sons, 2008.

Web and Video link(s):

1. https://www.youtube.com/watch?v=3zVNVwr9i_0&list=PLq-Gm0yRYwTgX2FkPVcY6io003-tZd8Ru&index=12 Spectrum of AM Signals.
2. https://www.youtube.com/watch?v=GhBEdM-tR3A&list=PLq-Gm0yRYwTgX2FkPVcY6io003-tZd8Ru&index=30FM with Sinusoidal Modulation Signal| IIT Kanpur.
3. https://www.youtube.com/watch?v=4Mx13ifG5Is&list=PLq-Gm0yRYwTjdesS06WhESHJCVcJz6ibO&index=8Digital Communication Receiver -I | IIT Kanpur.

Laboratory Manual (for laboratory component):

1. *Analog and Digital Communications Laboratory Manual,* Department of ECIE, 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: estimate the performance of AM systems, its generation and reception

CO2: evaluate the performance of FM system in the presence of noise and discuss pulse modulation techniques

CO3: determine code efficiency of source coding algorithms and different digital modulation techniques

CO4: examine the performance of coherent band pass data transmission systems.

(based on psychomotor skills acquired from laboratory component)

CO5 : determine the modulation index and percentage modulation of an AM carrier from the time domain curve plot

CO6 : determine the modulation index and also measure the frequency deviation of an FM signal

CO7 : verify sampling theorem & observe the quantization process of the input analog signal in PCM, DM and analyse the effect of sampling rate on Quantization noise & step-size

CO8 : analyse the amplitude, frequency and phase in different shift keying techniques

Course Articulation Matrix (CAM):		**U24EC402 COMMUNICATION SYSTEMS**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24EC402.1**	2	2	1	1	-	-	1	1	1	-	1	1	2
CO2	**U24EC402.2**	2	2	1	1	-	-	1	1	1	-	1	1	2
CO3	**U24EC402.3**	2	2	1	1	-	-	1	1	1	-	1	1	2
CO4	**U24EC402.4**	2	2	1	1	-	-	1	1	1	-	1	1	2
CO5	**U24EC402.5**	2	1	1	1	-	-	1	1	1	1	1	1	2
CO6	**U24EC402.6**	2	1	1	1	-	-	1	1	1	1	1	1	2
CO7	**U24EC402.7**	2	1	1	1	-	-	1	1	1	1	1	1	2
CO8	**U24EC402.8**	2	1	1	1	-	-	1	1	1	1	1	1	2
U24EC402		2	1.5	1	1	_	-	1	1	1	1	1	1	2
3 – HIGH, 2 – MEDIUM, 1 – LOW														

ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Class: B.Tech. IV -Semester		**Branch:** ECE	
Course Code:	**U24EC403**	**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: electric field due to various charge distributions, energy stored in electrostatic field

LO2: magnetic field due to various current distributions, and wave propagation in different medium

LO3: poynting theorem, field components in rectangular & parallel plane waveguides

LO4: transmission line equations, distortion-less transmission line, smith chart and stub-matching

UNIT-I	**9 Hrs**

Review of vector calculus, co-ordinate systems - cartesian, cylindrical and spherical, statements of Stoke's theorem and Divergence theorem

Electrostatics: Coulomb's law, electric field intensity, electric field due to point charge, line charge and sheet charge, electric flux density, Gauss's law, relation between E & V, work, potential, energy stored, energy density and boundary conditions

Self Learning Topics (SLTs):*Poisson's and Laplace's equations(Text1: topic 5.2), Resistance and Capacitance (Text1: topic 5.5),* ***Solved problems*** *(Text1: Examples 3.1, 3.4, 3.8, 3.10,3.14 and 4.5)*

UNIT-II	**9 Hrs**

Magnetostatics: Biot–Savart's law, magnetic field intensity, magnetic flux density, Ampere's circuit law, magnetic field due to straight conductor and circular ring, magnetic scalar and vector potentials and boundary conditions

Time-Varying Fields: Continuity equation, Faraday's law of electromagnetic induction, inconsistency of Ampere's circuit law, Maxwell's equations in differential & integral forms

Electromagnetic waves: Plane wave equation and its general solution, wave propagation in lossy dielectric, loss-less dielectric, free space and good conductor, skin effect and polarization – linear, circular(left and right) and elliptical(left and right) polarizations

Self Learning Topics (SLTs): *Magnetic energy(Text1: topic 7.8) and Reflection of a plane wave at normal incidence(Text1: topic 9.7),* ***Solved problems*** *(Text1: Examples 6.3, 6.7,8.4,9.2 and sample GATE problems on em waves)*

UNIT-III	**9 Hrs**

Power and Poynting Vector: Poynting vector, Poynting theorem, average Poynting vector and average power crossing a given surface

Waveguides: Rectangular waveguides – Field components, impossibility of propagation of TEM mode, TM mode propagation and propagation characteristics and introduction to circular wave guides

