ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.19) NIRF-2024 Rank Band : 201-300

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, TELANGANA, INDIA
काकतीय प्रौद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६०१५, तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
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B.TECH. CURRICULUM

ACADEMIC YEAR: 2024-25

DEPARTMENT OF ELECTRICAL & ELECTRONICS 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)

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

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

History:

PROGRAM	DESCRIPTION	
	INTAKE	NBA ACCREDITATION
UG in B.Tech. Electrical & Electronics Engineering	• Started with 60 seats in 1994	• First time accreditation: 2011-12 • Reaccreditation-1: 2016-17 • Reaccreditation-2: 2019-20 • Reaccreditation-3: 2022-23

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 the latest technical knowledge, analytical & practical skills, managerial competence, and interactive abilities to students, so that their employability is enhanced**

M2 ■ **To provide a strong human resource base to cater to the changing needs of industry and commerce**

M3 ■ **To inculcate a sense of brotherhood and National Integrity**

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEE

RING:

VISION AND MISSION

VISION

To fulfill the needs of the industry and society through excellence in education and research in electrical engineering.

MISSION

M1: To produce globally competent engineers in Electrical and Electronics Engineering

M2: To promote scientific inclination and cultivate professional ethics

M3 To serve organizations and society as adaptable engineers, entrepreneurs, or leaders

PROGRAM EDUCATIONAL OBJECTIVES

Technical Competence:

PEO1: apply the knowledge of electrical and electronics engineering to develop solutions for complex problems of electrical power industry and allied engineering areas

Successful Career

PEO2: demonstrate innovation & creativity in their professional practice, work effectively as an individual and in a team in multidisciplinary areas towards sustainable development

Soft Skills and Life-long Learning

PEO3: adapt to a constantly changing field through higher education, professional development and self-study for contributing to well-being of society

PEO TO MISSION MAPPING

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

PEO & Mission Statements	Justification
PEO1 with M1, M2 and M3	Quality education and comprehensive knowledge is imparted to the students, by highly qualified faculty in a congenial environment, to meet the current industrial needs
PEO2 with M1, M2 and M3	to inculcate professionalism, strong ethical attitude, and leadership traits as lifelong learning practice to achieve career goals
PEO3 with M1, M2 and M3	to identify and develop a sense of responsibility towards socio-technical, economic, and environmental-related issues.

PROGRAM SPECIFIC OUTCOMES

PSO1:	apply the fundamental knowledge of electrical and electronics engineering in providing solutions for the modern power industry and multi-disciplinary areas
PSO2:	analyze, design and simulate systems to generate, transmit, distribute, utilize and control electrical energy to meet societal and environmental needs using electrical and electronic systems

PO/PSO TO PEO MAPPING

PO's		PEO1	PEO2	PEO3
PO1	Engineering Knowledge	3	2	3
PO2	Problem Analysis	3	1	3
PO3	Design/Development of Solutions	3	2	2
PO4	Conduct Investigations of Complex Problems	3	1	3
PO5	Engineering Tool Usage	3	2	3
PO6	The Engineer and The World	1	3	1
PO7	Ethics	1	2	3
PO8	Individual and Collaborative Team work	2	3	2
PO9	Communication	3	3	2
PO10	Project Management and Finance	2	3	3
PO11	Life-Long Learning	2	2	2
PSO1	apply the fundamental knowledge of electrical and electronics engineering in providing solutions for the modern power industry and multi-disciplinary areas.	3	2	3
PSO2	analyze, design and simulate systems to generate, transmit, distribute, utilize and control electrical energy to meet societal and environmental needs using electrical and electronic systems.	2	2	2

ESIGN OF CURRICULUM

Salient Features

- The URR24 regulations are inline with the National Education Policy 2020 (NEP2020) and the AICTE model curriculum to provide multidisciplinary holistic education to produce well-rounded engineering graduates.
- Multiple Entry Multiple Exit (MEME) option.
- Multidisciplinary four year UG progrmme with award of the following degrees
    - B. Tech
    - B. Tech with "Minor"
    - B. Tech "Honours"
    - B. Tech "Honours with Research"
- 170+ Credit Liberal Engineering Education.
- A strong program core of 16 courses and 4 baskets of program electives to ensure the breadth and depth in a chosen domain of studies. Program electives are arranged either to grow in a specified vertical or have diversified exposure.
- Full semester industry internship to the interested students.
- Aggressive model of "Learning-by-doing" in the form of PRACTICUM.
- Activity Based Learning (ABL) about Life, Literature and Culture is embedded into 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 for the research-oriented students through "Honours with Research" programme.
- Along with Major and Minor disciplinary courses, students are expected to learn Multidisciplinary open elective courses (MOPEC), skill enhancement courses (SEC), ability enhancement courses (AEC), value added courses (VAC), activity based learning (AL) and experiential learning (EL) towards multidisciplinary holistic education and for increased employability.
- These regulations provide **COMPETENCY-FOCUSED OUTCOME BASED CURRICULUM (CF-OBC)** for skill development, multidisciplinary learning, wider access, inclusiveness and entrepreneurship.
- In our CF-OBC, each course has an additional component of "Contents for self-study", which is carefully designed to ensure additional hours of learner's engagement. The learner thus is nurtured towards the "Self-Learning" and "lifelong learning" which are essential attributes of a 21st Century learner. The same is incorporated in the scheme of instructions in the form of (i) Outside the class work (self-study) hours, (ii) total engagement hours for every course.
- In summary, these regulations are expected to develop technical competencies, through courses from programme core, programme electives, engineering science and basic science; and also develop generic competencies, soft skills, social, physical, mental and spiritual personality through carefully articulated courses from MOPEC baskets, Liberal Learning and Humanities sequels. Thus, offers a unique "T-Shaped" liberal "Pi-Model" of Engineering Education

The Curriculum consists of the following components of study:

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

Multidisciplinary Open Electives Courses (MOPEC)

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

Practicum

The curriculum provides ample opportunities for experiential learning (learning-by-doing) to impart important skills like problem-solving, critical thinking, and communication. Under experiential learning the PRACTICUM is a semester-long project work included in I to IV semesters, having a weightage of 1 credit in each semester. Under PRACTICUM, the students are expected to implement a micro-level project (at a level of course project)solving a practical problem or a project based on the combination of different theory or lab courses 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.

***(Note :** 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.*

The URR24 focuses on CF-OBC with program depth component in terms of Program Core Courses (PCCs) and Program Elective Courses (PECs)

Program Core Courses (PCC)

The curriculum offers fifteen core courses referred to as Program Core. Several academic models from reputed institutions in the country and outside the country are studied in articulating this Program Core, to make curriculum globally competitive. The courses are augmented with laboratory components as per the need.

Program Electives Courses (PEC)

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

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

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

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

The NEP-2020quotes, "*Higher education must develop good, well-rounded and creative individuals, with intellectual curiosity, spirit of service and a strong ethical compass*". Moving towards a more liberal undergraduate education is one of the most important feature of the NEP2020 . *"The needs of the 21stcentury require, that liberal broad-based multidisciplinary education become the basis for all higher education. This will help develop well-rounded individuals that possess critical 21stcentury capacities in fields across arts, humanities, sciences, social sciences, and professional, technical, and vocational crafts, an ethic of social engagement, and rigorous specialization in a chosen field or fields. Such a liberal education would be, in the long run, the approach across all undergraduate programs, including those in professional, technical, and vocational disciplines. Imaginative and flexible curricular structures will enable creative combinations of disciplines for students to study, thus demolishing currently prevalent rigid boundaries and creating new possibilities for lifelong learning. The notion of 'knowledge of many arts'- i.e. what is called 'liberal arts' in modern times – must be brought back to Indian education, as it is exactly the kind of education that will be required for the 21stcentury."*

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

(END OF THE SALIENT FEATURES OF URR24)

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

1. **Title:**

   URR24 Regulations governing the Choice Based Credit System (CBCS) with Multiple Entry and Multiple Exit (MEME) options with Competency-Focused Outcome Based Curriculum (CF-OBC)

2. **Scope:**

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

3. **Duration of Programmes:**

   The undergraduate degree should be of four years duration, with multiple entry and multiple exist (MEME) options. The maximum duration for a student for 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 EEE; UG Diploma in EEE after the study of two academic years (four semesters); and B. Voc in EEE degree after the completion of three academic years(six semesters). The successful completion of four years undergraduate programme would lead to B. Tech in EEE degree with optional Minor/Honours/ Honours with Research.

4. **Credit Requirement:**

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

Qualification Type and Credit Requirements		
NHEQF Levels	**Exit with**	**Credit Requirements**
4.5	**Undergraduate Certificate** (in the field of learning/discipline) for those who exit after the first year (two semesters) of the undergraduate programme. (Programme duration: first year or two semesters of the undergraduate programme)	36-40
5	**Undergraduate Diploma** (in the field of learning/discipline) for those who exit after two years (four semesters) of the undergraduate programme. (Programme duration: First two years or four semesters of the undergraduate programme)	72-80
5.5	**Bachelor's Degree** (Programme duration: Three years or six semesters).	108-120
6	**Bachelor's Degree (Honours/ Research)** (Programme duration: Four years or eight semesters).	144-160

6.5	**Post-Graduate Diploma** for those who exit after the successful completion of the first year or two semesters of the tqo-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 coursework and a thesis with published work

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

5. Commencement:

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

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

6. Eligibility Criteria:

(i) **Level 5:** The students who have successfully completed Grade 12 / Intermediate with MPC or its equivalent course shall be eligible for admission to the first year degree programme

(ii) **Level 6** : The students who have successfully completed Level 5 of the undergraduate programme at this Institute or any other HEIs registered on Academic Bank of Credits Portal

(iii) **Level 7** : The students who have successfully completed Level 6 of the undergraduate programme at this Institute or any other HEIs registered on Academic Bank of Credits Portal

(iv) **Level 8** : The students who have successfully completed Level 7 (bachelor degree of three years or six semesters) of undergraduate programme at this Institute or any other HEIs registered on Academic Bank of Credits Portal

7. Academic Bank of Credits (ABC):

The Academic Bank of Credits (ABC), a national-level facility promotes the flexibility of curriculum framework and interdisciplinary/ multidisciplinary academic mobility of students across the HEUIs in the country with appropriate "credit transfer" mechanism. It is mechanism to facilitate the students to choose their own learning path to attain a Certificate /

Diploma / Degree, working on the principle of multiple entry and exit as well as anytime, anywhere, and any level of learning. ABC will enable the integration of multiple disciplines of higher learning leading to the desired learning outcomes including increased creativity, innovation, higher order thinking skills and critical analysis. ABC will provide significant autonomy to the students by providing an extensive choice of courses for a programme of study, flexibility in curriculum, novel and engaging course options across a number of higher education disciplines / institutions.

7.1 Operationalization of ABC:

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

The ABC related operations shall be as follows:

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

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

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

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

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

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

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

7.2 Monitoring, Support and Quality by Universities and ABC:

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

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

(iii) The quality assurance of the implementation of ABC at the level of the registered university shall be looked by the Director, Examinations and Evaluation of the Institute

of the officer nominated by him different from ABC nodal officer, under the directives and guidance of Controller of Examinations of the Institute

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

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

8. Building Competencies through Padegogy:

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

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

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

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

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

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

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

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

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

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

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

(xi) The UGC regulations, 2021 on Credit Framework for Online Learning Courses through SWAYAM, facilitates an institution to allow up to 40 percent of the total courses being offered in a particular programme in a semester through massive open online courses

(MOOCS) offered by the SWAYAM / NPTEL and other e-learning platforms. Students shall be encouraged to complete equivalent courses through SWAYAM / NPTEL and other-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).

11.1 MULTIPLE EXIT OPTIONS

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

10.2 MULTIPLE ENTRY OPTIONS

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

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

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

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

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

11. Options for Degree Certificate

(i). Learners who earn a minimum of total 172 credits will be **awarded** ***"B.Tech"degree which confirms to NEP2020 requirements of multidisciplinary holistic education.***

(ii). Fast Learners will have the following options to earn***B. Tech degree withHonours / 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

SEMESTER	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

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

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

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

12. Distribution of Courses:

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

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	HSMC	U24MH205	English Communication and Report Writing	II	2
2.	HSSM	U24MH508	Technical English	V	1
3.	HSMC	U24MB605	Management Course Basket	VI	3

(ii) Basic Science Courses (BSC)

No.	Course Type	Course Code	Course Name	Semester	Credits
1.	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	I	3
2.	BSC	U24PY102D	Engineering Physics (for EEE)	I	4
3.	BSC	U24MH201	Matrix Theory and Vector Calculus	II	3
4.	BSC	U24CY202D	Engineering Chemistry (for EEE)	II	4
5.	BSC	U24MH301G	Applied Mathematics	III	3

(iii) Engineering Science Courses (ESC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	**ESC**	**U24CS104**	**Programming for Problem Solving with C**	I	4
2.	**ESC**	**U24EE105D**	**Basic Electrical Engineering**	I	4
3.	**ESC**	**U24CS204**	**Data Structures through C**	II	4
4.	**ESC**	**U24ME207**	**Engg. Graphics & CAD**	II	1
5.	**ESC**	**U24CS305**	**OOP through Java#**	III	4
6.	**ESC**	**U24CS405**	**Python Programming**	IV	4
7.	**ESC**	**U24CS504**	Artificial Intelligence & Machine Learning	V	4
8.	**ESC**	**U24CS604**	Microprocessors & Microcontrollers	VI	4

(iv) Program Core Courses (PCC)

No.	Course Type	Course Code	Course Name	Semester	Credits
1.	PCC	U24EE103	**Electrical Measurements & Sensors**	I	3
2.	**PCC**	**U24CI203**	**Analog Electronics**	II	3
3.	**PCC**	**U24EE302**	**Network Analysis**	III	4
4.	**PCC**	**U24CI311**	**Digital Electronics & Operational Amplifiers**	III	4
5.	**PCC**	**U24EE304**	**DC Machines& Transformers**	III	3
6.	**PCC**	**U24EE401**	**Control Systems Engineering**	IV	4
7.	**PCC**	**U24EE402**	**AC Machines**	IV	4
8.	**PCC**	**U24EE403**	**Electromagnetic Fields**	IV	3
9.	**PCC**	**U24EE404**	**Power System Generation & Distribution**	IV	3
10.	**PCC**	**U24EE502**	**Power Electronics**	V	4
11.	**PCC**	**U24EE503**	**Power System Analysis**	V	3
12.	**PCC**	**U24EE504**	Artificial Intelligence & Machine Learning	V	4
13.	**PCC**	**U24EE602**	**Power Semiconductor Drives**	VI	4
14.	**PCC**	**U24EE603**	**Switchgear & Protection**	VI	3
15.	**PCC**	**U24EE604**	Microprocessors & Microcontrollers	VI	4
16.	**PCC**	**U24EE607**	AI & ML Applications in Electrical Engineering	VI	1
17.	**PCC**	**U24EE703**	**Power System Operation and Control**	VII	4
18.	**PCC**	**U24EE704**	**Utilization of Electric Power**	VII	3
19.	**PCC**	**U24EE705**	**Electric Vehicles**	VII	3

(v) Program Elective Courses (PEC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	**PEC**	**U24EE601**	**Program Elective –I / MOOCs-I**	VI	3
2.	**PEC**	**U24EE702**	**Program Elective - II/ MOOCs-II**	VII	3
3.	**PEC**	**U24EE802**	**Program Elective - III / MOOCs-III**	VIII	3
4.	**PEC**	**U24EE803**	**Program Elective - IV / MOOCs-IV**	VIII	3

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

(vi) Experiential Learning Courses (ELC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	**ELC**	**U24EL108**	**Practicum-1**	I	1
2.	**ELC**	**U24EL209**	**Practicum-2**	II	1
3.	**ELC**	**U24EL308**	**Practicum-3**	III	1
4.	**ELC**	**U24EL408**	**Practicum-4**	IV	1
5.	**ELC**	**U24EE509**	**Seminar**	V	1
6.	**ELC**	**U24EE608**	**Mini Project**	VI	1
7.	**ELC**	**U24EE706**	**Internship Evaluation***	VII	1
8.	**ELC**	**U24EE707**	**Major Project, Phase-1 / Industrial Internship - 1**	VII	4
9.	**ELC**	**U24EE804**	**Major Project, Phase – 2 / Industrial Internship - 2**	VIII	6

(vii) Indian Knowledge System (IKS)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1	**IKSC**	U24IK100	**AICTE Mandated Student Induction Programme (Universal Human Values - I)**	Student Induction Programme	-
2	**IKSC**	**U24IK506**	**EITK**	V	2
3	**IKSC**	**U24IK606**	**UHV-II**	VI	2

IKS 01: From Basket

(viii) Multidisciplinary Open Electives Courses (MOPEC)

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

MOPEC 01: From Baskets of MOPEC
MOPEC 02: From Baskets of MOPEC
MOPEC 03: From Baskets ofMOPEC

(ix) Value Added Courses (VAC)

No.	Course Type	Course Code	Course Name	Semester	Credits
1.	**VAC**	**U24CY106**	**Environmental Studies**	I	-
2.	**VAC**	**U24VA109**	**SEA – I / SAA-1**	I	1
3.	**VAC**	**U24VA206**	**Sports & Yoga**	II	1
4.	**VAC**	**U24VA210**	**SEA-2 / SAA -2**	II	1
5.	**VAC**	**U24VA306**	**QALR / Soft & Interpersonal Skills**	III	2
6.	**VAC**	**U24VA309**	**SEA-3 / SAA -3**	III	1
7.	**VAC**	**U24VA406**	**Soft & Interpersonal Skills / QALR**	IV	1
8.	**VAC**	**U24VA409**	**SEA - 4 / SAA - 4**	IV	1
9.	**VAC*** ***(*For Lateral Entry Students Only)***	**U24CY411***	**Environmental Studies**	IV	3

(x) Skill Enhancement Courses (SEC)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1.	**SEC**	**U24SE208**	**Programming Skill Development (PSD) Lab - 1**	II	1
2.	**SEC**	**U24SE307**	**PSD -02**	III	1
3.	**SEC**	**U24SE407**	**PSD-03**	IV	1
4.	**SEC**	**U24SE507**	**PSD-04**	V	1

(xi) Ability Enhancement Courses (AEC)

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

(xii) Startups &Entrepreneurship(STE)

Sr. No.	Course Type	Course Code	Course Name	Semester	Credits
1	**STE**	**U24ST505**	**S&E Basket**	**V**	**3**

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

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

Table: SEA

SEA (Social Empowerment Activities)			
Module	**Title**	**Course Code**	**Courses Title**
SEA-I	**Socho Bharat**	U24VAYYYSE101	Study of Green & White Revolutions in India
		U24VAYYYSE102	Government Missions (Study of any 2)
		U24VAYYYSE103	Study of India's top 2 problems
		U24VAYYYSE104	Study of World's top 2problems
		U24VAYYYSE105	How Government Works? (Study of one department ofthe Central/ State Government)
		U24VAYYYSE106	Study of one of the identified Books
		U24VAYYYSE107	Study of two National policies
		U24VAYYYSE120	Any other activity approved by Dean Academic Affairs
SEA-II	**Swacch Bharat**	U24VAYYYSE201	River/Beach/Mohalla/School/Campus/Govt offices Cleaning
		U24VAYYYSE202	Waste Segregation Surveys
		U24VAYYYSE203	NSS camp in village for a week
		U24VAYYYSE204	Medical camps in schools
		U24VAYYYSE205	First Aid training for a week
		U24VAYYYSE206	Surveys and Estimation for roof top s

		U24VAYYYSE207	NCC participation
		U24VAYYYSE220	Any other activity approved by Dean Academic Affairs
SEA-III	**Shikshit Bharat**	U24VAYYYSE301	Mentoring of School Children
		U24VAYYYSE302	Digital Literacy for yielders
		U24VAYYYSE303	Value addition for deprived schools
		U24VAYYYSE304	Mentoring junior (first year) students at KITSW
		U24VAYYYSE305	Teaching Assistantship at KITSW
		U24VAYYYSE306	Development of learning material for schools/ITIs
		U24VAYYYSE307	Participation in "Teach-for-India" movement
		U24VAYYYSE320	Any other activity approved by Dean Academic Affairs
SEA-IV	**Samruddha Bharat**	U24VAYYYSE401	Great Grass Root Innovations
		U24VAYYYSE402	Innovation and Creativity
		U24VAYYYSE403	Critical Thinking and Problem solving
		U24VAYYYSE404	Team work and collaboration
		U24VAYYYSE405	Leadership & Entrepreneurship
		U24VAYYYSE406	Design Thinking
		U24VAYYYSE407	Study of one of the identified books
		U24VAYYYSE408	Work with START-UP at KITSW
		U24VAYYYSE409	Basics of fire safety
		U24VAYYYSE420	Any other activity approved by Dean Academic Affairs

Table : SAA

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

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

(xiv) Mandatory Internship (Six to Eight Weeks)
(xv) Mini Project Work
(xvi) Major Project Phase-I
(xvii) Major Project Phase-II

13. SUMMARY OF CURRICULUM COMPONENTS

S. No.	CATEGORY	COURSE COMPONENT	TOTAL COURSES	TOTAL CREDITS	CURRICULUM CONTENT (% OF CREDITS)
1	HSMC	Humanity, Social Sciences and Management Courses	3	6	3.48
2	BSC	Basic Science Courses	5	17	9.88
	ESC	Engineering Science Courses	6	21	12.13
3	PCC	Program Core Courses	19	64	36.99
4	PEC	Program Elective Courses	4	12	6.97
5	MOPEC	Multidisciplinary Open Elective Courses	3	9	5.23
6	ELC	Experiential Learning Courses	9	17	9.88
7	IKSC	Indian Knowledge System Courses	2	4	2.32
9	VAC	Value Added Courses	8	8	4.65
10	SEC	Skill Enhancement Courses	4	4	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**

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

14. SEMESTER WISE COURSE / CREDIT DISTRIBUTION

Semester	Number of Courses / Number of Credits (*Course Category wise*)												
	BSC	**ESC**	**HSMC**	**PCC**	**MOPEC**	**PEC**	**SEC**	**VAC**	**ELC**	**AEC**	**IKSC**	**STE**	**TOTAL**
I	2/7	2/8		1/3				2/1	1/1	2/2			10/22
II	2/7	2/5	1/2	1/3			1/1	2/1	1/1	1/1			11/21
III	1/3	1/4		3/11			1/1	2/3	1/1	1/1			10/24
IV		1/4		4/14			1/1	2/3	1/1	1/1			10/24
V			1/1	3/11	1/3		1/1		1/1	1/1	1/2	1/3	10/23
VI			1/3	4/12		1/3			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**	**6/21**	**3/6**	**19/64**	**3/9**	**4/12**	**4/4**	**8/8**	**9*/17**	**7/7**	**2/4**	**1/3**	**71/172**
% Weightage of Course Category	9.88% (17/172)	12.13% (21/172)	3.46 % (6/172)	36.99 % (64/172)	5.7% (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 % (71/172)

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

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

Abbreviations

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

I SEMESTER

Stream – I

Sl. 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	U24PY102D	Engineering Physics (for EEE)	2	1	2	5	10	4
3	PCC	U24EE103	Electrical Measurements & Sensors	2	1	-	4	7	3
4	ESC	U24EE104	Programming for Problem Solving with C	2	1	2	5	10	4
5	ESC	U24EE105D	Basic Electrical Engineering (for EEE)	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	U24VA109	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-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

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

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

II SEMESTER

Stream-I

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24CY202D	Engineering Chemistry (for EEE)	2	1	2	5	10	4
3	PCC	U24CI203	Analog Electronics	2	1	-	4	7	3
4	ESC	U24EE204	Data Structures through C	2	1	2	5	10	4
5	HSMC	U24MH205	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA206	Sports & Yoga	-	-	2	2	4	1
7	ESC	U24ME207	Engineering Graphics Through CAD	-	-	2	2	4	1
8	SEC	U24SE208	Programming Skill Development (PSD) Lab - 1	-	-	2	2	4	1
9	ELC	U24EL209	Practicum-2	-	-	-	4	4	1
10	VAC	U24VA210	SEA-2 / SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
			Total:	10	4	10	36	60	22
Summer/ Inter-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

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 projects (6-Credits)during a 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 EEE)

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

Exit Option to Qualify UG Certificate in EEE: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24EE212X	Electrical Wiring	2	-	2	-	4	3
2	PCC	U24EE213X	Fundamentals of Electrical Wire joints and Soldering	2	-	2	-	4	3
3	PCC	U24EE214X	Lighting installation	2	-	2	-	4	3
4	PCC	U24EE215X	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 EEE: Any Two (02) Skill-based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE212X	Electrical Household Wiring	-	-	6	-	6	3
2	SEC	U24SE213X	Electrical Earthing Installation	-	-	6	-	6	3
3	SEC	U24SE214X	Electrical illumination and testing	-	-	6	-	6	3
4	SEC	U24SE215X	Any other skill-based course approved by BoS Chair and Dean AA	-	-	6	-	6	3

III SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH301G	Applied Mathematics	2	1	-	6	9	3
2	PCC	U24EE302	Network Analysis	2	1	2	5	10	4
3	PCC	U24CI311	Digital Electronics & Operational Amplifiers	2	1	2	5	10	4
4	PCC	U24EE304	DC Machines & Transformers	2	1	-	4	7	3
5	ESC	U24EE305	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 (PSD) Lab - 2	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
			Total:	12	5	8	36	61	24
			Additional Learning[@]:Maximum credits allowed for Honours/Minor	-	-	-	-	-	5
			Total credits for Honours/Minor students:	-	-	-	-	-	29
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

Branch Specific Mathematics (Pool-4)		
S. No.	**Course Code**	**Course Title**
1.	U24MH301A	Numerical and Statistical Methods ***(for Civil Engineering)***
2.	U24MH301B	Applied Mathematics ***(for Mechanical Engineering)***
3.	U24MH301G	Applied Mathematics ***(for EEE)***
4.	U24MH301D	Discrete Mathematics and Probability Statistics ***(Common to CSE, CSN, CSO & IT)***
5.	U24MH301E	Essential Mathematics and Statistics for Machine learning ***(for CSM)***
6.	U24MH301F	Essential Mathematics and Statistics for Data science ***(for CSD)***

IV SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24EE401	Control Systems Engineering	2	1	2	5	10	4
2	PCC	U24EE402	AC Machines	2	1	2	5	10	4
3	PCC	U24EE403	Electromagnetic Fields	2	1	-	4	7	3
4	PCC	U24EE404	Power System Generation & Distribution	2	1	-	4	7	3
5	ESC	U24EE405	Python Programming	2	1	2	5	10	4
6	VAC	U24VA406B	Soft & Interpersonal Skills	-	-	2	2	4	1
7	SEC	U24SE407	Programming Skill Development(PSD) Lab -03	-	-	2	2	4	1
8	ELC	U24EL408	Practicum-4	-	-	-	4	4	1
9	VAC	U24VA409	SEA - 4 / SAA - 4	-	-	-	2	2	1
10	AEC	U24AE410	Expert Talk Series-4	-	-	-	1	1	1
11	VAC*	U24CY411*	Environmental Studies	2	-	-	3	5	-
Total:				12	5	10	37	64	23
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	28
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

For Lateral Entry Students Only

Bridge Courses for exit:

Successful completion of two projects (6-Credits)during a 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 EEE)

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

Exit Option to Qualify UG Diploma in EEE: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24EE412X	Working, Servicing, and Repair of Electrical Appliances	2	-	2	-	4	3
2	PCC	U24EE413X	Electrical Design, Drawing and Estimation	2	-	2	-	4	3
3	PCC	U24EE414X	Testing and maintenance of DC machines	2	-	2	-	4	3
4	PCC	U24EE415X	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 EEE: Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE412X	Electrical Estimation and Energy Auditing	-	-	6	-	6	3
2	SEC	U24SE413X	Programmable Logic Controller	-	-	6	-	6	3
3	SEC	U24SE414X	Electrical CAD (Computer-Aided Design)	-	-	6	-	6	3
4	SEC	U24SE415X	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 their respective department during the summer vacation after IV Semester.

V SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE501YYX	MOPEC Elective –I#	2	1	-	3	6	3
2	PCC	U24EE502	Power Electronics	2	1	2	5	10	4
3	PCC	U24EE503	Power System Analysis	2	1	-	4	7	3
4	PCC	U24EE504	Artificial Intelligence & Machine Learning	2	1	2	5	10	4
5	STE	U24ST505X	Startups & Entrepreneurship Basket	2	1	-	2	5	3
6	IKSC	U24IK506A	Essence of Indian Traditional Knowledge	2	-	-	2	4	2
7	SEC	U24SE507	Programming Skill Development (PYTHON) Lab -04	-	-	2	2	4	1
8	HSSM	U24MH508	Technical English	-	-	2	2	4	1
9	ELC	U24EE509	Seminar	-	-	-	2	2	1
10	AEC	U24AE510	Expert Talk Series-5	-	-	-	1	1	1
Total:				12	5	8	28	53	23
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	28
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

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

VI SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PEC	U24EE601	Program Elective –I / MOOCs-I	2	1	-	4	7	3
2	PCC	U24EE602	Power Semiconductor Drives	2	1	2	4	9	4
3	PCC	U24EE603	Switchgear & Protection	2	1	-	4	7	3
4	PCC	U24EE604	Microprocessors & Microcontrollers	2	1	2	5	10	4
5	HSMC	U24MB605X	Management Course Basket	2	1	-	2	5	3
6	IKSC	U24IK606B	Universal Human Values-II	2	-	-	2	4	2
7	PCC	U24SE607	AI & ML Applications in Electrical Engineering Lab	-	-	2	2	4	1
8	ELC	U24EE608	Mini Project	-	-	2	2	4	1
9	AEC	U24AE609	Expert Talk Series-6	-	-	-	1	1	1
Total:				12	5	8	26	51	22
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	-	27
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				-	-	-	-	-	-

@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 their respective department during the summer vacation after the VI Semester.

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

Bridge Courses for exit:

Successful completion of two projects (6-Credits)during a 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 EEE)

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

Exit Option to Qualify B. Voc in EEE: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24EE610X	Testing and maintenance of AC machines	2	-	2	-	4	3
2	PCC	U24EE611X	Testing and maintenance of batteries and solar cell	2	-	2	-	4	3
3	PCC	U24EE612X	Introduction to Control of Electric Vehicle	2	-	2	-	4	3
4	PCC	U24EE613X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify forB. Voc in EEE Degree.

Exit Option to Qualify B. Voc in EEE: Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE610X	Introduction to Hybrid Electric Vehicle using MATLAB and Simulink	-	-	6	-	6	3
2	SEC	U24SE611X	Installation of Solar PV panel	-	-	6	-	6	3
3	SEC	U24SE612X	Fault Detection and troubleshooting of inverter, stabilizer, UPS & battery charger	-	-	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	U24EE702	Program Elective - II/ MOOCs-II	2	1	-	4	7	3
3	PCC	U24EE703	Power System Operation and Control	2	1	2	4	10	4
4	PCC	U24EE704	Utilization of Electric Energy	2	1	-	4	7	3
5	PCC	U24EE705	Electric Vehicles	2	1	-	4	7	3
6	ELC	U24EE706	Internship Evaluation*	-	-	2	-	2	1
7	ELC	U24EE707	Major Project, Phase-1 / Industrial Internship - 1	-	-	8	6	14	4
Total:				10	5	12	25	53	21
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	-	4
Total credits for Honours/Minor students:				**-**	**-**	**-**	**-**	**-**	**25**

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

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

B. Tech Honours with Research

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

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

VIII SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week					Credits
				L	T	P	O	E	C
1	MOPEC	U24OE801YYX	MOPEC Elective –III	2	1	-	3	6	3
2	PEC	U24EE802	Program Elective - III / MOOCs-III	2	1	-	4	7	3
3	PEC	U24EE803	Program Elective - IV / MOOCs-IV	2	1	-	4	7	3
4	ELC	U24EE804	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 for three courses (one course per semester under the MOPEC slot) from the available 14 MOPEC Baskets.

Students who opt for open elective courses will be thinking of getting introduced to courses other than their program courses to start rooting their professional goals in their breadth component of study to explore 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.

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 Department 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 Department under MOPEC basket to the students of other branches:

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

(VII) ELECTRICAL ENGINEERING: EE-MOPEC BASKET

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

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

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

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

V/VII/VIII SEMESTER		
1	U24OEX01DSA	Exploratory Data Analysis with R Programming
2	U24OEX01DSB	Predictive Analytics and Data Mining
3	U24OEX01DSC	Big data Analytics
4	U24OEX01DSD	Machine Learning
5	U24OEX01DSE	Deep Learning
6	U24OEX01DSF	Data Visualization
7	U24OEX01DSG	Social and Information Network Analysis
8	U24OEX01DSH	Web Scraping with Python
9	U24OEX01DSI	Introduction to MLOps
10	U24OEX01DSZ	Any other course approved by BoS Chair and Dean AA

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

The following Courses will be offered by the CSE(AI&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	U24OEX01MTG	Partial Differential Equations and Applications
8	U24OEX01MTH	Probability Theory and Stochastic Processes
9	U24OEX01MTI	Descriptive Statistics with R software
10	U24OEX01MTJ	Numerical Linear Algebra
11	U24OEX01MTK	Applied Linear Algebra in AI and ML
12	U24OEX01MTL	Matrix Computation and Applications
13	U24OEX01MTM	Reliability Theory
14	U24OEX01MTN	Numerical Methods for Partial Differential Equations
15	U24OEX01MTZ	Any other course approved by BoS Chair and Dean AA

(XIII) ENGLISH : EN-MOPEC BASKET

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

V/VII/VIII SEMESTER		
1	U24OEX01ENA	Creative Writing
2	U24OEX01ENB	Public Speaking
3	U24OEX01ENC	Conversational English
4	U24OEX01END	Exam Skills
5	U24OEX01ENE	English for Competitive Examinations
6	U24OEX01ENF	Comprehensive Reading
7	U24OEX01ENG	Corporate Writing
8	U24OEX01ENH	Scientific English
9	U24OEX01ENI	Foundation for IELTS/TOEFL
10	U24OEX01ENJ	Narrative Skills

11	**U24OEX01ENK**	Professional Writing
12	**U24OEX01ENL**	English Language Enhancement
13	**U24OEX01ENZ**	Any other course approved by BoS Chair and Dean AA

(XIV) PHYSICS: PY-MOPEC BASKET

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

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

(XV) CHEMISTRY : CY-MOPEC BASKET

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

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

(XVI) COMMERCE & MANAGEMENT : CM-MOPEC BASKET

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

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

(XVII) LIBERAL ARTS* : LI-MOPEC BASKET

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

V/VII/VIII SEMESTER		
1	U24OEX01LIA	Indian Language-I
2	U24OEX01LIB	Indian Language-II
3	U24OEX01LIC	Psychology for Well-Being
4	U24OEX01LID	Foreign Language-I
5	U24OEX01LIE	Foreign Language-II
6	U24OEX01LIF	Introduction to Indian Art -An Aprreciation
7	U24OEX01LIG	Drama Appreciation
8	U24OEX01LIH	Cultural Studies
9	U24OEX01LII	Film Appreciation
10	U24OEX01LIJ	Ethics in Engineering Practice
11	U24OEX01LIZ	Any other course approved by BoS Chair and Dean AA

* Through MOOCS only

(XVIII) ARTS*: AR-MOPEC BASKET

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

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

* Through MOOCS only

(XIX) LAW*: LW-MOPEC BASKET

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

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

* Through MOOCS only

(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

* Through MOOCS only

PROGRAM ELECTIVE COURSES (PEC)

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

Each major specialization of the B. Tech Programme is treated as a vertical.