Self Learning Topics (SLTs):*TE mode propagation in rectangular wave guide (Text1: topic 11.4),* ***Solved problems*** *(Text1: Examples 9.6, 11.3 and sample GATE problems on Average Poynting vector, Average Power and Waveguides)*

UNIT-IV	9 Hrs

Transmission Lines: Primary & Secondary constants, Transmission Line Equations, Infinite length transmission line, Phase velocity & Group velocity, Loss-less transmission line, Condition for distortion-less transmission line, Input impedance of a transmission line, Short-circuit & Open-circuit transmission lines, Quarter wave transformer, Smith chart – Construction, Properties and Applications, Single-stub matching

Self Learning Topics (SLTs): *Transmission line equations(Text2: topic 1.7) and Stub matching(Text2: topics 6.11, 6.12, 6.13 and 6.14),* ***Solved problems*** *(Text2: Examples 1.2, 2.1, and sample GATE problems on Transmission Lines)*

Course Learning Outcomes (COs):

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

CO1: determine the electric field at any given point due to various charge distributions and measure the energy stored in a given electrostatic field

CO2: apply biot-savart's law for determining magnetic field intensity and analyze the wave propagation in different medium

CO3: prove poynting theorem and derive the field components in rectangular waveguide

CO4: find voltage and current in a given transmission line and evaluate the impedance using smith chart

Textbook(s):

1. Mathew N.O. Sadiku, "*Principles of Electromagnetics*", 4th ed. Oxford University Press, New York, 2014
2. Umesh Sinha "*Transmission Lines and Networks*", 2nd ed. Satya Prakashan Publication, New Delhi, 1999

Reference Book(s):

1. Edward C. Jordan, Keith G. Balmain,"*Electromagnetic Waves and Radiating Systems*", 2nd ed. Pearson Education, London, 2015
2. William H. Hayt, John A. Buck, Jaleel M. Akhtar, "*Engineering Electromagnetics*", 9th ed. The McGraw-Hill Companies, New York, 2020

Web and Video link(s):

1. *https://www.youtube.com/watch?v=0OwmYAljz4A&list=PL0925FD10648D664E;NPTEL Video Lecture on Electromagnetic Waves by Prof. R.K.Shevgaonkar, Dept of Electrical Engineering, IIT Bombay.*
2. *https://www.youtube.com/watch?v=G5P6dInMTFg&list=PLuv3GM6-gsE3-hVNaw-YEb7EeY5XVPZdz; NPTEL Video Lecture on Electromagnetic Theory by Prof. K. Pradeep Kumar, Dept of Electrical Engineering, IIT Kanpur.*

Course Articulation Matrix (CAM):		U24EC403 ELECTROMAGNETIC WAVES AND TRANSMISSION LINES												
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	U24EC403.1	2	2	2	2	2	1	-	2	1	-	2	2	1
CO2	U24EC403.2	2	2	2	2	2	1	-	2	1	-	2	2	1
CO3	U24EC403.3	2	2	2	2	2	1	-	2	1	-	2	2	1
CO4	U24EC403.4	2	2	2	2	2	1	-	2	1	-	2	2	1
	U24EC403	**2**	**2**	**2**	**2**	**2**	**1**	**-**	**2**	**1**	**-**	**2**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

COMPUTER ORGANIZATION AND MICROPROCESSORS

Class: B.Tech. IV -Semester		**Branch:** ECE	
Course Code:	**U24EC404**	**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: basic components of computers
LO2: computer arithmetic and I/O organization
LO3: instruction sets, instruction formats and various addressing modes of 8086
LO4: the representation of data at the machine level and how computations are performed at machine level, develop assembly level programs to solve problems

UNIT-I	**9 Hrs**

Digital Computers: Introduction, Block diagram of digital computer, Definition of computer organization, Computer design and computer architecture

Basic Computer Organization and Design: Instruction codes, Computer registers, Computer instructions, Timing and control, Instruction cycle, Memory reference Instructions, Input – Output and interrupt, Complete computer description

Micro Programmed Control: Control memory, Address sequencing, micro program example, Design of control unit

Self Learning Topics (SLTs): *Text1: Table 5.3,5.4,5.5,7.3, design of control unit (text 1: topic 7.4)*

UNIT-II	**9 Hrs**

Computer Arithmetic: Introduction, Addition and subtraction, Multiplication algorithms, Division algorithms, Floating - point arithmetic operations

Input-Output Organization: Peripheral devices, Input-Output interface, Asynchronous data transfer, Modes of Transfer, Priority interrupt, Direct memory access, Input –Output Processor (IOP), Intel 8089 IOP

Self Learning Topics (SLTs): *Peripheral Devices (text 1: topic 11.1), Direct memory Access, Input – Output Processor (IOP), Intel 8089 IOP (text 1: topic 11.6)*

UNIT-III	**9 Hrs**

Central Processing Unit: The 8086 Processor Architecture, Register organization, Physical memory organization, General Bus Operation, I/O Addressing Capability, Special Processor Activities, Minimum and Maximum mode system and timings

8086 Instruction Set and Assembler Directives: Machine language instruction formats, Addressing modes, Instruction set of 8086, Assembler directives and operators

Self Learning Topics (SLTs): *Text 2: Special Processor Activities (topic 1.7)*

UNIT-IV	9 Hrs

Assembly Language Programming with 8086: Machine level programs, Machine coding the programs, Programming with an assembler, Assembly Language example programs. Stack structure of 8086, Interrupts and Interrupt service routines, Interrupt cycle of 8086, Interrupt programming, Passing parameters to procedures, Macros, Timings and Delays

Self Learning Topics (SLTs): *Text 2: Ex:3.1,3.4,3.6,3.9,3.15,3.17,4.1,4.3 Prog:3.3,3.7,3.10,3.15,4.1,4.3,4.5.*

Course Learning Outcomes (COs):

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

CO1: interpret the basic components and examine the design of CPU, ALU and Control Unit
CO2: appraise computer arithmetic & input-output organization
CO3: adapt the architecture; make use of the instruction set, instruction formats and addressing modes of 8086
CO4: develop assembly language programs to solve problems

Textbook(s):

1. M. Moris Mano, *Computer System Architecture*, 3rd ed. Pearson. (Chapters 5,6,7,10,11)
2. K M Bhurchandi, A.K Ray , *Advanced Microprocessors and Peripherals*, 3rd edition, McGraw Hill India Education Private Ltd (Chapters 1,2,3,4)

Reference Book(s):

1. D V Hall, SSSP Rao, *Microprocessors and Interfacing*, 3rd ed. McGraw Hill India Education Private Ltd
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: *Computer Organization*, 5th ed. Tata McGraw Hill, 2002
3. William Stallings, *Computer Organization and Architecture*, 9th ed. Pearson.
4. David A. Patterson, John L. Hennessy: *Computer Organization and Design – The Hardware / Software Interface ARM Edition*, 4th ed. Elsevier, 2009

Web and Video link(s):

1. https://archive.nptel.ac.in/courses/106/105/106105163*NPTEL Video Lecture: 1 on Evolution of Computer Systems*
2. https://archive.nptel.ac.in/courses/108/103/108103157*NPTEL Video Lecture: 3 on Functional Diagram of 8086*
3. https://archive.nptel.ac.in/courses/108/103/108103157*NPTEL Video Lecture:14 on Programs on Subroutines*
4. https://archive.nptel.ac.in/courses/106/105/106105163*NPTEL Video Lecture: 39 on FloatingPoint Arithmetic*

Course Articulation Matrix (CAM):		U24EC404 COMPUTER ORGANIZATION AND MICROPROCESSORS												
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	U24EC404.1	2	2	1	1	-	1	-	1	1	-	1	1	2
CO2	U24EC404.4	2	2	1	1	-	1	-	1	1	-	1	1	2
CO3	U24EC404.2	2	2	1	1	-	1	-	1	1	-	1	1	2
CO4	U24EC404.3	2	2	1	1	-	1	-	1	1	-	1	1	2
U24EC404		**2**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**1**	**1**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

PYTHON PROGRAMMING

Class: B.Tech. IV -Semester		**Branch:** ECE	
Course Code:	**U24EC405**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-5**	**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, Lambda 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

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*, 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):

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

2. https://onlinecourses.nptel.ac.in/noc25_cs17 *NPTEL Video Lecture on Data Analytics with Python By Prof. A Ramesh, IIT Roorkee*
3. https://onlinecourses.nptel.ac.in/noc25_cs69/__*NPTEL Video Lecture on The Joy of Computing using Python By Prof. Sudarshan Iyengar , IIT Ropar*

Laboratory Manual (for laboratory component):

1. *Python Programming Laboratory Manual and Record Book,* Department of CSE, 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):								**U24EC405 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	**U24EC405.1**	1	2	2	2	2	1	-	-	-	1	1	2	2
CO2	**U24EC405.2**	2	2	2	2	2	1	-	-	-	1	1	2	2
CO3	**U24EC405.3**	2	2	2	2	3	1	-	-	-	1	1	2	2
CO4	**U24EC405.4**	2	2	2	2	3	1	-	-	-	1	1	2	2
CO5	**U24EC405.5**	1	2	2	2	2	1	1	1	1	1	2	2	2
CO6	**U24EC405.6**	2	2	2	2	2	1	1	1	1	1	2	2	2
CO7	**U24EC405.7**	2	2	2	2	3	1	1	1	1	1	2	**2**	**2**
CO8	**U24EC405.8**	2	2	2	2	3	1	1	1	1	1	2	2	2
U24EC405		**1.75**	2	**2**	2	**2**	1	1	1	1	1	1.5	2	2
3 – HIGH, 2 – MEDIUM, 1 – LOW														