VERTICAL /PE	PE1	PE2	PE3	PE4
VERTICAL 1: Power Systems	U24EE601A: Renewable Energy Systems	U24EE702A: Microgrids & Distributed Generation	U24EE802A: Energy Storage Techno logies & Energy Auditing	U24EE803A: Restructured Power Systems
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 2: Electrical Machines	U24EE601B: Special Electrical Machines	U24EE702B: Permanent Magnet Synchronous Machines	U24EE802B: Electric Machines for Renewable Energy & Electric Traction	U24EE803B: Modeling and Simulation of Electrical Machines
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 3: Power Electronics	U24EEE601C: Power Converters for Microgrid and Electric Traction	U24EE702C: Multilevel Inverters	U24EE802C: Modern Power Electronics	U24EE803C: HVDC & FACTS
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 4: Controls & Automation	U24EEE601D: Modern Control Theory	U24EEE702D: Digital Control Systems	U24EEE802D: Robotics & Autonomous systems	U24EEE803D: Industrial Automation with PLC and SCADA systems
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 5: Intelligent & Smart Electrical systems	U24EE601E: IoT using Arduino &Raspberry Pi	U24EE702E: AI Techniques in Electrical Engineering	U24EE802E: Machine Learning Applications in Electrical Engineering	U24EE803E: Smart Electric Grid
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 6: Signal Processing &VLSI	U24EE601F: Signals & Systems	U24EE702F: Digital Signal Processing	U24EE802F: Microcontrollers and its applications	U24EE803F: Introduction to VLSI & Embedded systems
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			

First Year -Syllabi

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

Abbreviations

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

I SEMESTER

Stream – I

Sl. 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	U24PY102D	Engineering Physics (for EEE)	2	1	2	5	10	4
3	PCC	U24EE103	Electrical Measurements & Sensors	2	1	-	4	7	3
4	ESC	U24EE104	Programming for Problem Solving with C	2	1	2	5	10	4
5	ESC	U24EE105D	Basic Electrical Engineering (for EEE)	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	U24VA109	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)		
No.	**Course Code**	**Course Title**
1.	U24EE105A	Basic Electrical and Electronics Engineering ***(for Civil Engineering)***
2.	U24EE105B	Basic Electrical Engineering ***(Common to ECE and ECI)***
3.	U24EE105C	Basic Electrical Engineering ***(for CSE)***
4.	U24EE105D	Basic Electrical Engineering ***(for EEE)***

DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS

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

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

UNIT-I	**9 Hrs**

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

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

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

UNIT-II	**9 Hrs**

Partial differentiation and its applications: Functions of two or more variables, Partial derivatives, Total derivative, Change of variables, Jacobians, Functional relationship, Geometrical Interpretation-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 analogies

Self-Learning Topics (SLTs):
Finding the particular integral of $Q(X) = X^m V(X)$ *[(Text 1: topic 13.7, Solved problems: 13.16,13.17,13.19, Practice problems: exercise 13.2 (21,22)].*
Additional problems on method of variation of parameters [(Text 1: topic 13.8(1), Solved problems: 13.25, 13.26, Practice problems: exercise 13.3(1,5)]
Cauchy's homogeneous linear differential equation [(Text 1: topic 13.9(1), Solved problems: 13.31,13.34, Practice problems: exercise 13.4(3,6,9)]

Course Learning Outcomes (COs):
After completion of this course, the students should be able to…
CO1: examine the convergence of a series and interpret mean value theorems
CO2: apply partial differentiation to functions of several variables in solving various engineering problems
CO3: apply appropriate methods of differential equations of first order and first degree to solve real life engineering problems
CO4: analyze the solutions of higher order linear differential equation with constant coefficients

Textbook(s):
1. Grewal, B.S., *Higher Engineering Mathematics*, Khanna Publishers, Delhi, 44th edition, 2017

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

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

Course Articulation Matrix (CAM):		U24MH101 DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24MH101.1	2	2	1	1	-	-	-	1	1	-	1	2	1
CO2	U24MH101.2	2	2	1	1	-	-	-	1	1	-	1	2	1
CO3	U24MH101.3	2	2	1	1	-	-	-	1	1	-	1	2	1
CO4	U24MH101.4	2	2	1	1	-	-	-	1	1	-	1	2	1
U24MH101		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENGINEERING PHYSICS *(for EEE)*			
Class: B.Tech. I- Semester		**Branch:** EEE	
Course Code:	**U24PY102D**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60%**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: fundamental laws of electrostatics and magnetostatics, piezoelectric materials used in electrical engineering

LO2: properties of conducting, superconducting, dielectric, magnetic and insulating materials

LO3: semiconductor materials and semiconductor diodes

LO4: operation of rectifiers and bipolar junction transistors (BJTs)

THEORY COMPONENT

UNIT-I	9 Hrs

Electrostatics and Magnetostatics: Electric charges, Coulomb's law, Electric field, Electrostatic potential, Computation of electric field and electrostatic potential due to point and line charges; Magnetic field, Magnetic flux density, Biot-Savart's law, Ampere's law, Faraday's law and Lenz's law

Piezoelectric materials: Properties, Piezoelectric effect- applications in electrical engineering

Self Learning Topics (SLTs): *concepts of scalars and vectors (Text1: topic 5.21), Solved problems (Text1: Prob 5.1, Prob 5.2).*

UNIT-II	9 Hrs

Conducting, Superconducting and Dielectric materials: Conductors- Electrical and mechanical properties, Low resistivity and high resistivity materials; Superconducting materials- Transition temperature, Critical magnetic field, Meissner effect, Isotope effect, Type-I and Type-II superconductors, Applications in electrical engineering; Dielectric materials- Dielectric constant, Polarization, Properties, Classification of dielectric materials, Dielectric breakdown

Magnetic and Insulating materials: Permeability, Susceptibility, Dia, Para and Ferro magnetic materials, Hysteresis, Soft and hard magnetic materials; Insulating materials- Electrical, Mechanical, Thermal and chemical properties, Classification of insulating materials based on operating temperature

Self Learning Topics (SLTs): *Classification of solids(Text1: topic 36.7), induced dipoles (Text1: topic 40.9), Permeability- susceptibility (Text1: topic 41.2).*

UNIT-III	9 Hrs

Semiconductor Physics: Classification of solids based on energy band theory- Conductors, Semiconductors and Insulators, Intrinsic semiconductor- Carrier generation and recombination, Intrinsic conductivity; Extrinsic semiconductors- n-type and p-type (qualitative), Extrinsic conductivity, Variation of Fermi energy level with temperature and impurity concentration, Drift and diffusion currents; Hall effect (qualitative)

Semiconductor diodes: Formation of a PN junction, Forward and reverse bias, PN junction diode, Diode current equation and its V-I characteristics, Zener diode, Zener diode as voltage regulator, Light emitting diode (LED) and Photodiode (qualitative), Examples of applications of semiconductor diodes

Self Learning Topics (SLTs): *concept of holes (Text1: topic 37.5), Solved problems (Text1: Prob 37.7, Prob 37.8), Solved problems (Text1: Prob 37.7, Prob 37.8), Solved problems (Text2: Prob 4.17).*

UNIT-IV	9 Hrs

Rectifiers: Types of rectifiers- Half-wave rectifier, Full-wave rectifier, Ripple factor, Filters-L, C, LC(L-section) and CLC(π - section)

Bipolar Junction Transistors (BJTs): Transistor structure, Representation of NPN and PNP transistors, Transistor action, Transistor configurations- Common base(CB), Common emitter(CE) and Common collector(CC), Corresponding α, β, γ parameters and their relations

Self Learning Topics (SLTs): *Solved problems (Text2: Prob18.1 to 18.3), transistor as amplifier (Text2: topics 6.7), Solved problems (Text2: Prob 6.1 to 6.5).*

LABORATORY COMPONENT

List of Experiments

1. Linear Measurements using Vernier callipers and screw gauge
2. Determination of wavelength of He-Ne laser using reflection and transmission diffraction grating
3. Determination of dielectric constant of materials using parallel plate capacitor
4. Magnetic hysteresis- B-H curve tracing using CRO
5. Measurement of amplitude and frequency using CRO
6. Study of V-I characteristics of PN junction diode, LED and photodiode
7. Study of V-I characteristics of Zener diode- breakdown voltage
8. Study of I-V characteristics of Solar cell
9. Study of common emitter characteristics of NPN transistor
10. Determination of energy band gap of given semiconductor material
11. Determination of Hall coefficient, carrier density of given semiconducting material using Hall effect setup
12. Numerical aperture and acceptance angle of an optical fiber

Textbook(s):

1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, *A Text Book of Engineering Physics,* S. Chand & Company Ltd, 11th Edn., 2018
2. S Salivahanan, N Suresh Kumar, *Electronic devices and circuits,* Mc Graw Hill Edn., 2017 K.B.Raina, S.K.Bhattacharya, T. Joneja, *Electrical Engineering Materials and Electronic Components*, S.K.Kataria & Sons Publisher, 2005

Reference Book(s):

1. Bhattacharya and Bhaskaran, *Engineering Physics*, Oxford University Press, 1st Edn., 2013
2. V. Rajendran, *EngineeringPhysics*, Mc Graw Hill, 2013
3. R.K. Gaur and S.L.Gupta, *Engineering Physics*, Dhanpath Rai and Sons publications, 2013
4. David Halliday, Robert Resnick & S Krane, *Physics Volume I&II*, Wiley India Limited, 5th Edn., 2014

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_ph28/preview; NPTEL *video lecture on Concepts in Magnetism and Superconductivity by Prof. Arghya Taraphder IIT Kharagpur*
2. https://onlinecourses.nptel.ac.in/noc24_lw07/preview; *NPTEL video lecture on Introduction to Law on Electricity by Prof. Uday Shankar, IIT Kharagpur*
3. https://onlinecourses.nptel.ac.in/noc24_ph45/preview; NPTEL *video lecture on Introduction to LASER by Prof. M. R. Shenoy, IIT Delhi*
4. https://onlinecourses.nptel.ac.in/noc24_ee143/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 Edn.,2017

Course Learning Outcomes (COs):

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

CO1: calculate the electric field, electric potential, magnetic field and flux density using fundamental laws of electrostatics and magnetostatics

CO2: classify conducting, superconducting, dielectric materials; determine the properties of magnetic and insulating materials

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

CO4: calculate load voltage and current of diode rectifier and determine resistances of transistor biasing circuits

(based on psychomotor skills acquired from laboratory component)

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

CO6: calculate the amplitude & frequency of a signal and plot the hysteresis curve of ferromagnetic material

CO7: determine forward voltage and currents from I-V characteristics of semiconductor diodes and solar cell

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

Course Articulation Matrix (CAM):		**U24PY102D- ENGINEERING PHYSICS (***for EEE)*												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PSO1**	**PSO2**
CO1	**U24PY102D.1**	2	1	1	-	-	1	1	1	1	-	1	2	1
CO2	**U24PY102D.2**	2	1	-	-	-	1	1	1	1	-	1	2	1
CO3	**U24PY102D.3**	2	1	-	-	-	1	1	1	1	-	1	2	1
CO4	**U24PY102D.4**	2	1	-	-	-	1	1	1	1	1	1	2	1
CO5	**U24PY102D.5**	2	1	1	-	1	1	1	1	2	-	1	1	1
CO6	**U24PY102D.6**	2	1	-	-	1	1	1	1	2	-	1	1	1
CO7	**U24PY102D.7**	2	1	-	-	1	1	1	1	2	-	1	1	1
CO8	**U24PY102D.8**	2	1	-	1	1	1	1	1	2	1	1	1	1
	U24PY102D	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.5**	**1**	**1**	**1.5**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ELECTRICAL MEASUREMENTS AND SENSORS

Class: B.Tech. I - Semester		**Branch:** EEE	
Course Code:	**U24EE103**	**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: error analysis and measurement of voltage and current

LO2: measurement of power, energy and power factor

LO3: measurement of impedance using DC & AC bridges

LO4: CRO and sensors

UNIT-I	**9 Hrs**

Error Analysis: Significance of Measurement, Static characteristics of measuring system- Linearity, Sensitivity, Precision, Accuracy, Errors in measuring instruments

Voltage and Current Measuring Instruments: Introduction and types of analog instruments, Construction, operation, Sensitivity, Errors, Advantages and disadvantages of Permanent Magnet Moving Coil (PMMC) instrument, Moving iron (MI) instruments, Extension of ranges of voltmeters and ammeter, Loading effect on measuring instruments

Self-Learning Topics (SLTs): *Derivation for Deflecting Torque equation of Moving Coil Instruments (Text: topics 9.4.2), Derivation for Deflecting Torque equation of Moving Iron Instruments (Text: topics 9.9.1)*

UNIT-II	**9 Hrs**

Measurement of Power, Energy and Power factor: Construction, Operation, Errors, advantages and disadvantages of Dynamo meter type wattmeter, Induction type energy meter, Measurement of three phase active and reactive power, Phantom loading, Operation of Digital energy meter and power factor meter

Self-Learning Topics (SLTs): *Derivation for Deflecting Torque equation of Electro Dynamometer Type Instruments (Text: topic 9.10.3), Derivation for Pressure coil Inductance Compensation (Text: topic 11.3.3), Derivation for Deflecting Torque equation of single-phase Energy meter (Text: topic 12.7.2)*

UNIT-III	**9 Hrs**

DC Bridges: Measurement of unknown resistance using Wheatstone bridge, Kelvin's double bridge, Megohm Bridge and Megger

AC Bridges: Measurement of unknown inductance using Maxwell's bridge, Anderson's bridge, Hay's bridge, Owen's bridge, Measurement of unknown capacitance using DeSauty's bridge, Schering bridge and Wien 's bridge, Q-meter

Self-Learning Topics (SLTs): *General equation for Bridge balance (Text: topic 16.3).*

UNIT-IV	**9 Hrs**

Electronic Instruments- CRO: Construction and operation of Cathode Ray Oscilloscope (CRO) and Digital Storage Oscilloscope (DSO), Measurement of amplitude and frequency using CRO, DSO: Block diagram of DSO, Measurement of signal parameters using DSO, Frequency and phase angle measurement using Lissajous patterns

Sensors: ACS712: Hall effect based linear current sensor, 170640: Voltage sensor, LM393: Speed sensor.

Self-Learning Topics (SLTs): *Cathode Ray Tube (Text: topic 21.2), Classification of transducers (Text: topic 25.8).*

Course Learning Outcomes (COs):

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

CO1: calculate error in MI & PMMC instruments for measuring of voltage and current in AC & DC circuits

CO2: calculate active power, reactive power, energy and power factor using wattmeter, energy meter and power factor meter

CO3: determine the R, L & C parameters of a given element using DC and AC bridges

CO4: calculate the unknown frequency & phase angle using Lissajous patterns and design simple circuits to integrate sensors for measurement of current, voltage & speed.

Textbook(s):

1. A. K. Sawhney, *Electrical and Electronics Measurement and Instrumentation*, Dhanpat Rai Publications, 12th edition, 2001.

Reference Book(s):

1. J. B. Gupta, *A course in Electrical and Electronic Measurements and Instrumentation*, Kataria and Sons, 13th edition, 2009.
2. J.G. Joshi, *Electronics Measurements & Instrumentation,* Khanna Publishing House, 2021.
3. Alfred D. Helthic & Willem D.Cooper, *Modern Electronics Instrumentation Techniques*, Pearson/ Prentice Hall of India, 1st edition , 2007.
4. https://www.alldatasheet.es/datasheet-pdf/pdf/174116/ALLEGRO/ACS712.html
5. https://www.datasheethub.com/0-to-25v-dc-voltage-sensor-module/
6. https://ampere-electronics.com/product/lm393-infrared-speed-sensor-encoder-odule/

Web and Video link(s):

1. https://archive.nptel.ac.in/courses/108/105/108105153/; *NPTEL Video Lectures on Electrical Measurements and Electronics Instruments.*
2. https://archive.nptel.ac.in/courses/106/105/106105193/; *NPTEL Video Lectures on output devices, sensors and actuators.*

Course Articulation Matrix (CAM):		**U24EE103-ELECTRICAL MEASUREMENTS & SENSORS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE103.1**	3	3	2	1	1	1	1	1	1	1	1	3	2
CO2	**U24EE103.2**	3	3	2	1	1	1	1	1	1	1	1	3	2
CO3	**U24EE103.3**	3	2	2	1	1	1	1	1	1	1	1	3	2
CO4	**U24EE103.4**	3	2	2	1	2	1	1	1	1	1	1	3	2
U24EE103		**3**	**2.5**	**2**	**1**	**1.25**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

PROGRAMMING FOR PROBLEM SOLVING WITH C

Class: B.Tech. I -Semester		**Branch:** Common to all branches	
Course Code:	**U24CS104**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

LO2: control structures and array operations

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

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

THEORY COMPONENT

UNIT-I — **9 Hrs**

Introduction to Programming: Art of programming through algorithms and flowcharts

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

Constants, Variables and Data Types: Character set, C tokens, Declaration of variables, Defining symbolic constants

Managing Input and Output Operations: Reading a character, Writing a character**,** Formatted input, Formatted output

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

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

UNIT-II — **9 Hrs**

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

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

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

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

UNIT-III — **9 Hrs**

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

Modular Programming with User Defined Functions: Need for user-defined functions, Elements of user-defined functions, Definition of functions, Return values and their types, Function calls, Function declaration, Category of functions, Recursion, The scope, visibility and lifetime of variables (storage classes)

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

UNIT-IV — **9 Hrs**

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

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

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

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

LABORATORY COMPONENT

List of Experiments

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

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

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

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

CO3: develop string operations and modular programming with functions

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

(based on psychomotor skills acquired from laboratory component)

CO5: develop programs using operators and decision making statements

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

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

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

Course Articulation Matrix (CAM):		U24CS104: PROGRAMMING FOR PROBLEM SOLVING WITH C												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CS104.1	2	1	1	1	-	-	1	-	1	-	2	1	2
CO2	U24CS104.2	2	2	2	1	-	-	1	-	1	-	2	2	2
CO3	U24CS104.3	2	2	3	1	-	-	1	-	1	-	2	2	2
CO4	U24CS104.4	2	2	3	2	-	-	1	-	1	-	2	2	2
CO5	U24CS104.5	1	1	1	1	1	-	1	1	1	-	2	1	2
CO6	U24CS104.6	1	2	2	2	1	-	1	1	1	-	2	2	2
CO7	U24CS104.7	1	2	3	2	1	-	1	1	1	-	2	2	2
CO8	U24CS104.8	1	2	3	2	1	-	1	1	1	-	2	2	2
U24CS104		**1.5**	**1.75**	**2.25**	**1.5**	**1**	**-**	**1**	**1**	**1**	**-**	**2**	**1.75**	**2**

BASIC ELECTRICAL ENGINEERING

Class: B.Tech. I -Semester		**Branch:** EEE	
Course Code:	**U24EE105D**	**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 and resonance

LO4: 3- Ø AC circuits and network topology

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.**

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 & Millman's theorem.