SOFT AND INTERPERSONAL SKILLS LABORATORY

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

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

LIST OF ACTIVITIES

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

Course Learning Outcomes (COs):

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

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

Textbook(s):

1. Krishna Mohan & Meera Benerji, *Developing Communications Skills*, 2nd 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	PSO 1	PSO 2
CO1	U24VA406B .1	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	U24VA406B .2	-	-	-	-	-	-	2	3	3	-	1	-	-
CO3	U24VA406B .3	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	U24VA406B .4	-	-	-	-	-	-	1	2	3	-	1	-	-
U24VA406B		-	-	-	-	-	-	1.5	2.25	3	-	1	-	-
3 – HIGH, 2 – MEDIUM, 1 - LOW														

PRACTICUM – 4

Class: B.Tech. IV semester	**Branch:** Common to all branches		
Course Code:	**U24EL408**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-4-4**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: literature review and identifying research gaps

LO2: implementing a project independently by applying knowledge to practice

LO3: preparing well-documented report and informative PPT

LO4: effective technical presentation and creating video pitch

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

(i). Practicum is a mandatory semester project work.

(ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)

(iii). Allotment of Practicum topics for students:

a. **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	**U24EC401**	**U24EC402**	**U24EC403**	**U24EC404**	**U24EC405**	**U24VA406A**
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

b. In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.

c. The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

****

CIRCULAR

Allotment of Practicum topics to students

Section : …….

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

Note:

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

(Signature of class teacher)

****

(iv). ***To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.***

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

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

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

(viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course

(ix). A sample rubric for assessment and evaluation of practicum is as follows:

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

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

(a) **Practicum Topic**: Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.

(b) **Working Model**: Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and

demonstrate/present, during the allotted time, before the course teacher.

(c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.
- What was the objective of the practicum assigned?
- What are the main responsibilities and tasks for practicum?
- What knowledge and skills from the coursework are applied in the practicum?
- What new knowledge and skills are acquired during the practicum?
- In what ways, can the practicum be helpful for the professional career?
- What gaps are identified in your practicum work?
- What improvements or changes you suggest for addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(g) The student has to register for the Practicum as a supplementary examination in the following cases:
- i) he/she is absent for oral presentation and viva-voce
- ii) he/she fails to submit the report in prescribed format
- iii) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

Course Learning Outcomes (COs):

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

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

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

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

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

Course Articulation Matrix (CAM):		U24EL408 PRACTICUM-4											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24EL408.1	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	U24EL408.2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	U24EL408.3	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	U24EL408.4	2	2	2	2	2	2	2	2	2	2	2	2	2
U24EL408		2	2	2	2	2	2	2	2	2	2	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

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

Class: B.Tech. IV semester	**Branch:** Common to all branches		
Course Code:	**U24VA409XXXXX**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

- **LO1:** **holistic development** through activity-based learning to gain real-life experience which effectively help individuals deal appropriately with problems/challenges
- **LO2:** **positive mindset** by actively adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity and handling rejection in life
- **LO3:** **skills for effective fieldwork practice**, which include ethics, observation, communication, interviewing, problem solving, time management, organisation and documentation
- **LO4:** **making a well-documented report and an effective oral presentation** through PPTs portraying knowledge, skills, qualities acquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building **generic competencies** in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the **physical, emotional, cognitive, spiritual and social aspects**. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.

It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely **SEA** (Social Empowerment Activities) and **SAA** (Self Accomplishment Activities)

These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.

(a) Each SEA/SAA activity is treated as one credit course
(b) Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester.
(c) Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA
(d) To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc.,
(e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enroll in the forthcoming semesters.

Monitoring SEA/SAA:

(a) **Nodal units:** The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA.

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

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

i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity

ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyses the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.

iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

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

i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.

ii. Fieldwork consists of three phases: preparation, the actual activity and feedback

iii. As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.

iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.

v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more

vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.

vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

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

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

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

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

x. **Ethics of fieldwork**: Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged

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

xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.

xiii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practice sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.

xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.

- During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.

(e) **Demonstration / Presentation and Report**: Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.

(f) **Flow process for completion of SEA/SAA course**:

i. ***Faculty counsellor approval***: In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal center. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

ii. ***Identification of goals and preparation of action plan:*** In week (1), the respective faculty coordinator(s) of nodal centers shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal center, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent

personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.

iii. ***Field work:*** Under the guidance of nodal center, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal center.

iv. ***Demonstration/ Presentation:*** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal center in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal center shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.

v. ***Report writing:*** After successful demonstration/presentation, student shall write a 2–3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

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

The CIE for SEA/SAA is as follows:

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

Note:

(a) **<u>Presentation/ Demonstration:</u>** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal center. In case of demonstration, student must take timeslot from

the nodal center and demonstrate the skills learnt/improved during the allotted timeslot.

- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.

(b) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator.*

(c) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.

(d) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she

a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal center, **and**
b. scores a minimum of 40 marks in the CIE of the course

(e) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Course Learning Outcomes (COs):

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

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

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

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

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

Text / Reference book(s):

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

Course Articulation Matrix (CAM):		U24VA409XXXXX - Courses listed under SEA/ SAA												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24VA409XXXXX.1	-	-	-	-	-	2	2	2	2	2	2	-	-
CO2	U24VA409XXXXX.2	-	-	-	-	-	2	2	2	2	2	2	-	-
CO3	U24VA409XXXXX.3	-	-	-	-	-	2	2	2	2	2	2	-	-
CO4	U24VA409XXXXX.4	-	-	-	-	-	2	2	2	2	2	2	-	-
U24VA409XXXXX		-	-	-	-	-	2	2	2	2	2	2	-	-
3 – HIGH, 2 – MEDIUM, 1 – LOW														

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

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

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

EXPERT TALK SERIES – 4

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

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

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

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

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

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

(a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.

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

(c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximized if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.

(d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".

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

(e) The answer is Industry **Expert Talk Series (ETS)**. Through ETS, we invite industry experts in different fields to deliver talks and interact with students.

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

(g) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.

(h) Our competency-focused curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses

(i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.

(j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.

(k) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.

(l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing

styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.

(m) ETS enhances your learning in many ways for global opportunities for your career.

(n) All in all, learning from industry experts**,** is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.

(o) Salient features of ETS are hereunder:

(i) ETS is offered from I semester to VI semester.

(ii) ETS, in any given semester, is treated as one credit course

(iii) Students are required to earn six credits (from I to VI semester)

(iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**

(v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.

(vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs; *duration: 10-15 mins*), on the contents covered in the expert talk.

(vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators.**

(viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.

(ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.

(x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks

(xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).

(p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

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

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

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

ii. Supplementary Exam:

(a) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE

(b) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs; *duration: 2Hrs*) on the content covered in ETS lectures.

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

(d) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

Course Learning Outcomes (COs):

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

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

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

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

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

Course Articulation Matrix (CAM):		**U24AE410 EXPERT TALK SERIES – 4**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AE410.1**	1	1	1	1	1	1	2	1	2	1	2	1	1
CO2	**U24AE410.2**	1	1	1	1	1	1	2	1	2	1	2	1	1
CO3	**U24AE410.3**	1	1	1	1	1	1	2	1	2	1	2	1	1
CO4	**U24AE410.4**	1	1	1	1	1	1	2	1	2	1	2	1	1
U24AE410		**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

Course code U24AE1YY: ***X represents semester, YY represents ETA course serial number***

ENVIRONMENTAL STUDIES

Class: B.Tech. IV Semester		**Branch:** ECE	
Course Code:	**U24CY411***	**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):		U24CY411* 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	U24CY411.1	2	1	2	1	-	2	1	1	1	-	-	-	-
CO2	U24CY411.2	-	-	2	-	-	1	1	1	1	1	-	-	-
CO3	U24CY411.3	1	2	1	-	-	1	1	1	1	1	1	-	-
CO4	U24CY2411.4	-	-	1	-	-	1	1	1	1	-	1	-	-
U24CY4--		1.50	1.50	1.50	1.00	-	1.25	1.00	1.00	1.00	1.00	1.00	-	-

2nd Year
Exit Courses
Syllabus

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 ECE)

(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 ECE: Any Two (02) Courses during the 2 - Months internship									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	PCC	U24EC412X	Basic Embedded Systems	2	-	2	-	4	3
2	PCC	U24EC413X	Fundamentals of IoT (Internet of Things)	2	-	2	-	4	3
3	PCC	U24EC414X	VLSI Design, Tools & Technology	2	-	2	-	4	3
4	PCC	U24EC415X	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 ECE: Any Two (02) Skill based Courses -:									
S. No.	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**O**	**E**	**C**
1	SEC	U24SE412X	Digital Cable TV Technician https://www.essc-india.org/images/QPs/Digital%20Cable%20Technician%20-%20Access%20-%20ELE_Q8106_v4.0.pdf	-	-	6	-	6	3
2	SEC	U24SE413X	Arduino Based Embedded System Design https://www.nielit.gov.in/sites/default/files/headquarter/Certificate%20Course%20in%20ARDUINO%20based%20Embedded%20System%20Design.pdf	-	-	6	-	6	3

3	SEC	U24SE414X	VLSI Design using EDA Tools https://www.nielit.gov.in/sites/default/files/Delhi/VLSI%20DESIGN%20AND%20TOOL.pdf	-	-	6	-	6	3
4	SEC	U24SE415X	Optical fiber Technician https://rajshaladarpan.nic.in/sd2/Home/Public2/VocationalSchool/Curriculum/11th_12th_Telecom.pdf	-	-	6	-	6	3
5	SEC	U24SE416X	Any other skill based 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.