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.

Resonance: Series Resonance, Parallel Resonance, Resonant frequency, Half power frequencies, Quality factor, Bandwidth & Selectivity.

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**

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.

Network Topology: Topological description of networks - lumped vs distributed circuits, Network graph, Tree, Co-tree, Incidence matrix, Fundamental tie-set matrices, and Fundamental cut-set matrices.

Self-Learning Topics (SLTs): *Planar & Non-planar graph (Text2: Topic, 2.2) Solved*

problems (Text2: Prob 2.2,2.4 & 2.5), Practice problems (Text2: Chap-2,Prob 2.4.2&2.4.2).

LABORATORY COMPONENT

List of Experiments

1. Verification of Kirchoff's laws
2. Verification of voltage divider rule and current divider rule
3. Verification of Mesh and 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. Frequency response of series RLC circuit
11. Voltage and current relationships between line & phase quantities for balanced 3-phase star & delta connections
12. Interfacing Sensors with Arduino using TINKER CAD -LED blinking

Textbook(s):

1. K. Uma Rao, *Basic Electrical Engineering*, Pearson Education, Revised edition ,2016. (Unit-I, II & III)
2. A. Sudhakar, Shyammohan S. Palli – *Circuits and networks*, McGraw-Hill Education, 2015, 5th Edition. (Unit-IV)

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

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

CO2: apply suitable network theorems to analyze DC circuits

CO3: determine impedance, voltage, current & power in 1- Ø AC circuits and bandwidth & quality factor of series & parallel resonant circuits

CO4: determine line & phase quantities in 3- Ø AC circuits and construct incidence, tie-set & cut-set matrices of a given electrical network

(based on psychomotor skills acquired from laboratory component)

CO5: validate electrical circuits using mesh and nodal analysis

CO6: validate network theorems

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

CO8: determine line & phase quantities for balanced 3- Ø Star and Delta connection

Course Articulation Matrix (CAM):		U24EE105D: BASIC ELECTRICAL ENGINEERING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24EE105D.1	2	1	-	-	-	-	1	1	1	1	**1**	2	1
CO2	U24EE105D.2	2	2	-	-	-	-	1	1	1	1	**1**	2	1
CO3	U24EE105D.3	3	3	1	1	1	1	1	1	1	1	**1**	2	1
CO4	U24EE105D.4	3	3	1	1	1	1	1	1	1	1	**1**	2	1
CO5	U24EE105D.5	2	1	-	-	-	-	1	1	1	1	**1**	2	1
CO6	U24EE105D.6	2	2	-	-	-	-	1	1	1	1	**1**	2	1
CO7	U24EE105D.7	3	3	1	1	1	1	1	1	1	1	**1**	2	1
CO8	U24EE105D.8	3	3	1	1	1	1	1	1	1	1	**1**	2	1
U24EE105D		**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 Edn., Universities Press (India) Pvt. Ltd, 2013

Reference Book(s):

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

Web and Video link(s):

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

Course Articulation Matrix (CAM):		U24CY106 ENVIRONMENTAL STUDIES												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CY106.1	2	1	2	1	-	2	1	1	1	-	-	1	1
CO2	U24CY106.2	-	-	2	-	-	1	1	1	1	1	-	1	1
CO3	U24CY106.3	1	2	1	-	-	1	1	1	1	1	1	1	1
CO4	U24CY106.4	-	-	1	-	-	1	1	1	1	-	1	1	1
U24CY106		**1.5**	**1.5**	**1.5**	**1**	**-**	**1.25**	**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 Edition 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		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
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														

II SEMESTER

Stream-I

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24CY202D	Engineering Chemistry (for EEE)	2	1	2	5	10	4
3	PCC	U24CI203	Analog Electronics	2	1	-	4	7	3
4	ESC	U24EE204	Data Structures through C	2	1	2	5	10	4
5	HSMC	U24MH205	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA206	Sports & Yoga	-	-	2	2	4	1
7	ESC	U24ME207	Engineering Graphics Through CAD	-	-	2	2	4	1
8	SEC	U24SE208	Programming Skill Development (PSD) Lab - 1	-	-	2	2	4	1
9	ELC	U24EL209	Practicum-2	-	-	-	4	4	1
10	VAC	U24VA210	SEA-2 / SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
			Total:	10	4	10	36	60	22
Summer/ Inter-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

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 projects (6-Credits)during a 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 EEE)

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

Exit Option to Qualify UG Certificate in EEE: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24EE212X	Electrical Wiring	2	-	2	-	4	3
2	PCC	U24EE213X	Fundamentals of Electrical Wire joints and Soldering	2	-	2	-	4	3
3	PCC	U24EE214X	Lighting installation	2	-	2	-	4	3
4	PCC	U24EE215X	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 EEE: Any Two (02) Skill-based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE212X	Electrical Household Wiring	-	-	6	-	6	3
2	SEC	U24SE213X	Electrical Earthing Installation	-	-	6	-	6	3
3	SEC	U24SE214X	Electrical illumination and testing	-	-	6	-	6	3
4	SEC	U24SE215X	Any other skill-based course approved by BoS Chair and Dean AA	-	-	6	-	6	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, Eigen values, Eigen vectors, Properties of Eigen values, Cayley Hamilton's theorem, Reduction to diagonal form, Factorization method (LU Decomposition)

Applications of Eigen value problems: Stretching of an elastic membrane, Eigen value problems arising from Markov processes, Eigen value problems arising from population models, Leslie model

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

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

Additional problems on System of homogeneous and non-homogeneous equations [Text 1: topic 2.18, Solved problems: 2.52, Practice problems: exercise 2.10 (13,14)]

Additional problems on Eigen values and Eigen vectors [Text 2: topic 8.1, Solved problems: 8.1(1,2), Practice problems: exercise 8.1(4,6)]

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

UNIT-II	**9 Hrs**

Multiple Integrals and Beta, Gamma functions:

Double Integrals, change of order of integration, Double Integrals in polar coordinates, Area enclosed by plane curves, Triple integrals, Volumes of solids, Calculation of Mass for a plane lamina, Beta function, Gamma function, Relation between Beta and Gamma functions (without proof)

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

Additional problems on change of order of integration [Text 1: topic 7.2, Solved problems: 7.4,7.6, Practice problems: exercise 7.1 (9,14))

Centre of gravity of a plane lamina [Text 1: topic 7.10, Solved problems 7.34,7.35, Practice problems: exercise 7.6 (9,10)]

Moment of Inertia of plane lamina [Text 1: topic 7.12(1,2), Solved problems: 7.37,7.38, Practice problems: exercise 7.7 (1,4)]

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

UNIT-III	**9 Hrs**

Vector Calculus and its applications: - Vector Space, Linear dependent and independent vectors, Differentiation of vectors, Curves in space, Tangent, Principal normal, Binormal, Curvature, Torsion, Velocity and acceleration, Scalar and vector point functions, Del applied to scalar point functions - Gradient, Geometrical interpretation, Directional derivative, Del applied to vector point functions -Divergence, Curl, Physical interpretation of divergence, Physical interpretation of curl, Del applied twice to point functions, Del applied to products of point functions, Decomposition of vector valued functions

Self-Learning Topics (SLTs): *Review of vectors [Text 2: topics 9.1, 9.2, 9.3]*

Vector identities [Text 1: topic 8.9, Solved problems: 8.22, 8.23, Practice problems: exercise 8.4 (13,14)]

Additional problems on Directional derivatives [Text 1: topic 8.5(3), Solved problems: 8.13,8.14, Practice problems: exercise 8.3 (4,6,8,9)]

UNIT-IV	**9 Hrs**

Integration of vectors:

Line integral, Surfaces-Surface integral, flux across a surface, Green's theorem in the plane (without proof), Stoke's theorem (Relation between line and surface integrals) (without proof), Volume integral, Gauss divergence theorem (Relation between surface and volume integrals) (without proof), irrotational fields, solenoidal fields

Self-Learning Topics (SLTs): *Additional problems on Green's theorem [Text 1: topic 8.13, Solved problems: 8.33,8.35, Practice problems: exercise 8.8 (1,2,4)]*

Additional problems on Stoke's theorem [Text 1: topics 8.14, Solved problems: 8.39, 8.40, Practice problems: exercise 8.9 (1,2)]

Additional problems on Gauss Divergence theorem [Text 1: topic 8.16, Solved problems: 8.44,8.46, Practice problems: exercise 8.10 (1,2)]

Course Learning Outcomes (COs):

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

CO1: analyze eigen value problems using matrix theory

CO2: apply basic concepts of multiple integrals in evaluating physical quantities of real-life engineering problems

CO3: apply differential operators on vector and scalar point functions

CO4: solve line, surface, volume integrals and correlate these with applications of Green, Stoke and Gauss divergence theorems

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Course Articulation Matrix (CAM):		**U24MH201 MATRIX THEORY AND VECTOR CALCULUS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24MH201.1**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO2	**U24MH201.2**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO3	**U24MH201.3**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO4	**U24MH201.4**	2	2	1	1	-	-	-	1	1	-	1	1	1
U24MH201		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENGINEERING CHEMISTRY (*for EEE*)			
Class: B.Tech. II-Semester		**Branch:** EEE	
Course Code:	**U24CY202D**	**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: causes and control of industrial pollution and properties of chemical fuels

LO4: synthesis of nanomaterials, properties and applications of polymers

THEORY COMPONENT

UNIT-I	9 Hrs

Electrochemical Energy Systems: Specific conductance, Equivalent conductance, The effect of dilution; Conductometric titrations, Electrode potential, Nernst equation, Potentiometric titrations

Batteries:Introduction, Classification of batteries, Components, Construction, Working principles, Chemical equation and application of zinc carbon, Lead acid, Lithium-ion, Ni -Cd batteries, and Fuel cells

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

UNIT-II	9 Hrs

Water Technology: Characteristics of natural water**,** Hardness of water, Estimation of hardness of water by Complexometry, Alkalinity, Determination of alkalinity, Determination of fluoride, Effect of fluoride, Water treatment by Filtration, Aeration, Electro dialysis, De-mineralization

Corrosion and its Control: Introduction, Dry corrosion, Wet corrosion, Pilling-Bedworth rule, Effect of purity, Relative areas of anodic and cathodic parts, Nature of surface film, Humidity, p^H and Temperature on corrosion, Cathodic protection-Impressed current cathodic protection, Sacrificial anodic protection; Electroplating, Galvanization

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

Industrial Pollution and its Control: Industrial pollution and wastewater from various industries, Environmental pollution due to thermal & nuclear power plants and its control and solid waste disposal

Chemical fuels: Introduction, Definition and classification of chemical fuels, Primary and secondary fuels, Solid, Liquid and gaseous fuels, Requirements of good fuel, Calorific value, Solid fuels, Coal and its ranking, Liquid fuels, Fractionation of petroleum, Composition and uses of gasoline, Diesel and kerosene, Cracking & its significance

Self Learning Topics (SLTs): C*ause of pollution (*Text1:* chapter 4 topics: 1), Introduction to fuels, Classification of fuels (*Text1:* chapter 2 topics: 1& 2), Comparison of diesel fuel & gasoline fuel (*Text1:* chapter 2 topic 18, table 5)

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 and graphene's-brief explanation, Properties and applications, Biosensors

Polymers: Introduction–polymer, Monomer condensation, Thermo-setting and thermoplastic resins, Bakelite-applications, PVC-applications

Self Learning Topics (SLTs): *Introduction to nanotechnology* **(***Text1: chapter 37 topic 1). Mechanism of addition polymerization (Text1: chapter 3 topic 6)*

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)

Text Book(s):

1. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Company, 17th Edn., 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 Edn., 2003
3. S. S. Dara, S. S. Umare, *A Text book of Engineering Chemistry*, S. Chand & Company Ltd., 12th Edn.,2010

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs)

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

CO1: apply the concepts of electrochemical energy systems for batteries and fuel cells
CO2: interpret suitable techniques of water analysis and corrosion treatment of solid materials
CO3: perceive solution for industrial pollution and suggest the suitability of chemical fuels for electrical applications
CO4: summarize the synthesis of nanomaterials and polymers
(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):		**U24CY202D ENGINEERING CHEMISTRY (*for EEE*)**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CY202D.1**	2	-	-	-	1	1	1	-	1	-	1	1	1
CO2	**U24CY202D.2**	2	-	-	-	1	1	1	-	1	-	1	1	1
CO3	**U24CY202D.3**	2	1	1	-	-	1	1	-	1	-	1	1	1
CO4	**U24CY202D.4**	2	-	-	-	1	1	1	-	1	-	1	1	1
CO5	**U24CY202D.5**	2	1	-	-	-	1	1	-	1	-	1	-	-
CO6	**U24CY202D.6**	2	1	-	-	2	1	1	-	1	-	1	-	-
CO7	**U24CY202D.7**	2	1	-	-	-	1	1	-	1	-	1	-	-
CO8	**U24CY202D.8**	2	1	-	-	-	1	1	-	1	-	1	-	-
U24CY202D		**2.00**	**1.00**	**1.00**	**-**	**1.25**	**1.00**	**1.00**	**-**	**1.00**	**-**	**1.00**	**1**	**1**

ANALOG ELECTRONICS

Class: B.Tech. II -Semester	**Branch:** Common to ECI and EEE		
Course Code:	**U24CI203**	**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: small signal low frequency analysis of transistor amplifier circuits

LO2: frequency response of RC-coupled amplifier and JFET & MOSFET characteristics

LO3: negative feedback amplifier circuits

LO4: oscillator circuits and large signal amplifiers

UNIT-I	**9 Hrs**

Bipolar Junction Transistor (BJT) Biasing: Bias stability - Need for biasing , Operating point, Thermal runaway; Stability factor (S), Methods of BJT biasing - Fixed bias, Collector to base bias, Self bias

Small Signal Low Frequency Transistor Amplifier Circuits: BJT small signal low frequency h-parameter model, Analysis of transistor amplifier circuits using h-parameters, Analysis of single stage CE transistor amplifier circuits, Hybrid- Л(pi) Common emitter transistor model

Self Learning Topics (SLTs): E*mitter feedback bias (Text1: topics6.12.2), Simplified CE and CC h-parameter model (Ref1: topics 12.4 , 12.5), Solved problems (Text1: Examples 6.30, 6.37,6.41), Solved problems (Text1:Examples 9.3, Prob 9.4)*

UNIT-II	**9 Hrs**

Multistage Amplifiers : Different coupling schemes used in cascading of amplifiers, Choice of transistor configurations in cascading, Effect of cascading on gain and bandwidth, Frequency response of RC coupled amplifier, Emitter follower, Darlington connection

Junction Field Effect Transistor (JFET) : Construction and operation, Characteristic parameters of JFETs, Drain & transfer characteristics, FET as a switch, Analysis of single stage FET amplifier, Metal Oxide Semiconductor Field Effect Transistor(MOSFET)-structure and operation of Enhancement MOSFET and Depletion MOSFET

Self Learning ***Topics (SLTs):*** *General analysis of cascade amplifier(Text1:topics10.3), cascode amplifier (Text1: topics 10.3,10.9), solved problem(Text1:Example10.1)*

UNIT-III	**9 Hrs**

Feedback Amplifiers: Basic concept of feedback, Negative feedback amplifiers - Characteristics, Effect of negative feedback, Topologies; Analysis of voltage series, Voltage shunt, Current series and Current shunt feedback amplifiers

Self Learning Topics (SLTs): *effect of feedback on input and output impedances (Text1:topics14.6.14.7), Solved problems (Text1: Prob 14.7, Prob 14.10,14.13)*

UNIT-IV	**9 Hrs**

Oscillators: Conditions for oscillations (Barkhausen criterion), RC and LC oscillators, Crystal Oscillator

Large Signal Amplifiers: Classification based on biasing, Series fed and transformer coupled Class A amplifier, Class B power amplifier, Push-pull and complementary symmetry Class B amplifiers, Cross over distortion, Class-AB power amplifier

Self Learning Topics (SLTs): *classification of oscillators (Text1:topics 15.2),Second and higher order harmonic distortion(Text1: topics 12.4,12.5), Thermal stability and heat sinks (Text1: topics 12.9)*

Course Learning Outcomes (COs):

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

CO1: design biasing circuits for BJT amplifier and apply h-parameters to determine the gain & impedance of BJT amplifiers

CO2: analyze the frequency response of RC coupled amplifier and volt-ampere characteristics of JFET &MOSFET

CO3: determine the gain and impedance of the feedback amplifier by identifying its topology

CO4: estimate the frequency of oscillations of given oscillator and efficiency of a large signal amplifier

Textbook(s):

1. S. Salivahana and N.Suresh Kumar, *Electronic Devices and Circuits*, McGraw Hill Education , New Delhi, 3rd edition, 2015

Reference Book(s):

1. Jacob Millman and C.C.Halkias, *Integrated Electronics*, Tata McGraw-Hill, New Delhi, 2nd edition, 1991
2. Robert L.Boylestad, Louis Nashelsky, *Electronic Devices and Circuit Theory*, Pearson education, New Delhi, 10th edition, 2013
3. Donald A Neamen, *Electronic Circuits Analysis and Design*, Tata McGraw-Hill, New Delhi, 3rd edition, 2009

Web and Video link(s):

1. https://www.youtube.com/watch?v=PSdHf6yozyc; *NPTEL Video Lecture on Transistor Biasing by Prof. T.S.Natarajan, Department of physics, IIT Madras*
2. https://www.youtube.com/watch?v=BSR26SU3R2U; *NPTEL Video Lecture on RC coupled amplifiers – frequency response by Prof. D.C. Dube, Department of Physics, IIT Delhi*
3. https://www.youtube.com/watch?v=xHNDrbB-iWY; *NPTEL Video Lecture on positive feedback and oscillations by Dr.Chitralekha Mahanta, Department of Electronics and Communication Engineering ,IIT Guwahati*
4. https://www.youtube.com/watch?v=4m49vM0Ryt8; *NPTEL Video Lecture on Field Effect Transistors Prof. T.S.Natarajan, Department of physics, IIT Madras*