BASIC EMBEDDED SYSTEMS

Class: B.Tech. IV –Semester (Exit course)		**Branch:** ECE	
Course Code:	**U24EC412X**	**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%**

Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: Understand the fundamentals and architecture of embedded systems

LO2: Analyse hardware and software components of embedded systems

LO3: Design simple embedded systems using microcontrollers and interfacing techniques

LO4: Develop embedded applications and implement real-time operating systems

THEORY COMPONENT

UNIT-I	**4 Hrs**

Unit 1: Introduction to Embedded Systems: Definition and Characteristics of Embedded Systems, Applications of Embedded Systems, Embedded System Architecture: Harvard and Von Neumann Architectures, Basic Components: Sensors, Actuators, and Peripherals

UNIT-II	**4 Hrs**

Microcontrollers and Interfacing: Introduction to Microcontrollers: 8051, AVR, ARM, Memory Organization and I/O Ports, Interfacing Sensors and Actuators, ADC/DAC Conversions and Serial Communication (UART, SPI, I2C)

UNIT-III	**4 Hrs**

Embedded Software Development: Embedded C Programming: Variables, Functions, and Pointers, Cross Compilation and Debugging, Real-Time Operating Systems (RTOS): Concepts and Scheduling, Interrupts and Timers

UNIT-IV	**4 Hrs**

Embedded System Design and Applications: Designing a Simple Embedded System: Case Studies (e.g., Automatic Door Control, Temperature Monitoring System), Power Management and Energy Efficiency, Communication Protocols: CAN, Zigbee, Bluetooth, Security Aspects in Embedded Systems

LABORATORY COMPONENT

List of Experiments:

1. Introduction to Arduino Boards, pin description and basic functions of Arduino
2. Design an embedded system to monitor the room temperature using LM35 and display it on serial monitor
3. Design an embedded system to monitor light intensity and if light intensity >512 lux turn ON the LED, otherwise Turn OFF the LED
4. Design an embedded system to find distance of an object and display it on LCD
5. Design an embedded system to turn ON Buzzer if person is detected
6. Design an embedded system to control the direction of DC motor using serial port
7. Design a weather monitoring system
8. Design a home automation system (Note: you can use different sensors and different appliances)

Textbook(s):

1. Raj Kamal, *Embedded Systems: Architecture, Programming and Design*, McGraw Hill Education
2. Shibu K. V, *Introduction to Embedded Systems*, McGraw Hill Education

Reference Book(S):

1. Frank Vahid and Tony Givargis, *Embedded System Design: A Unified Hardware/Software Introduction*, Wiley
2. David E. Simon, *An Embedded Software Primer*, Addison-Wesley

Laboratory Manual (for laboratory component):

1. Fundamentals of IoT laboratory manual and Record Book, Department of ECE, 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: Explain the architecture and components of embedded systems

CO2: Demonstrate knowledge of microcontrollers and interfacing

CO3: Design simple embedded systems using hardware and software tools

CO4: Implement real-time embedded applications and operating systems

(based on psychomotor skills acquired from laboratory component)

CO5: Demonstrate the ability to use Arduino for embedded system development and interface various sensors and actuators

CO6: Implement real-time monitoring systems for environmental parameters like temperature, light intensity, and distance

CO7: Develop automation applications such as buzzer activation, DC motor control, and home automation

CO8: Analyze and design IoT-based embedded systems for smart applications like weather monitoring and home automation

Course Articulation Matrix (CAM):		U24EC412X BASIC EMBEDDED SYSTEMS												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24EC412X.1	3	2	-	-	-	-	-	-	-	-	1	3	2
CO2	U24EC412X.2	3	3	2	-	3	-	-	-	-	-	1	3	3
CO3	U24EC412X.3	3	2	3	2	3	1	-	2	2	2	2	3	3
CO4	U24EC412X.4	3	2	3	3	3	2	1	2	2	2	1	3	3
CO5	U24EC412X.5	3	2	2	2	3	1		2	2	2	2	3	2
CO6	U24EC412X.6	3	2	3	3	3	2	1	2	2	2	3	3	3
CO7	U24EC412X.7	3	2	3	2	3	2	1	2	2	2	2	3	3
CO8	U24EC412X.8	3	3	3	3	3	3	2	3	2	3	3	3	3
U24EC412X		**3**	**2.25**	**2.71**	**2.50**	**3.00**	**1.83**	**1.25**	**2.17**	**2.00**	**2.17**	**1.88**	**3.00**	**2.75**

FUNDAMENTALS oF IoT (INTERNET oF THINGS)