Course Articulation Matrix (CAM):		**U24CI203 ANALOG ELECTRONICS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CI203.1**	2	2	-	-	-	-	1	-	1	-	1	1	-
CO2	**U24CI203.2**	2	2	-	-	-	-	1	-	1	-	1	1	-
CO3	**U24CI203.3**	2	2	-	-	-	-	1	-	1	-	1	1	-
CO4	**U24CI203.4**	2	2	-	-	-	-	1	-	1	-	1	1	-
U24CI203		**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**-**

DATA STRUCTURES THROUGH C

Class: B.Tech. II –Semester		**Branch:** EEE	
Course Code:	**U24EE204**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60%**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: time complexity, space complexity, array operations, and dynamic memory allocation

LO2: stacks and various forms of queues

LO3: various types of linked lists

LO4: various sorting techniques and hashing techniques

THEORY COMPONENT

UNIT-I — 9 Hrs

Data Structures: Basic terminology, Classification of data structures, Applications and operations on data structures, Time and space complexity

Arrays: Operations on arrays-traversing an array, Inserting an element in an array, Deleting an element from an array, Searching an element using binary search and their complexities,

Dynamic Memory Allocation: Memory allocation functions, Dynamic memory allocation for single and two dimensional arrays

Self Learning Topics (SLTs): *Three dimensional and n-dimensional arrays (Text1: topics 2.4.3), passing arrays to functions and pointers (Reference1: topics 3.6, 3.7), Practice problems (Text1: Prob 2.3, Reference1: Prob 1,Prob 2,Prob 3,Prob 4)*

UNIT-II — 9 Hrs

Stacks: stacks, Array representation of stacks, Operations on a stack–push and pop; Multiple stacks, Applications of stacks- recursion, Fibonacci series, tower of Hanoi, evaluation of expressions (infix to postfix conversion, evaluation of postfix expression)

Queues: queues, Array representation of queues, Double ended queues, Circular queues

Self Learning Topics (SLTs): *Infix to prefix (Reference1: topics 7.7.3), priority Queue(Reference1: 8.4.3), Solved problems (Reference1: Prob 7.7.1, Prob 7.7.2), Practice problems (Text1: Prob 4.5, Prob 4.11, Prob 5.7, Prob 5.9)*

UNIT-III — 9 Hrs

Linked Lists: Basic terminologies, Linked list versus arrays, Memory allocation and de-allocation for a linked list, Singly linked list, Circular linked list, Doubly linked list, Circular doubly linked list (linked list operations- traversing, searching, inserting, deleting), Representing stack and queue using linked list

Self Learning Topics (SLTs): *Merging (Text1: topics 3.3), Skiplist (weblink: https://www.geeksforgeeks.org/skip-list/), Deallocation strategy(Text1: topic 3.9), Solved problems (Text1: Prob 3.6.1, Prob 3.6.2), Practice problems (Reference1: Prob 5.5, Prob 5.7, Prob 5.9)*

UNIT-IV — 9 Hrs

Sorting Techniques: Selection sort, Insertion Sort, Shell sort and radix sort, Time complexities of sorting

Hashing: Hashing techniques, Collision resolution techniques, Closed hashing, Open hashing, Comparison of collision resolution techniques

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

LABORATORY COMPONENT

List of Experiments

Experiment-I

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

Experiment-II

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

Experiment-III

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

Experiment-IV

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

Experiment-V

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

Experiment-VI

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

Experiment-VII

19. Program to create single linked list and implement its operations

Note:- Linked list Operations**:** i) traversing ii) inserting iii) deleting iv) searching v) reversing vi) concatenation

Experiment-VIII

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

Experiment-IX

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

Experiment-X

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

Experiment-XI

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

Experiment-XII

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

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

1. *Data Structures through C Laboratory Manual and Record Book*, Department of EEE , KITSW.

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: analyze and implement array operations by utilizing dynamic memory allocation and evaluating their time and space complexities

CO2: analyze and implement stack and queue data structures by utilizing array representations and evaluating their applications and operational complexities

CO3: analyze and implement various types of linked lists by utilizing dynamic memory allocation techniques and evaluating their operational complexities

CO4: develop various sorting algorithms, analyze their time complexities, and apply hashing techniques with collision resolution methods, comparing their efficiencies

(based on psychomotor skills acquired from laboratory component)

CO5: develop and test basic data structures and array operations, including dynamic memory allocation to evaluate their performance and complexity

CO6: apply the linear data structures such as stacks and queues and perform various operations using LIFO or FIFO order respectively

CO7: solve problems using various linked list representations for efficiently storing and retrieving the data

CO8: apply different sorting techniques on unsorted data and sort them in an order, able to store the data using hashing techniques to retrieve the data very effectively

Course Articulation Matrix (CAM):		**U24EE204 DATA STRUCTURES THROUGH C**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE204.1**	2	2	2	1	-	-	1	-	1	-	1	2	1
CO2	**U24EE204.2**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	**U24EE204.3**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	**U24EE204.4**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO5	**U24EE204.5**	2	2	2	1	-	-	1	1	1	-	1	2	1
CO6	**U24EE204.6**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO7	**U24EE204.7**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO8	**U24EE204.8**	2	2	2	2	-	-	1	1	1	-	2	2	2
U24EE204		**2**	**2**	**2**	**1.75**	**-**	**-**	**1**	**1**	**1**	**-**	**1.75**	**2**	**1.75**

U24MH105/205: ENGLISH COMMUNICATION & REPORT WRITING

UNIT-III	9 Hrs

GRAMMAR

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

VOCABULARY

- Phrasal Verbs-Technical Words-Latin Words

READING STRATEGY

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

WRITING PRACTICES

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

LIFE SKILLS: Positive Attitude

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

Self Learning Topics (SLTs):

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

UNIT-IV	9 Hrs

GRAMMAR

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

VOCABULARY

- Appropriate Use of Words in Communication-Commonly Confused Words

ACTIVE READING and NOTE-MAKING

- Note-Making-Definition-Purpose-Effectiveness

WRITING PRACTICES

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

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

Self-Learning Topics (SLTs):

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

Course Learning Outcomes (COs):

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

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

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

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

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

Textbook(s):

1. Sanjay Kumar & Pushp Lata, " *English Language and Communication Skills for Engineers"* As per the latest AICTE syllabus, Oxford University Press, 1st edition 2018
2. "*Language and Life: A Skill's Approach*" Based on the latest AICTE model curriculum Orient Blackswan Private Limited 2nd Edition 2019.

Reference Book(s):

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

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc20_hs56/preview Technical English for Engineers by Aisha Icbal, IIT Madars
2. https://onlinecourses.swayam2.ac.in/cec21_lg13/preview Indian Writing in English by Dr.Bindu Ann Philip, St Mary's College Trissur

Course Articulation Matrix (CAM): U24MH105/205: ENGLISH COMMUNICATION & REPORT WRITING													
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24MH105.1	-	-	-	-	-	1	-	2	2	2	2	1	1
CO2	U24MH105.2	-	-	-	-	-	1	-	2	2	2	2	1	1
CO3	U24MH105.3	-	-	-	-	-	1	-	2	2	2	2	1	1
CO4	U24MH105.4	-	-	-	-	-	1	-	2	2	2	2	1	1
U24MH105/205		-	-	-	-	-	1		2	2	2	2	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

SPORTS /YOGA

Class: B.Tech : II-Semester		**Branch : All UG Branches**	
Course Code:	**U24VA206**	**Credits:**	**1**
Hours/Week(L-T-P-O-E):	**0-0-2-2-4**	**CIE :**	**60 %**
Total Number of Teaching Hours:	**130 Hrs (13 weeks X10 hours)**	**ESE :**	**40%**

Course Learning Objectives (LOs): This course Sports/Yoga will enable students to:
LO1: know about Yoga and its Benefits
LO2: develop skills and techniques of various Sports &Games.
LO3: inculcate Sportsman spirit.
LO4: all round development of the students to meet the requirements of the society.

Sports and Games

List of Sports and Games

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

Textbook(s):

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

Reference Book(s):

1. Rules and Skills of Games and Sports, Author – B.K.Chaturvedi, Publisher – Goodwill Publishing House, B-9, Rattan Jyoti, 18 Rajendra Place, New Delhi – 110008 (India)
2. Dare To Be A Champion.Lee Chong Wei (Brand), Genres**Biography**
3. 199 pages, Paperback,First published July 1, 2012
4. This edition,Format,199 pages, Paperback,Published,January 1, 2012 by Bukuganda Digital & Publication,ISBN,9789671084328,ASIN,967108432X,Language,English.
5. ***The Book of Basketball: The NBA According to the Sports Guy*** is the second book by former ESPN columnist Bill Simmons.[1] Published in 2009, it covers the history of the National Basketball Association (NBA). In 2019, Simmons launched a sequel podcast series, **Book of Basketball 2.0**, which analyzes the evolution of the league since the book was published.
6. Title. How to Reassess Your Chess: Chess Mastery Through Chess Imbalances. Author:Jeremy Silman, Edition, 4, illustrated, reprint, Publisher : Silman-James Press, 2010, ISBN.1890085138, 9781890085131, Length : 658 pages, Subject :Games & Activities ,General.

7. The Stars of Football: The World's Best Players Kindle Edition by Rodolphe Gaudin (Author) Format: Kindle Edition, Games & Activities / Chess, Games & Activities / General
8. The Complete Volleyball Handbook Kindle Edition, by Bob Bertucci (Author), Makoto Katsumoto (Author), Yasumi Nakanishi (Author), Toshiaki Yoshida (Author) Format : Kindle Edition. 4.5.4.5 out of 5 stars 15 ratings.
9. Cricket skills& Rules, Author.V.Thani,khel sahitya Kendra ,4264/3,Ansari Road,Darya Ganj,New Delhi-110002. Length : 202 pages
10. Health Exercise And Fitness, Author – J.P.Muller, Sports Publication, WP-474, 1st Floor, Shiv Market, Ashok Vihar, Delhi -110052, Length : 117 Pages.
11. Yogic Science, Author – Dr.T.Thangamani, Dr.T.Godwin Vedanayagam Rajkumar, Publisher - Physical Education & Sports Books, 7/26, Ground Floor, Ansari Road, Daryaganj, New Delhi-110002, Length : 274 pages.

Web and Video link(s):

Badminton game Video Link :
https://www.youtube.com/watch?v=HucIqi8Lw3E&t=22s
Basket Ball game Video Link :
https://www.youtube.com/watch?v=-tkE2lJoR58
Chess Video Link :
https://www.youtube.com/watch?v=mDw7lgM8ePo
Carrom game Video Link :
https://www.youtube.com/watch?v=z8vvJpNceeg
Football game Video Link :
https://www.youtube.com/watch?v=mXjW78AgGu4
Table Tennis game Video Link :
https://www.youtube.com/watch?v=bLrJGWvWI4U
Volleyball game Video Link :
https://www.youtube.com/watch?v=BJJb3-O0Q1U
Cricket game Video Link :
https://www.youtube.com/watch?v=87hO_Vs3-wQ
Handball game Video Link :
https://www.youtube.com/watch?v=VCa_0USaq8k
Kabaddi game Video Link :
https://www.youtube.com/watch?v=ai1m7ARNyNI
Kho-Kho game Video Link :
https://www.youtube.com/watch?v=P3_z3LKdLdg
Yoga Aasanas Video Link :
https://www.youtube.com/watch?v=e0Q88DUOXjk
https://www.youtube.com/watch?v=JoDKbXEUrvQ

Course Learning Outcomes(COs):

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

CO1: demonstrate physical fitness by performing Yoga – Asanas.
CO2: demonstrate physical fitness through various games & sports events with defined benchmarks.
CO3: demonstrate Sportsman spirit and ethics..
CO4: demonstrate Physical, Psychological, Social and Emotional balance.

ESE-40.

		Grade-P (50%)	Grade-D (60%)	Grade-C (70%)	Grade-B (80%)	Grade-A (90%)	Grade-S (100%)
50 mts / 30 mts (Sprint)	Women	11sec above	10-11 sec	9-10 sec	8-9 sec	7-8 sec	7 sec below
		5	6	7	8	9	10
	Men	11sec above	10-11 sec	9-10 sec	8-9 sec	7-8 sec	7 sec below
		5	6	7	8	9	10
Jump (Standing Broad Jump)	Women	0.90 – 1 mts	1.00 – 1.25 mts	1.25 – 1.50 mts	1.5 – 1.75 mts	1.75 – 2 mts	2 mts above
		5	6	7	8	9	10
	Men	1.50 – 1.7 mts	1.7 – 1.9 mts	1.90 – 2.1 mts	2.30 – 2.1 mts	2.5 – 2.7 mts	2.70 mts above

		5	6	7	8	9	10
Throw (Shot-put)	Women	3.5-4.0mts	4.0-4.5mts	4.5.5.0mts	5.0-5.5mts	5.5-6.0mts	6.0-6.5mts
		5	6	7	8	9	10
	Men	4.0-5.0mts	5.0-6.0mts	6.0-7.0mts	7.0-8.0mts	8.0-9.0mts	9mts above
		5	6	7	8	9	10
Yoga Aasanas (Surya Namaskaras)	Women	2 repetition (12min)	3 repetition (18min)	4 repetition (24min)	5 repetition (30min)	6 repetition (36min)	7 repetition (42min)
		5	6	7	8	9	10
	Men	2 repetition (12min)	3 repetition (18min)	4 repetition (24min)	5 repetition (30min)	6 repetition (36min)	7 repetition (42min)
		5	6	7	8	9	10

.CIE-60.

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

SPORTS AND YOGA FOR ALL UG BRANCHES-U24VA206

COs	POs/PSOs	Justification for mapping (Students will be able to)	Level of mapping
CO1:demonstrate physical fitness by performing Yoga-Asanas	PO12	Performing Yoga Aasanas and make it habituated as a life long process, so that one can improve concentration levels through better mind-body co-ordination.	1
CO2: Demonstrate physical fitness through various games & sports events with defined benchmarks.	PO9	Engage in games and sports regularly thus promotes individual and team work.	1
CO3: demonstrate sportsman spirit and ethics.	PO8	Exhibit Sportsman Spirit and learn ethics through various games & sports to be a worthy citizen.	2
CO4: demonstrate Physical, Psychological, Social and Emotional balance.	PO10	Exhibit proper balance during emotions sportsman can communicate effectively with peers and can demonstrate physical, psychological, social skills effectively.	1
	PO12	Maintain physical, psychological, Social and emotional balance and make it as a lifelong process through Games and Sports.	1

P010.Maintaining physical, psychological, Social and emotional balance is a lifelong process which can be habituated through Games and Sports and enhances communication skills.

Course Articulation Matrix (CAM):		U24VA206 Sports / Yoga for all UG Branches												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	U24VA206.1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	U24VA206.2	-	-	-	-	-	-	-	1	-	-	-	-	-
CO3	U24VA206.3	-	-	-	-	-	-	2	-	-	-	-	-	-
CO4	U24VA206.4	-	-	-	-	-	-	-	-	1	-	1	-	-
Average		-	-	-	-	-	-	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 centre and tool palettes
2. Introduction to orthographic projections-Vertical Plane, Horizontal plane; Views-Front view, Top view, and Side view and draw the Projection of points in different quadrants.
3. Draw the Projection of straight lines
4. Draw the Projection of planes
5. Draw the Projection of solids- Simple position(Axis perpendicular to HP or VP)
6. Draw the projections of solids inclined to both the planes
7. Draw the Sections of solids
8. Draw the Orthographic projections of given objects
9. Conversion of isometric view to orthographic projections
10. Draw the Isometric view from the given orthographic views
11. Draw the pictorial view (3D) from the given Isometric view
12. AutoCAD application in Electrical and Electronics circuits

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

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

Course Learning Outcomes (COs)

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

CO1: draw projections of points and straight lines inclined to one plane with Auto CAD.
CO2: develop the projections of planes using Auto CAD
CO3: construct the projections of solids and sections of solids using Auto CAD
CO4: create orthographic and isometric projections and develop the simple electrical and electronic circuit using Auto CAD

Course Articulation Matrix (CAM): U24ME 207 ENGINEERING GRAPHICS THROUGH CAD													
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24ME107/207.1	2	1	1	-	2	-	1	-	2	-	1	1	1
CO2	U24ME107/207.2	2	1	1	-	2	-	1	-	2	-	1	1	1
CO3	U24ME107/207.3	2	1	1	-	2	-	1	-	2	-	1	1	1
CO4	U24ME107/207.4	2	1	1	-	2	-	1	-	2	-	1	1	1
U24ME107/207		**2**	**1**	**1**	**-**	**2**	**-**	**1**		**2**	**-**	**1**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ELECTRICAL WIRING

Class: B.Tech. II -Semester		**Branch:** EEE	
Course Code:	**U24EE212X**	**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: electrical wiring and laying installations
LO2: types of electrical systems and safety regulations
LO3: electrical Tools and Equipment
LO4: wiring methods used in Residential Wiring Systems

THEORY COMPONENT

UNIT-I	**4 Hrs**

Fundamentals of Electrical wiring: Identify various conduits and different electrical accessories, Practice cutting, Threading of different sizes & laying installations, Prepare test boards /extension boards and mount accessories like lamp holders, Various switches, Sockets.

UNIT-II	**4 Hrs**

Electrical Safety & Regulations: Overview of electrical systems in residential, Commercial, Industrial settings, Importance of electrical safety and regulations, Principle of laying out of domestic wiring, Voltage drop concept.

UNIT-III	**4 Hrs**

Electrical Tools and Equipment: Identification and proper use of tools (pliers, screwdrivers, wire strippers, etc.). Measurement tools: Multimeter, Clamp meter, Safety equipment: Gloves, Goggles, Safety shoes.

UNIT-IV	**4 Hrs**

Residential Wiring Systems: Types of residential circuits (lighting, outlets, appliances), Wiring methods and materials (conduit, cables), Installation of switches, Outlets and fixtures, Basic load calculations and circuit design, Inspection and testing of wiring installations.

LABORATORY COMPONENT

List of Experiments

1. Installation of a single-phase incoming supply system.
2. Installation and wiring of lighting circuits.
3. Installation and wiring of power circuits.
4. Wiring and installation of a distribution board.
5. Installation and testing of earthing systems.
6. Installation and wiring of switches, sockets, and light fixtures.
7. Wiring and installation of a control panel.
8. Installation and testing of circuit protection devices (MCBs, RCDs).
9. Testing and measurement of circuit parameters using basic electrical instruments.
10. Installation and testing of energy meters.

Textbook(s):

1. Satheesh Kumar, *Electrical Wiring: An Introduction,* Ane Books Pvt. Ltd, 2nd edition, 2011, New Delhi.

Reference Book(S):

1. Phil Simmons, Ray Mullin, *Electrical Wiring Residential,* Delmar Cengage Learning, 17th edition, 2011, USA.
2. H.P. Richter, W. Creighton Schwan, *Practical Electrical Wiring: Residential, Farm and Industrial,* McGraw-Hill Inc, 17th edition, 1996, USA.

Web and Video link(s):

https://www.youtube.com/watch?v=hKtedrJKyQs; *YOUTUBE Video lecture on Basic Residential Wiring by Sam Maltese, Professor, Faculty of Applied Science & Technology, Brampton, Canada.*

Laboratory Manual (for laboratory component):

1. *Electrical Household Wiring Lab Manual and Record Book (LMRB),* Department of EEE, KITSW

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: design electrical wiring with extension boards, Conduits & accessories

CO2: apply electrical safety & regulations in designing domestic/industrial layout

CO3: identify suitable tools & equipment used for electrical wiring

CO4: calculate electrical load and suggest testing of wiring installations

(based on psychomotor skills acquired from laboratory component)

CO5: instal and perform wiring of lighting & power components

CO6: demonstrate the installation of the distribution board & earthing

CO7: instal the electrical panel with protective devices

CO8: test the performance of electrical instruments

Course Articulation Matrix (CAM):		**U24EE211 ELECTRICAL WIRING (RESIDENTIAL)**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE211.1**	2	1	-	-	-	-	1	-	1	-	1	2	1
CO2	**U24EE211.2**	2	2	-	-	-	-	1	-	1	-	1	2	1
CO3	**U24EE211.3**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO4	**U24EE211.4**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO5	**U24EE211.5**	2	1	-	-	-	-	1	-	1	-	1	2	1
CO6	**U24EE211.6**	2	2	-	-	-	-	1	-	1	-	1	2	1
CO7	**U24EE211.7**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO8	**U24EE211.8**	3	3	1	1	1	1	1	-	1	-	1	2	1
U24EE211		**2.5**	**2.25**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

FUNDAMENTALS OF ELECTRICAL WIRE JOINTS AND SOLDERING			
Class: B.Tech. II -Semester		**Branch:** EEE	
Course Code:	**U24EE213X**	**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: soldering of small electrical/electronic components

LO2: importance of joints/lugs in domestic and commercial applications

LO3: testing of insulation resistance of cables using proper instruments

LO4: surface mount and tools used

THEORY COMPONENT

UNIT-I	4 Hrs

Introduction to soldering: Prepare terminations of cable ends, Practice on skinning, Twisting and crimping, Identify various types of cables, Measurement of conductor size using SWG and micrometer, Soldering lead, Soldering rod.

UNIT-II	4 Hrs

Types of Joints / lugs: Simple twist, Married, Tee and western union joints, Britannia straight, Britannia Tee and rat tail joints, Soldering of joints/lugs.

UNIT-III	4 Hrs

Testing of insulation resistance of cables: Identify various parts, Skinning and dressing of cables, Straight joint of different types of cables, Testing of insulation resistance of various cables using Megger, Testing of various cables for faults.

UNIT-IV	4 Hrs

Introduction to Surface mount and its types: Introduction to surface mount, Specifications / applicable documents, Surface mount terms and definitions, Tools and material selection and maintenance, Procedures in making a good solder joint, Soldering technology – Surface mount.

LABORATORY COMPONENT

List of Experiments

1. Demonstration of the tools used in joints & soldering.
2. Make simple straight twist and rat-tail joints in single strand conductors.
3. Make married and 'T' (Tee) joint in stranded conductors.
4. Prepare a Britannia straight and 'T' (Tee) joint in bare conductors.
5. Prepare western union joint in bare conductor.
6. Solder the c conductor joints with precaution.
7. Prepare termination of cable lugs by using crimping tool.
8. Make straight joint in different types of underground cables.
9. Measure insulation resistance of underground cable.
10. Prepare one application used in the institute (Stand).

Textbook(s):

1. P.K Tripathi, *Manufacture of Electrical Cables, Wire and Wire Products*, NIIR Project Consultancy Services, 2nd edition, 2023, New Delhi.

Reference Book(S):

1. Adam Evan, *Soldering Guide: Guide that will help you to master soldering basics of electrical wires especially for a starter,* Amazon Asia-Pacific Holdings Private Limited, 2nd edition, 2021, USA
2. American Wire Steel & Co, *Catalogue and Handbook of Electrical Wires and Cables*, Legare Street Press, 2022, USA.

Web and Video link(s):

http://acl.digimat.in/nptel/courses/video/108108031/L37.html; *NPTEL Video Lecture on An Introduction to Electronics Systems Packing by Prof. G. V. Mahesh, Professor of Electronic Systems Engineering, Indian Institute of Science, Bengaluru.*

Laboratory Manual (for laboratory component):

1. *Fundamentals of Electrical Wire Joints and Soldering Lab Manual and Record Book (LMRB),* Department of EEE, KITSW

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: select the tools suitable for soldering

CO2: suggest cables for joints/lugs in domestic & commercial applications

CO3: measure/calculate insulation resistance using megger

CO4: suggest suitable procedures of soldering technology for surface mount

(based on psychomotor skills acquired from laboratory component)

CO5: demonstrate straight twist and rat-tail joints of single strand conductors

CO6: perform Britannia straight and 'T' (Tee) joint of different conductors

CO7: prepare & solder the western union joint of bare & finished copper conductors

CO8: demonstrate the use of the crimping tool for cable joints

Course Articulation Matrix (CAM):		**U24EE213X FUNDAMENTALS OF ELECTRICAL WIRE JOINTS AND SOLDERING**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE213X.1**	2	1	-	-	-	-	1	-	1	**-**	**1**	2	1
CO2	**U24EE213X.2**	2	2	-	-	-	-	1	-	1	**-**	**1**	2	1
CO3	**U24EE213X.3**	3	3	1	1	1	1	1	-	1	**-**	**1**	2	1
CO4	**U24EE213X.4**	3	3	1	1	1	1	1	-	1	**-**	**1**	2	1
CO5	**U24EE213X.5**	2	1	-	-	-	-	1	-	1	**-**	**1**	2	1
CO6	**U24EE213X.6**	2	2	-	-	-	-	1	-	1	**-**	**1**	2	1
CO7	**U24EE213X.7**	3	3	1	1	1	1	1	-	1	**-**	**1**	2	1
CO8	**U24EE213X.8**	3	3	1	1	1	1	1	-	1	**-**	**1**	2	1
U24EE213		**2.5**	**2.25**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

LIGHTING INSTALLATION

Class: B.Tech. II -Semester		**Branch:** EEE	
Course Code:	**U24EE214X**	**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: electrical lighting and lighting sources

LO2: residential lighting design and electrical wiring

LO3: installation and troubleshooting techniques for residential lighting

LO4: methods of commercial lighting design and planning

THEORY COMPONENT

UNIT-I	**4 Hrs**

Basics of lighting: Introduction to lighting, History and evolution of lighting, Basic lighting terminology (lumen, watt, lux, colour temperature), Light sources and luminaries, Types of light sources: Halogen Lamp, Mercury vapour lamp, Sodium vapour lamp etc.

UNIT-II	**4 Hrs**

Residential lighting design and electrical wiring: Lighting design principles, Residential lighting design, Room-wise lighting requirements, Electrical planning for residential lighting, Electrical wiring diagrams and symbols, Load calculations and distribution.

UNIT-III	**4 Hrs**

Installation Troubleshooting of Residential Lighting: Installation of light fixtures for ceiling, Walls & floor lamps, etc., Testing of switches, Fuse, MCB, Switch board, Installed lighting systems, Troubleshooting common issues.

UNIT-IV	**4 Hrs**

Commercial Lighting Design and Planning: Lighting design for commercial spaces, Principles of commercial lighting design, Requirements for different commercial areas - offices, Retail, Hospital & flood lighting, Energy efficiency and sustainability in lighting, Commercial electrical load calculations, Smart lighting systems and controls

LABORATORY COMPONENT

List of Experiments

1. Installation and wiring of incandescent, fluorescent, and LED lighting fixtures.
2. Measurement of illumination levels using a light meter.
3. Analysis of light distribution and uniformity in lighting setups.
4. Installation of dimmer switches for light intensity control.
5. Evaluation of the performance of Halogen/CFL/LED lamps.
6. Design of lighting system for given residential and commercial areas.
7. Measurement of power consumption and efficiency of various lighting systems.
8. Troubleshooting common issues in lighting systems (e.g., flickering, dimming)
9. Installation and testing of emergency lighting systems and exit signs.
10. Evaluation of energy efficiency and cost-effectiveness of various lighting sources.

Textbook(s):

1. M. A. Chaudhari, *Illumination and Electrification of Buildings,* Nirali Prakashan, 1st edition, 2019, New Delhi.

Reference Book(S):

1. Mark Karlen, Christina Spangler, James R. Benya, *Lighting Design Basics*, Wiley, 3rd edition, 2017, USA.
2. Henry Charles Horstmann, *Modern Illumination, Theory and Practice: A Handbook of Practical Information for the Users of Electric Light, Architects, Contractors,* Legare Street Press, 2nd edition, 2022, USA.
3. Victor Hugo Tousley, *Modern Illumination, Theory and Practice: A Handbook of Practical Information for the Users of Electric Light, Architects, Contractors and Electricians*, Legare Street

Press, 3rd edition, 2022, USA.

Web and Video link(s):

https://vorlane.com/how-to-install-commercial-lighting-fixtures/ by Steven Y. Liang, Associate professor in the Department of Radiology and Imaging Sciences, GWW School of Mechanical Engineering, Atlanta.

Laboratory Manual (for laboratory component):

1. *Electrical Illumination and Testing Lab Manual and Record Book (LMRB),* Department of EEE, KITSW

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: identify a suitable lighting source based on its features

CO2: calculate number of lamps, power and energy of a given residential system

CO3: design and troubleshoot the lighting system of the given residential area

CO4: calculate number of lamps, power and energy of a given commercial system

(based on psychomotor skills acquired from laboratory component)

CO5: calculate the lumens level of lighting sources

CO6: control the light intensity of lighting sources using a dimmer switch

CO7: design a suitable lighting system for a given residential/commercial area

CO8: suggest an efficient lighting system and troubleshoot the lighting issues

Course Articulation Matrix (CAM):		**U24EE214X LIGHTING INSTALLATION (RESIDENTIAL, COMMERCIAL)**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE214X.1**	2	1	-	-	-	-	1	-	1	-	1	2	1
CO2	**U24EE214X.2**	2	2	-	-	-	-	1	-	1	-	1	2	1
CO3	**U24EE214X.3**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO4	**U24EE214X.4**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO5	**U24EE214X.5**	2	1	-	-	-	-	1	-	1	-	1	2	1
CO6	**U24EE214X.6**	2	2	-	-	-	-	1	-	1	-	1	2	1
CO7	**U24EE214X.7**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO8	**U24EE214X.8**	3	3	1	1	1	1	1	-	1	-	1	2	1
U24EE214		**2.5**	**2.25**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

SECOND YEAR -SYLLABI

III SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH301G	Applied Mathematics	2	1	-	6	9	3
2	PCC	U24EE302	Network Analysis	2	1	2	5	10	4
3	PCC	U24CI311	Digital Electronics & Operational Amplifiers	2	1	2	5	10	4
4	PCC	U24EE304	DC Machines & Transformers	2	1	-	4	7	3
5	ESC	U24EE305	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 (PSD) Lab - 2	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
			Total:	12	5	8	36	61	24
Summer/ Inter-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

Branch Specific Mathematics (Pool-4)		
S. No.	**Course Code**	**Course Title**
1.	U24MH301A	Numerical and Statistical Methods ***(for Civil Engineering)***
2.	U24MH301B	Applied Mathematics ***(for Mechanical Engineering)***
3.	U24MH301G	Applied Mathematics ***(for EEE)***
4.	U24MH301D	Discrete Mathematics and Probability Statistics ***(Common to CSE, CSN, CSO & IT)***
5.	U24MH301E	Essential Mathematics and Statistics for Machine learning ***(for CSM)***
6.	U24MH301F	Essential Mathematics and Statistics for Data science ***(for CSD)***

APPLIED MATHEMATICS (*for Electrical & Electronics Engineering*)			
Class: B.Tech. III -Semester		**Branch: Electrical & Electronics Engineering**	
Course Code:	**U24MH301G**	**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: Fourier series
LO3: complex integration
LO4: statistical methods and theoretical probability distributions

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); Initial value and final value theorems; 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

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**

Fourier Series: Periodic functions, Orthogonal and orthonormal functions and systems of orthogonal functions, Representation of a function as trigonometric Fourier series (FS) in a range of length 2π, Euler formulae, Conditions for the existence of Fourier series (Dirichlet's conditions), FS for typical wave forms - Square wave, Pulse train, Impulse train(comb function), Periodic rectangular wave, Triangle, Saw-tooth, Half-wave rectified signal, Full-wave rectified signal; Plotting FS coefficients - Line spectrum (magnitude and phase spectra); Effects of symmetry of function on FS coefficients, Exponential FS ,Fourier series of , and combination of Sinusoids, Fourier series on an arbitrary period; Half range series – Half range cosine and sine series expansions

Self-Learning Topics (SLTs): *Additional problems on Change of interval [Text: topic 10.5, Solved problem: 10.8,10.9,10.10], Additional problems* on *half range cosine and sine series expansions in the interval (0, l) [Text: topic 10.7, Solved problem: 10.16,10.17,10.19,10.20].*

UNIT-III	**9 Hrs**

mplex 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, 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

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-IV	**9 Hrs**

Statistical Methods: Measures of central tendency-Mean, Median, Mode, Measures of dispersion-Standard deviation and Variance, correlation coefficient, rank correlation, regression – Linear regression equations

Probability and Distributions: Review of the concepts of probability, conditional probability, Random variable, Discrete probability distribution and continuous probability distribution, Binomial distribution, Poisson distribution, mean and variance of distributions, and Normal distribution

Applications: fitting of Binomial distribution, Poisson distribution to the given real time data

Self-Learning Topics (SLTs): *Additional problems on Measures of central tendency [Text 1: topic 25.5, Solved problems: 25.2, Practice problems: exercise 25.1 (3)], Additional problems on Binomial distribution[Text 1: topic 26.14, Solved problems: 26.40, Practice problems: exercise 26.5 (15)], Additional problems on Poisson distribution [Text 1: topic 26.15, Solved problems: 26.43, Practice problems: exercise 26.6 (12)]*

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 function as Fourier series

CO3: represent a given function in Taylor's and Laurent's series and evaluate integrals using integral theorems

CO4: interpret the data using various statistical measures and probability distributions

Textbook(s):

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

Reference Book(s):

1. SP Ghosh and AK Chakraborty., *Network Analysis and Synthesis*, McGraw HILL. Publication 2nd edition, 2014
2. Alan V. Oppenheim, Alan S. Willsky, Syed Hamid Nawab, *Signals & Systems,* 2nd ed., NJ, USA: Prentice-Hall International Inc., (signal processing series), 1997
3. Churchill R.V., *Complex Variable and its Applications*, 9th ed., New York, USA: McGraw Hill, 2013.
4. Kreyszig E, *Advanced Engineering Mathematics*, 10th ed., U.K: John Wiely & Sons, 2020
5. S.P. Gupta, *Statistical Methods*, 46th ed., New Delhi: Sultan Chand & Sons, 2023.

Web and Video link(s):

1. *https://archive.nptel.ac.in/courses/111/106/111106139/ : NPTEL Video Lecture on Laplace transform/ PROF. INDRAVA ROY/ Institute of Mathematical Sciences Chennai.*
2. https://youtu.be/HoGNkZclxDU?si=K9DFQ4jVL1OQiArb : *NPTEL Video Lecture on Fourier Series and its Convergence/Dr.S.K.Gupta /IIT Roorkee*
3. https://onlinecourses.nptel.ac.in/noc25_ma33/preview?user_email=dsreddy.hari@gmail.com: *NPTEL Video Lecture on Introduction to Probability Theory and Statistics by Prof. S Dharmaraja, IIT Delhi*

Course Articulation Matrix (CAM):		**U24MH301G: APPLIED MATHEMATICS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24MH301G.1**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO2	**U24MH301G.2**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO3	**U24MH301G.3**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO4	**U24MH301G.4**	2	2	1	1	-	-	-	1	1	-	1	2	1
U24MH301B		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

NETWORK ANALYSIS

Class: B.Tech. III -Semester		**Branch:** EEE	
Course Code:	**U24EE302**	**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 theorems and coupled circuits
LO2: time response analysis of networks
LO3: two port networks and their interconnections
LO4: network functions and synthesis

THEORY COMPONENT

UNIT-I — **9 Hrs**

Network Theorems: Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Tellegen's theorem, Superposition theorem, Reciprocity theorem, Compensation theorem and Substitution theorem.

Coupled Circuits: Introduction, Mutual inductance, Direction of self and mutual Induced EMF, Dot convention for coupled coils, Coupled coils in series, Coupled coil in parallel, Transformer as a coupled circuit.

Self-Learning Topics (SLTs): *Mesh & Nodal analysis (Text1: Chapter2-Topic 2.5, Problems: 2.41, 2.51), Solved problems (Text1: Prob 2.42,2.43, 2.52, 2.53), Practice problems (Text1: Prob 6,7,8,9).*

UNIT-II — **9 Hrs**

Time response analysis of networks: Transient analysis of R-L, R-C, R-L-C series and parallel networks with Step, Impulse, Sinusoidal and Pulse excitation-Initial conditions-Special signal waveforms-Ramp, Triangular, Train of pulses, Delayed input.

Self-Learning Topics (SLTs): *(Text1: Chapter8- Topic 8.2, ; Example 8.3,8.4, Chapter9-Topic 9.2,9.3,9.4,9.5) Solved problems (Text1: Prob 8.8,8.9), Practice problems (Text1: Prob 7,8,9)*

UNIT-III — **9 Hrs**

Two port networks: Characterizations of linear time invariant two port networks - Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Inverse-transmission parameters, Hybrid parameters, Inverse-hybrid parameters, Symmetry and reciprocity conditions in terms of two-Port parameters.