Class: B.Tech. IV –Semester (Exit course)		**Branch:** ECE	
Course Code:	**U24EC413X**	**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%**

Learning Objectives (LOs):

This course will develop students' knowledge in /on…

- **LO1:** fundamentals of IoT, IoT characteristics, sensors & actuators, and domain specific applications
- **LO2:** IoT devices and its interfacing with Raspberry Pi
- **LO3:** IoT communication, data link, network, transport, and application layer protocols
- **LO4:** IoT software platforms, cloud, edge and fog computing

THEORY COMPONENT

UNIT-I	**4 Hrs**

Basics of Internet of Things (IoT): Introduction to IoT**,** Characteristics of IoT; Principles: Sensors and Actuators-characteristics, applications; Domain Specific IoT Applications: Home automation, industrial automation, smart cities, healthcare and agriculture

UNIT-II	**4 Hrs**

IoT devices and interfacing: Introduction to IoT Devices, Raspberry Pi; Raspberry Pi interfaces-Inter Integrated Circuits (I2C), Serial Peripheral Interfacing (SPI), UART; Interfacing sensors and actuators, Connecting Raspberry Pi to cloud platform-Data Analytics and visualization

UNIT-III	**4 Hrs**

IoT Protocols-Communication protocols, Data link layer Protocols, network layer Protocols, transport layer Protocols, and Application Layer Protocols

UNIT-IV	**4 Hrs**

IoT Software Platforms, Cloud Computing, Edge Computing and Fog Computing

LABORATORY COMPONENT

List of Experiments

1. Demonstration of Sensors, Actuators, and Setting Up Raspberry Pi and Installing OS
2. Controlling an LED using Raspberry Pi (GPIO Programming)
3. Interfacing Sensors with Raspberry Pi
4. Interfacing Actuators with Raspberry Pi
5. Cloud Connectivity with Raspberry Pi
6. Implement MQTT/CoAP Protocol with Raspberry Pi for data transmission and reception
7. Implement Communication protocols with Raspberry Pi for an IoT applications

Textbook(s):

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-on Approach*, Universities Press.
2. Bharat Bhushan, Bhuvan Unhelkar, *Internet of Things (IoT): Principles, Paradigms and Applications of IoT*, Springer.
3. Peter Waher, *Mastering Internet of Things: Design and create your own IoT applications using*

Raspberry Pi 3, Packt Publishing.

Reference Book(s):

1. Raj Kamal, *Internet of Things: Architecture and Design Principles*, McGraw Hill Education.
2. Peter Waher, *Learning Internet of Things*, Packt Publishing, 2015.

Resources: https://azure.microsoft.com/en-us/solutions/iot/iot-technology-protocols

Laboratory Manual (for laboratory component):

1. *Fundamentals of IoT laboratory manual and Record Book*, Department of ECE, 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: describe IoT characteristics, applications of IoT along with the functioning of sensors, and actuators

CO2: develop IoT systems using Raspberry Pi, interfacing sensors & actuators, and cloud integration

CO3: analyze various IoT communication, data link, network, transport, and application layer protocols

CO4: elaborate IoT software platforms, cloud platforms, and perform data analytics to build and evaluate IoT applications.

(based on psychomotor skills acquired from laboratory component)

CO5: examine the setup & OS configuration of Raspberry Pi along with a sensor or an actuator interfacing

CO6: develop GPIO programming using Raspberry Pi with IoT devices, sensors & actuators

CO7: Integrate an IoT device with Raspberry Pi using MQTT/CoAP protocols for data transmission and reception

CO8: realize Communication protocols like Wi-Fi, Bluetooth, and Zigbee for an IoT applications

Course Articulation Matrix (CAM):		**U24EC413X FUNDAMENTALS OF IoT (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	**U24EC413X.1**	3	3	3	2	2	3	3	2	2	2	2	2	3
CO2	**U24EC413X.2**	3	3	3	2	3	3	3	2	2	2	3	2	3
CO3	**U24EC413X.3**	3	2	2	2	2	2	2	1	1	2	-	2	3
CO4	**U24EC413X.4**	3	2	2	2	2	3	3	2	1	2	-	2	3
CO5	**U24EC413X.5**	3	2	3	1	3	2	2	2	3	3	3	2	3
CO6	**U24EC413X.6**	3	3	3	2	3	3	3	2	3	3	3	2	3
CO7	**U24EC413X.7**	3	2	3	2	3	2	2	1	3	3	3	2	3
CO8	**U24EC413X.8**	3	2	3	2	3	2	2	1	3	3	3	2	3
U24EC413X		**3**	**2.375**	**2.75**	**1.8**	**2.5**	**2.5**	**2.5**	**1.6**	**2.25**	**2.5**	**2.1**	**2**	**3**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