Interconnections of two-port networks: Ladder network, Bridged-T, parallel-T and lattice-T networks, Terminated two-Port networks.

Self-Learning Topics (SLTs): *Solved problems (Text1: Prob 13.28,13.29,13.32,13.35), Practice problems (Text1: Prob 1,9,10)*

UNIT-IV — **9 Hrs**

Network Functions: Network functions for 1-port and 2-port networks and their relationships Ladder Networks - General Networks - Poles and Zeros of Network functions - Restrictions on poles and zeros of driving point impedances.

Network Synthesis: Positive real function properties - Hurwitz Polynomials - Even and odd functions - Test for positive Real functions - Elementary synthesis operation - Properties and Foster and Cauer forms of RL, RC and LC networks.

Self-Learning Topics (SLTs): *Solved problems (Text1: Prob 21.16, Prob 21.17, Prob 21.18)*

LABORATORY COMPONENT

List of Experiments

1. Verification of superposition theorem
2. Verification of Thevenin's theorem
3. Verification of maximum power transfer theorem
4. Verification of reciprocity theorem
5. Determination of Z-parameters of two-port network

6. Determination of Y-parameters of two-port network
7. Determination of ABCD parameters of two-port network
8. Determination of hybrid parameters of two-port network
9. Determination of loop currents of the given circuit using MATLAB software
10. Determination of nodal voltages of the given circuit using MATLAB software
11. Time response analysis of electrical network using MATLAB software
12. Determination of self, mutual inductance and coefficient of coupling of coupled coils.

Textbook(s):

1. A. Chakrabarti, "*Circuit Theory Analysis and Synthesis*", Dhanpat Rai & Co, 7th ed.,, 2017.

Reference Book(s):

1. M.E. Van Valken Burg, "*Network Analysis*", Pearson Education 3rd ed., , 2006
2. W.H. Hayt and Jr. Kemmerly, "*Engineering Circuit Analysis*", McGraw-Hill Higher Education, 7th ed., 2006
3. D. Roy Choudhary, "*Network analysis and Synthesis*", New age Publishers, 1st ed., , 2006
4. K. A. Gangadhar, "*Circuit Theory*", Khanna Publishers, 2nd, ed., , 2006
5. Parker Smith, "*Problems in Electrical Engineering*", CBS Publishers, 1st ed., , 2010
6. A. Sudhakar, Shyammohan S. Palli – "*Circuits and networks*" McGraw-Hill Education, 2015, Fifth edition.

Web and Video link(s):

https://nptel.ac.in/courses/108/105/108105159/; *NPTEL Video Lecture on Network Analysis by Prof. Tapas Kumar Bhattacharya, Professor of EED, IIT Kharagpur.*

Laboratory Manual (for laboratory component):

1. *Networks & Simulation Laboratory Manual,* Department of EEE, KITSW.

Course Learning Outcomes (COs):

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

CO1: analyse electrical circuits using appropriate network theorems
CO2: determine transient & steady state response of RLC circuits with step, sinusoidal & other special signals
CO3: determine the parameters of a two-port network and draw its equivalent circuit.
CO4: analyse network functions and synthesize RL, RC, and LC networks using Foster and Cauer forms.
(based on psychomotor skills acquired from laboratory component)
CO5: validate network theorems and evaluate the coefficient of coupling in coupled coils.
CO6: determine network parameters for a given two port network
CO7: validate mesh and nodal analysis using MATLAB
CO8: determine the transient response of electrical network using MATLAB

Course Articulation Matrix (CAM):		**U24EE302 NETWORK ANALYSIS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE302.1**	2	2	1	1	1	-	-	1	1	-	1	2	1
CO2	**U24EE302.2**	2	2	2	1	1	-	-	1	1	1	1	2	1
CO3	**U24EE302.3**	2	2	1	1	1	-	-	1	1	1	1	2	1
CO4	**U24EE302.4**	2	2	1	1	1	-	-	1	1	-	1	2	1
CO5	**U24EE302.5**	3	3	2	1	-	-	1	3	2	2	1	2	1
CO6	**U24EE302.6**	3	3	2	1	-	-	1	3	2	2	1	2	1
CO7	**U24EE302.7**	3	3	3	1	2	-	1	3	2	2	2	2	1
CO8	**U24EE302.8**	3	3	3	1	2	-	1	3	2	2	2	2	1
U24EE302		2.5	2.5	1.88	1	1.33		1	2	1.5	1.67	1.25	2	1

DC MACHINES AND TRANSFORMERS

Class: B.Tech. III -Semester		**Branch:** EEE	
Course Code:	**U24EE304**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-4-7**	**CIE Marks:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE Marks :**	**40 %**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: *basic principles of magnetic circuits, electromechanical energy conversion and construction of electrical machines*
LO2: *principle, effects of armature reaction, commutation, characteristics and applications of d.c. generators*
LO3: *principle, characteristics, starting, speed control, testing and applications of d.c. motors*
LO4: *principle, construction, testing and applications of 1- Φ and 3-Φ transformers*

THEORY COMPONENT

UNIT-I	**9 Hrs**

Magnetic Circuits: Series and Parallel Magnetic Circuits Core with air gap B-H relationship (Magnetization Characteristics), Hysteresis with dc and ac excitation Hysteresis Loss and Eddy Current Loss, Faraday's Law of Electromagnetic Induction, Statically and Dynamically Induced EMF, Force on Current Carrying Conductor

Basic concepts of Rotating Electrical machines: Basic constructional features of rotating electrical machines. Principle of operation, Armature windings, Simplex and Multiplex lap and wave windings (Elementary Treatment). Types of dc generators, Emf equation

Self-Learning Topics (SLTs): *Principles of Electromechanical Energy Conversion, Singly and Doubly excited systems Solved problems (Text1: Section 2.2 a) Electric energy input b) Magnetic field energy stored c) Mechanical work done, Example 2.1, Example 2.2) Practice problems (Text1: Section 2.4, Example 2.13).*

UNIT-II	**9 Hrs**

DC Generators: Armature reaction & Commutation: Demagnetizing and cross magnetizing Ampere Turns, Interpoles, Compensating windings. Commutation, Reactance voltage, Methods of improving commutation

Characteristics of dc Generators: Methods of excitation, Separately and Self excited generators. Voltage build-up process in shunt generators, Critical field resistance and Critical speed. Characteristics & Applications of Shunt, Series & compound generators

Self-Learning Topics (SLTs):*,Critical field resistance and critical speed calculations for series and compound generators (Text1: Section 4.11.2, Example 4.19)*

UNIT-III	**9 Hrs**

D.C. Motors: Principle of operation, Back emf, Torque Equation, Classification of dc motors. Starters, Operating Characteristics and Speed Control of dc motors

Testing of dc Machines: Losses and Efficiency, Brake Test, Swinburne's Test, Hopkinson's Test, Field's Test, Applications of dc motors

Self-Learning Topics (SLTs): *Braking of dc motors: Solved problems (Text1: Sections 4.14, 4.14.1, 4.14.2, 4.14.3 Example 4.40, Example 4.41, Example 4.42, 4.46)*

UNIT-IV	**9 Hrs**

Transformers: Single Phase Transformers: Constructional features, principle of operation, Emf equation, and operation on no load and on load, Phasor diagrams. Equivalent circuit, determination of equivalent circuit parameters. Voltage Regulation. Determination of losses and efficiency by Open Circuit (OC), Short Circuit (SC) tests. Parallel operation, Load sharing

Auto Transformer: Principle of working, saving of copper as compared to two winding Transformer and applications

Three Phase Transformers: Types of connections, Relation between line and phase voltages and currents, Use of Tertiary winding, off load and on load tap changing of transformers

Self-Learning Topics (SLTs): *Sumpner's test, Scott connection of transformers, Separation of Core losses, All day efficiency. Three winding Transformer, induction Regulator. Solved problems (Text1: Sections 1.11, 1.13 Example 1.36 Example 1.49, Text1: Section 1.14 Example 1.55, Example 1.56 Text1: Section 1.15)*

Text Books:

1. Bimbhra P.S., *Electric Machinery,* Khanna Publisher, 7th ed, 2014

Reference Books:

1. Bimbhra P.S., *Generalized Machine Theory*, Khanna Publisher, 5th ed, 2014
2. Chakrabarthy, *Electric Machines*, McGraw Hill, Publications, 2015
2. A.E. Fitzgerald, Kingsly, Stephen., *Electric Machinery*, Tata McGraw Hill, 2015
3. Stephen J.Chapman *Electric Machinery Fundamentals*, Tata McGraw Hill, 4th ed, 2015
4. Nagrath and Kotari, *Electrical Machines* Tata McGraw Hill, 4th ed, 2004.

Web and Video link(s):

1. *NPTEL :: Electrical Engineering - NOC:Electrical Machines - I*
2. *NPTEL :: Electrical Engineering - Electrical Machines I*

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: apply the principles of electromechanical energy conversion to determine the force, torque, core losses and emf produced in singly excited and doubly excited systems and apply the concepts of constructional features to determine the induced emf in DC generators

CO2: design the compensating winding to minimize the demagnetization and cross magnetization effect of armature reaction for improved commutation in DC machines and analyse the characteristics of DC machines & determine the critical field resistance and critical speed for self-excitation

CO3: evaluate DC motor starting methods & speed control techniques for a given application and analyse the DC motor performance from various testing methods

CO4: analyse the performance of 1-phase transformer from various testing methods; compare the performance of auto transformer and select 3-phase transformer for a given application

Course Articulation Matrix (CAM):		**U24EE304 DC MACHINES & TRANSFORMERS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE304.1**	3	3	3	1	1	1	-	-	-	1	1	3	2
CO2	**U24EE304.2**	3	3	3	1	1	1	-	-	-	1	1	3	2
CO3	**U24EE304.3**	3	3	3	1	1	1	-	-	-	1	1	3	2
CO4	**U24EE304.4**	3	3	3	1	1	1	-	-	-	1	1	3	2
U24EE304		**3**	**3**	**3**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**3**	**2**

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Class: B.Tech. III –Semester		**Branch:** Common to All	
Course Code:	**U24EE305**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60(%)**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40(%)**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: programming paradigms and java programming constructs

LO2: classes, methods and strings

LO3: inheritance, dynamic method dispatch, interfaces and packages

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

THEORY COMPONENT

UNIT-I	**9 Hrs**

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

Java Basics: The History and evolution of Java, An overview of java, Data types, Variables and arrays, Operators, Control statements

Introducing Classes: Class fundamentals, Declaring Objects, Object reference variables, Introducing Methods

Self Learning Topics (SLTs): *Lexical Issues like Keywords, identifiers, Literals and comments (TextBook-Chapter 2), Type conversions and casting (TextBook-Chapter 3)*

UNIT-II	**9 Hrs**

Classes and Methods: Overloading methods, *this* keyword, Passing and returning objects, Recursion, Variable length arguments, Constructors, Overloading constructors, Garbage collection, Static variables, Static blocks, Static methods, Nested and inner classes, Command line arguments, Wrapper classes

Strings: Exploring String, StringBuffer, StringBuilder and StringTokenizer classes

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

UNIT-III	**9 Hrs**

Inheritance: Inheritance basics, Types of inheritance, Using *super*, Method overriding, Order of constructors Execution, Dynamic method dispatch, Abstract classes, *final* with inheritance, Object class

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

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

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

UNIT-IV	**9 Hrs**

Using I/O: I/O basics, Reading, Writing and copying files using byte and character streams

Exception Handling: Fundamentals, Exception types, Uncaught exceptions, Using *try* and *catch*, Multiple catch clauses, Nested try statements, *throw*, *throws*, *finally, Creating your own exception sub classes.*

Multithreading: Creating a thread, Creating multiple threads, Thread priorities, Synchronization, Interthread communication

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

LABORATORY COMPONENT

List of Experiments

Experiment-I:

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

Experiment-II:

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

Experiment-III:

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

Experiment-IV:

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

Experiment-V:

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

Experiment-VI:

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

Experiment-VII:

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

Experiment-VIII:

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

Experiment-IX:

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

Experiment-X:

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

Experiment-XI:

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

Experiment-XII:

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

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Laboratory Manual (for laboratory component):

1. *Object Oriented Programming through java Manual and Record Book,* Department of CSE, KITSW.

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: analyze the strengths and limitations of various programming paradigms to determine their suitability for solving various programming problems in java

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

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

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

(based on psychomotor skills acquired from laboratory component)

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

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

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

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

Course Articulation Matrix (CAM):		**U24CS305: OBJECT ORIENTED PROGRAMMING THROUGH JAVA**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CS305.1**	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	**U24CS305.2**	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	**U24CS305.3**	2	2	3	2	1	-	-	-	-	-	1	2	2
CO4	**U24CS305.4**	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	**U24CS305.5**	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	**U24CS305.6**	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	**U24CS305.7**	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	**U24CS305.8**	1	2	3	2	2	-	-	1	1	-	1	2	2
U24CS305		**1.5**	**1.87**	**2.37**	**1.71**	**1.62**	**-**	**-**	**1**	**1**	**-**	**1**	**1.5**	**1.5**

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):

2. **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)*
3. **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):

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

Course Articulation Matrix (CAM):		**U24VA306A QUANTITATIVE APTITUDE AND 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	**U24VA306A .1**	1	2	-	1	-	-	-	-	-	-	1	1	-
CO2	**U24VA306A.2**	1	2	-	1	-	-	-	-	-	-	1	1	-
CO3	**U24VA306A.3**	-	1	-	2	-	2	-	-	-	-	1	1	-
CO4	**U24VA306A.4**	-	1	-	2	-	2	-	-	-	-	1	1	-
U24VA306A		**1**	**1.5**	**-**	**1.5**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

DIGITAL ELECTRONICS AND OPERATIONAL AMPLIFIERS

Class: B.Tech. III -Semester		**Branch:** EEE	
Course Code:	**U24CI311**	**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: number systems, binary codes, Boolean algebra and minimisation techniques

LO2: design of combinational and sequential circuits

LO3: principles, characteristics of operational amplifiers, linear and non-linear applications of operational amplifiers

LO4: IC 555 timer and data converters

THEORY COMPONENT

UNIT-I — **9 Hrs**

Number systems and Codes: Review of number systems, binary arithmetic, binary weighted and non-weighted codes

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

Self-Learning Topics (SLTs): *Signed number representation (Text1: topic 1.5), 1's and 2's complement subtraction, BCD and XS-3 arithmetic (Text1: topic 1.6, 1.7)*

UNIT-II — **9 Hrs**

Combinational circuits: Design of combinational circuits using logic gates – half adder, full adder, half subtractor, full subtractor, BCD adder, decoders, encoders, multiplexers, demultiplexers, realization of switching functions using multiplexers and decoders

Sequential circuits: Flip flops – SR, JK, D and T flip flops, master slave flip flop, binary counters – design of synchronous and asynchronous counters, shift registers – modes of operation, ring counter and Johnson counter

Self-Learning Topics (SLTs): *Code converters (Text1: topic 4.4), 1's and 2's complement adder/subtractor (Text1: topics 4.5), Parity generators (Text1: topics 4.5), problems (Text1: Prob 4.10, 4.12, 4.16, 4.34, 4.35)*

UNIT-III — **9 Hrs**

Operational Amplifier (Op-Amp): Building blocks of Op-Amp, analysis of basic inverting & non-inverting amplifier configurations, DC & AC characteristics of Op-Amp

Linear Applications of Op-Amp: Summing and difference amplifiers, integrator, differentiator, voltage to current converter, current to voltage converter, sample and hold circuit

Non-linear Applications Op-Amp: Precision rectifiers–half and full wave rectifiers, Log amplifier, Op-Amp comparators

Self-Learning Topics (SLTs): *Differential amplifiers -balanced & unbalanced (Text2: topics 2.1, 2.2, 2.6), Fabrication process of IC (Text2: Prob 2.4, Prob 2.5, Prob 2.7), Anti-log amplifier (Text2: topics 3.1, 3.2, 3.6), Solved problems (Text2: Prob 3.4, Prob 3.5, Prob 3.7)*

UNIT-IV — **9 Hrs**

IC 555 timer: Introduction, functional diagram, design of astable and monostable multivibrators using 555timer, application of astable multivibrator-FSK generator; application of monostable multivibrator-linear ramp generator

Data Converters: DAC types –Weighted resistor, R-2R ladder; ADC types - Flash, Successive approximation & Dual slope

Self-Learning Topics (SLTs): Self-Learning Topics (SLTs): *Applications of IC 555 Timer: Pulse-Position modulation, Missing pulse detector, Pulse-width modulation (Text2: topics 4.1, 4.2, 4.6), Solved problems (Text2: Prob 4.4, Prob 4.5, Prob 4.7)*

LABORATORY COMPONENT

List of Experiments

1. Implementation of Boolean Functions using Basic and Universal gates
2. Implementation and functional verification of adders and subtractors using logic gates
3. Implementation and Functional verification of BCD to Excess-3 and Binary to Gray code converter
4. Implementation of Boolean functions on 4x1 Multiplexer and 1x4 Demultiplexer
5. Implementation and functional verification of shift registers
6. Implementation and functional verification of Ring counter and Johnson counters
7. Measurement of static and dynamic parameters of Op-Amp IC 741
8. Design and testing of Adder and Subtractor circuits using IC 741
9. Design and testing of differentiator using Op-Amp IC 741
10. Design and testing of integrator using Op-Amp IC 741
11. Design and testing of log amplifier using Op-Amp IC 741
12. Design and testing of Astable multivibrator using IC 555

Textbook(s):

1. M. Morris Mano, *Digital Design*, 5th ed. New Delhi: PHI, 2013 (Chapters 1 to 7)

2. D. Roy Choudhury and Shail B Jain, *Linear Integrated Circuits*, New Age International, New Delhi, 4th ed., 2010.

Reference Book(s):

1.A. Anand Kumar, *Fundamentals of Digital Circuits*, PHI, 3rd ed., New Delhi, 2014

2.Zvi. Kohavi, *Switching and Finite Automata Theory*, Tata McGraw-Hill, New Delhi, 2nd ed., 2008

3.Ramakant Gayakwad, *Op-Amps and Linear Integrated Circuits*, Pearson Education, New Delhi, 4th ed., 2015.