VLSI DESIGN TOOLS AND TECHNOLOGY

Class: B.Tech. IV -Semester		**Branch:** ECE	
Course Code:	**U24EC414X**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60%**
Total Number of Teaching Hours:	**32 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: fundamentals of VLSI design and fabrication
LO2: MOS circuit design, layout techniques, and scaling limitations
LO3: VHDL programming for digital circuit design
LO4: EDA tools for circuit simulation, synthesis, and layout

THEORY COMPONENT

UNIT-I	**4Hrs**

Introduction to VLSI Design and Technology: Evolution of VLSI technology and Moore's Law, Basic MOS transistor, IC fabrication process: NMOS and CMOS, CMOS inverter characteristics

UNIT-II	**4Hrs**

MOS Circuit Design Processes: MOS layers, Stick diagrams and symbolic diagrams, NMOS design style, CMOS design style, Layout, Lambda based design rules, Layout diagrams, Scaling parameters and Limitations of scaling

UNIT-III	**4Hrs**

Basics of VHDL: Introduction to VHDL, Need for HDL, VHDL vs. Verilog. Entity, Architecture, Configuration
Data Types & Operators in VHDL
Modeling Styles in VHDL: Behavioral, Dataflow, and Structural modeling
Combinational and sequential circuit design using VHDL

UNIT-IV	**4Hrs**

Overview of EDA Tools: Importance of different categories of toolsin VLSI design.
Schematic Capture & Circuit Simulation Tools: SPICE, Cadence Virtuoso.
Hardware Description Language (HDL) Tools: Model Sim, Xilinx Vivado.
Physical Design and Layout Tools: Cadence Encounter, Synopsys IC Compiler
FPGA Design Tools: Intel Quartus, Xilinx ISE/Vivado.

LABORATORY COMPONENT

List of Experiments

1. Design and simulation of Logic gates using VHDL
2. Design and simulation of Full Adder using VHDL
3. Design and simulation of Flip flops (JK, T, D) using VHDL
4. Design and simulation of 4-Bit Ring counter and johnson counter using VHDL
5. Transfer Characteristics of CMOS inverter
6. Design and analysis of Universal Logic Gates Using CMOS
7. Layout Design of NMOS and PMOS transistors
8. Layout Design of CMOS inverter

Textbook(s):

1. Douglas A. Pucknell and Kamran Eshraghian, ***Basic VLSI Design,*** 3rd ed. PHI
2. J. Bhasker, **"*A VHDL Primer*",** 3rd ed. PHI

Reference Book(s):

1. Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic, ***Digital Integrated Circuits: A Design Perspective,*** 2nd ed. Pearson
2. John P. Uyemura, *Introduction to VLSI Circuits and Systems*, Wiley
3. Debaprasad Das, *VLSI Design*, Oxford University Press.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_ee117/preview; *NPTEL Video Lecture on VLSI DESIGN &TECHNOLOGY by By Prof. Avishek Chatterjee| IIT Kharagpur*

Laboratory Manual (for laboratory component):

1. *VLSI DESIGN, TOOLS&TECHNOLOGY laboratory manual and Record Book,* Department of ECE, KITSW

Course Learning Outcomes (COs):

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

CO1: Learn VLSI fundamentals, MOS transistors, and fabrication processes.
CO2: Design MOS circuits and apply layout design rules
CO3: Develop digital circuits using VHDL
CO4: Use EDA tools for circuit simulation and design
(based on psychomotor skills acquired from laboratory component)
CO5 :Design and simulate basic and advanced digital circuits (logic gates, adders, flip-flops, counters) usingVHDL
CO6: Analyze the electrical behavior and transfer characteristics of CMOS inverters through simulation
CO7: Design universal logic gates and CMOS circuits using transistor-level CMOS logic principles
CO8: Create and verify layout designs for NMOS, PMOS, and CMOS inverter structures using layout tools and design rules

Course Articulation Matrix (CAM):		**U24EC414X VLSI DESIGN, TOOLS AND TECHNOLOGY**												
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	**U24EC414X.1**	3	3	2	3	3	2	--	2	2	--	2	3	2
CO2	**U24EC414X.2**	2	3	3	2	2	3	--	2	1	--	2	3	2
CO3	**U24EC414X.3**	2	2	3	2	2	2	--	2	1	--	3	3	2
CO4	**U24EC414X.4**	2	3	3	2	3	2	--	2	2	--	3	3	2
CO5	**U24EC414X.5**	3	2	2	2	2	2	--	2	1	--	2	3	2
CO6	**U24EC414X.6**	2	3	3	2	2	2	--	2	1	--	3	3	2
CO7	**U24EC414X.7**	3	3	3	2	2	2	--	2	1	--	2	3	2
CO8	**U24EC414X.8**	3	3	3	3	3	3	--	3	1	--	3	3	2
U24EC414X		**2.5**	**2.75**	**2.7**	**2.25**	**2.37**	**2.25**	**--**	**2.12**	**1.25**		**2.5**	**3**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														