4. George B. Clayton, *Linear Integrated Circuits and Applications*, The Macmillan Press Ltd., London, 1975.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc25_ee20/preview; *NPTEL Video Lecture on Digital Electronic Circuits by Prof. Goutam Saha, Dept. of Electronics and Electrical Communication Engineering at IIT Kharagpur*

https://onlinecourses.nptel.ac.in/noc23_ee65/preview; *NPTEL Video Lecture on Op-amp practical application: Design, Simulation and Implementation by Prof. Hardik J Pandya, Department of Electronic Systems Engineering, IISc Bangalore.*

Laboratory Manual (for laboratory component):

1. *Digital Electronics & Operational Amplifiers 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: simplify Boolean expressions and minimize SOP/POS forms of switching functions using Karnaugh Map & Tabulation methods

CO2: design combinational and sequential circuits such as adders, subtractors, code converters, encoders, decoders, multiplexers, demultiplexers, counters and shift registers

CO3: design Op-Amp based simple linear & non-linear circuits for the given specifications

CO4: design IC 555 timer based application circuits and choose suitable data converter for given design specifications

(based on psychomotor skills acquired from laboratory component)

CO5: design and test the functionality of combinational circuits

CO6: design and test the functionality of sequential circuits

CO7: determine AC & DC characteristics of operational amplifier

CO8: design application circuits using IC741 Op-Amp and test their functionality

Course Articulation Matrix (CAM):		U24CI311 DIGITAL ELECTRONICS & OPERATIONAL AMPLIFIERS												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CI311.1	2	2	1	1	1	-	1	1	1	1	1	1	1
CO2	U24CI311.2	2	2	1	1	1	-	1	1	1	1	1	1	1
CO3	U24CI311.3	2	2	1	1	1	-	1	1	1	1	1	1	1
CO4	U24CI311.4	2	2	1	1	1	-	1	1	1	1	1	1	1
CO5	U24CI311.5	2	2	1	1	1	1	1	2	2	2	1	1	1
CO6	U24CI311.6	2	2	1	1	1	1	1	2	2	2	1	1	1
CO7	U24CI311.7	2	2	1	1	1	1	1	2	2	2	1	1	1
CO8	U24CI311.8	2	2	1	1	1	1	1	2	2	2	1	1	1
U24CI311		**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1.5**	**1.5**	**1.5**	**1**	**1**	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

IV SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24EE401	Control Systems Engineering	2	1	2	5	10	4
2	PCC	U24EE402	AC Machines	2	1	2	5	10	4
3	PCC	U24EE403	Electromagnetic Fields	2	1	-	4	7	3
4	PCC	U24EE404	Power System Generation & Distribution	2	1	-	4	7	3
5	ESC	U24EE405	Python Programming	2	1	2	5	10	4
6	VAC	U24VA406B	Soft & Interpersonal Skills	-	-	2	2	4	1
7	SEC	U24SE407	Programming Skill Development(PSD) Lab -03	-	-	2	2	4	1
8	ELC	U24EL408	Practicum-4	-	-	-	4	4	1
9	VAC	U24VA409	SEA - 4 / SAA - 4	-	-	-	2	2	1
10	AEC	U24AE410	Expert Talk Series-4	-	-	-	1	1	1
11	VAC*	U24CY411*	Environmental Studies	2	-	-	3	5	-
			Total:	12	5	10	37	64	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

For Lateral Entry Students Only

Bridge Courses for exit:

Successful completion of two projects (6-Credits)during a 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 EEE)

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

Exit Option to Qualify UG Diploma in EEE: Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24EE412X	Working, Servicing, and Repair of Electrical Appliances	2	-	2	-	4	3
2	PCC	U24EE413X	Electrical Design, Drawing and Estimation	2	-	2	-	4	3
3	PCC	U24EE414X	Testing and maintenance of DC machines	2	-	2	-	4	3
4	PCC	U24EE415X	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 EEE: Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE412X	Electrical Estimation and Energy Auditing	-	-	6	-	6	3
2	SEC	U24SE413X	Programmable Logic Controller	-	-	6	-	6	3
3	SEC	U24SE414X	Electrical CAD (Computer-Aided Design)	-	-	6	-	6	3
4	SEC	U24SE415X	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 their respective department during the summer vacation after IV Semester.

CONTROL SYSTEMS ENGINEERING

Class: B.Tech. IV -Semester		**Branch:** EEE	
Course Code:	**U24EE401**	**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: transfer function representation of physical systems

LO2: assessing the system performance using time domain analysis and methods for improving it

LO3: assessing the system's stability and performance using frequency domain analysis

LO4: state space modelling of physical systems and the compensation techniques

THEORY COMPONENT

UNIT-I — 9 Hrs

Concepts of Control systems: Introduction, Classification of control systems, Open loop and closed loop control systems, Effects of feedback, Mathematical modelling – Linear differential equations- Translational and rotational mechanical systems, Analogous systems, Electro-mechanical systems, Electrical systems

Block diagram reduction technique, Signal flow graph method, Mason's Gain formula

Self-Learning Topics (SLTs): *Newton's laws of motion, Laplace Transforms, Solved problems (Text1: 2.3, 2.4, 2.10, 2.11, 3.2 and 3.5), Practice problems (Text1: Problems P2.4, P2.10, P3.6 and P3.7).*

UNIT-II — 9 Hrs

Control System Components: AC & DC Servomotors, Synchro's

Time Response Analysis: Introduction, Standard test signals – Type and order, Time response of first order systems, Classification of second order systems, Transient response of second order systems – Time domain specifications – Steady state response – Steady state errors and error constants, Controllers - P, I,D, PI, PD & PID

Self-Learning Topics (SLTs): *Inverse Laplace Transforms and Partial fractions (Text1: Chapter4- Topics 4.3, 4.4 & 4.5), Practice problems (Text1: Example 4.4, 4., 4.8 and 4.15)*

UNIT-III — 9 Hrs

Stability Analysis: Introduction, Routh-Hurwitz stability criteria – Qualitative stability and conditional stability, Root locus technique– Construction of root loci-Effects of adding poles and zeros to G(s)H(s) on the root loci

Frequency Response Analysis: Introduction, Frequency domain specifications -Correlation between frequency and time domain specifications- Bode plots- Transfer function from the bode plot- Phase margin and gain margin-Stability analysis from bode plots, Stability analysis through polar plots, Nyquist stability criteria, Determining the response of systems using MATLAB

Self-Learning Topics (SLTs): *Trigonometric basics, Polar to rectangle and rectangle to polar conversions: Solved problems (Text1: Problems: 7.2, 7.3, 7.7 and 7.10), Practice problems (Text1: Problems 7.4, 7.6)*

UNIT-IV — 9 Hrs

Control System Analysis using State Variable Method: Introduction- State variable representation conversion of state models to transfer functions- Conversion of transfer functions to state models deriving state models from physical systems, State transition matrix, Solution of state equations concepts of controllability and observability

Compensation: Introduction, Elementary treatment of lead, Lag and lead-lag compensation

Self-Learning Topics (SLTs): *Eigenvalues, Rank of Square matrix, Solved problems (Text1: Problems 10.35, 10.36, 10.37 and 10.39)*

LABORATORY COMPONENT

List of Experiments

1. Determination of time domain specifications of uncontrolled second order system
2. Effect of P, PI, PD, and PID Controllers on a system's performance
3. Study of characteristics of Synchro Transmitter-Receiver pair
4. Analysis of lag and lead compensation with reference to magnitude and phase plot
5. Determination of transfer function of a DC servo motor

6. Stability analysis through Root Locus plot of L.T.I. system using MATLAB
7. Stability analysis through Bode plot of L.T.I. system using MATLAB
8. Stability analysis through Nyquist criteria using MATLAB
9. Verification of Controllability & Observability of L.T.I system using MATLAB
10. Linear system analysis (Time domain analysis, Error analysis) using MATLAB
11. Study of characteristics of AC servomotor
12. Mathematical modelling of DC motor and its experimental validation

Textbook(s):

1. A. Anand Kumar, *Control Systems*, 2nd ed., New Delhi: Prentice Hall of India, 2014

Reference Book(s):

1. I.J.Nagrath& M. Gopal, *Control Systems Engineering*, 4th ed., New Delhi: New Age International
2. S. Palani, *Control Systems Engineering*, 2nd ed., New Delhi: Tata McGraw Hill Education (India) Pvt. Ltd., 2010
3. K. Ogata, *Modern Control Engineering*, 5th ed., New Delhi: Prentice Hall of India, 2010.
4. Benjamin C. Kuo, *Automatic Control Systems*, 7th ed., New Delhi: Prentice Hall of India, 1995

Web and Video link(s):

https://nptel.ac.in/courses/108106098//; *NPTEL Video Lecture on Control Engineering by Prof. Ramkrishna Pasumarthy, Professor of EED, IIT Madras.*

Laboratory Manual (for laboratory component):

1. *Control Systems Engineering Laboratory Manual,* Department of EEE, KITSW.

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: determine transfer function of dynamical systems using block diagram and signal flow graph methods

CO2: determine the time-domain specifications of first & second-order systems and compare the performance of P, PI, PD and PID controllers

CO3: assess system stability in both time and frequency domains

CO4: formulate the state-space model of a given physical system and explore the fundamental concepts of compensators

(based on psychomotor skills acquired from laboratory component)

CO5: analyze the time response specifications of uncontrolled and controlled second order systems & plot the characteristics of synchros

CO6: determine the transfer function of lag-lead compensators and DC and AC servo motor & visualize their characteristics

CO7: analyze the stability of LTI systems using MATLAB

CO8: determine controllability & observability of a given LTI system using MATLAB

Course Articulation Matrix (CAM):		**U24EE401 CONTROL SYSTEMS ENGINEERING**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE401.1**	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	**U24EE401.2**	2	2	-	1	-	-	-	-	-	-	1	2	1
CO3	**U24EE401.3**	2	2	-	1	1	-	-	1	-	-	1	2	1
CO4	**U24EE401.4**	2	2	-	1	-	-	-	1	-	-	1	2	1
CO5	**U24EE401.5**	2	-	-	-	-	-	-	2	2	-	1	2	-
CO6	**U24EE401.6**	2	-	-	-	-	-	-	2	2	-	1	2	-
CO7	**U24EE401.7**	2	1	-	-	2	-	-	2	2	-	1	1	-
CO8	**U24EE401.8**	2	1	-	-	2	-	-	2	2	-	1	1	-
U24EE401		2	1.67	-	1	1.67	-	-	1.67	2	-	1	1.75	1.00
3 – HIGH, 2 – MEDIUM, 1 – LOW														

AC MACHINES

Class: B.Tech. IV -Semester		**Branch:** EEE	
Course Code:	**U24EE402**	**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: construction, working, performance characteristics, starting methods and speed control of 3 Induction Motors

LO2: construction, working principle, equivalent circuit and applications of 1-Φ Motors.

LO3: construction, working and performance characteristics 3-Φ Synchronous Generators

LO4: construction, working, performance and applications of 3-Φ Synchronous Motors

THEORY COMPONENT

UNIT-I	**9 Hrs**

3-Φ Induction Motors: Construction details, Types, Production of rotating magnetic field, Principle of operation, Equivalent circuit, Phasor diagram, Torque equation, Slip torque characteristics, effects & change in supply voltage and frequency on torque and speed, Losses and efficiency, Determination of equivalent circuit parameters by no load and blocked rotor tests

Methods of Starting & Speed Control: Direct online (DOL), Star- Delta (γ-Δ), Autotransformer, Rotor resistance starters, Pole changing, variable frequency variable voltage, Rotor resistance

Self-Learning Topics (SLTs): *Double cage induction motor, Rotor injected emf technique: Solved problems (Text2: chapter5, topic 5.6.2, topic 5.8, Example 5.19 ,5.22, 5.23)*

UNIT-II	**9 Hrs**

1-Phase Induction Motors: Principle &operation, Double field revolving theory, Methods of starting Split Phase Induction Motors (Resistor spilt phase, Capacitor start motor Capacitors start and run motor) Shaded pole motor Reluctance start motor, Equivalent circuit, Determination of equivalent circuit parameters by conducting no-load & blocked rotor tests

Universal Motor: Constructional features. Working principle, Characteristics and applications of universal motor

Self-Learning Topics (SLTs): *Single phase Synchronous Motors: Reluctance motor Hysteresis motor (Text2: chapter6,topics 6.3,6.4)*

UNIT-III	**9 Hrs**

3-Φ Synchronous Generators: Cylindrical rotor machines: Construction, Types, Winding factors, Production of emf, Harmonics, Armature reaction, Synchronous reactance, Phasor diagrams, Load characteristics OC & SC tests, Methods of predetermination of voltage regulation by synchronous impedance (EMF), MMF and Potier triangle (ZPF) methods

Salient pole machines: Two-reaction theory and phasor diagrams. Slip test. Power angle characteristics

Synchronization & synchronizing power, Parallel operation and load sharing, operation on infinite bus bar, applications

Self-Learning Topics (SLTs): *Operation on infinite bus(Text1: Section 5.12,example 5.14 ,5.15, 5.16, 5.17), Practice problems (Text2: example 7.4, 7.6)*

UNIT-IV	**9 Hrs**

3-Φ Synchronous Motors: Principle of operation, No load and Load operation, Phasor diagrams, Methods of starting of 3-Φ synchronous motors, Effect of Excitation and power factor control, Hunting and its applications

V and Inverted V Curves: Excitation circles and power circles, Power factor correction using 3-Φ synchronous motors, Synchronous condenser, Applications

Self-Learning Topics (SLTs): *Power Angle Characteristics of Salient Pole Machine (Text1: Section 5.11,Example 5.24)*

LABORATORY COMPONENT

List of Experiments

1. Plotting of characteristics of dc shunt generator by conducting no load and load tests.
2. Predetermine the efficiency of dc machine by Swinburne 's test.
3. Determination of performance characteristics of dc series motor by brake test.
4. Speed Control of dc Shunt motor.
5. Predetermine the efficiency of 1- Φ transformer by open circuit and short circuit tests.
6. Determination of voltage regulation and efficiency of 1- Φ transformer by conducting load test.
7. Determination of equivalent circuit parameters of a 3-Φ induction motor by No-load and Blocked rotor tests.
8. Predetermination of regulation of 3-Φ synchronous generator by E.M.F & M.M.F method.
9. Determination regulation of 3-Φ synchronous generator by Z.P.F. method.
10. Determination of V and inverted V curves of 3-Φ synchronous Motors
11. Determination of Xd and Xq of a Salient Pole 3-Φ synchronous machine from slip test.
12. Determination of equivalent circuit parameters of a 1-Φ induction motor by No-load and Blocked rotor tests.

Text Books:

1. Bimbhra P.S., *Electric Machinery*, Khanna Publisher, 7th ed, 2014

Reference Books:

1. Bimbhra P.S., *Generalized Machine Theory*, Khanna Publisher, 5th ed, 2014
2. Chakrabarthy, *Electric Machines*, McGraw Hill, Publications, 2015
3. A.E. Fitzgerald, Kingsly, Stephen., *Electric Machinery*, Tata McGraw Hill, 2015
4. Stephen J.Chapman *Electric Machinery Fundamentals*, Tata McGraw Hill, 4th ed, 2015
5. Nagrath and Kotari, Electrical Machines‖ Tata McGraw Hill, 4th ed, 2004.

Web and Video link(s):

1. *NPTEL :: Electrical Engineering - NOC:Electrical Machines - II*
2. *NPTEL :: Electrical Engineering - NOC:Electrical Machines - I*

Laboratory Manual (for laboratory component):

Course Learning Outcomes (COs):

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

CO1: compare Direct online (DOL), Star- Delta (γ-Δ), Autotransformer and Rotor resistance starting of 3-phase induction motor; Compare the speed control methods of 3-phase induction motors

CO2: choose the best motor for a given application by comparing the performance of various fractional kilowatt motors and evaluating the equivalent circuit parameters of a 1-Φ induction motor from the no-load and blocked rotor tests

CO3: evaluate the voltage regulation of 3-Φ Synchronous Generators through EMF, MMF and ZPF methods; analyse the phasor diagrams of salient pole and cylindrical rotor synchronous generators under different load conditions; evaluate the load shared among the parallel operated synchronous generators

CO4: compare the starting methods of 3-Φ Synchronous motors; analyse the excitation and power circles of synchronous motors and hence evaluate the operating points of 3-Φ Synchronous machines; design the rating of 3-Φ Synchronous motors for power factor correction

(based on psychomotor skills acquired from laboratory component)

CO5: evaluate the DC generators' critical field resistance, critical speed, efficiency, and Voltage regulation; regulate the DC motor's speed while maintaining constant torque and power.

CO6: compare the efficiency and voltage regulation of the one-phase transformer using both direct and indirect testing methods

CO7: analyse the induction motor(s)' equivalent circuit parameters using test data from blocked and no-load rotors

CO8: apply the EMF, MMF, and ZPF techniques to assess the voltage control of a three-phase synchronous generator. Use the V and Inverted-V characteristics to evaluate the synchronous motor's operating point

Course Articulation Matrix (CAM):		U24EE402 AC MACHINES												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24EE402.1	2	2	1	1	-	-	-	-	-	-	-	1	1
CO2	U24EE402.2	1	1	1	1	-	-	-	-	-	-	-	1	1
CO3	U24EE402.3	2	2	1	1	-	-	-	-	-	-	-	1	1
CO4	U24EE402.4	1	1	1	1	-	-	-	-	-	-	-	1	1
CO5	U24EE402.5	1.5	1.5	1	1	-	-	-	-	-	-	-	1	1
CO6	U24EE402.6	1	2	1	1	-	-	-	-	-	-	-	1	1
CO7	U24EE402.7	1	2	1	1	-	-	-	-	-	-	-	1	1
CO8	U24EE402.8	1	2	1	1	-	-	-	-	-	-	-	1	1
U24EE402		1.3	1.6	1	1	-	-	-	-	-	-	-	1	1
3 – HIGH, 2 – MEDIUM, 1 – LOW														

ELECTROMAGNETIC FIELDS

Class: B.Tech. IV -Semester		**Branch:** EEE	
Course Code:	**U24EE403**	**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 forces and fields for different configurations
LO2: fields in different materials and capacitance calculations
LO3: effect of magnetic field in electrical systems, magnetic potential and inductance
LO4: maxwell's equations and wave equation

UNIT-I	**9 Hrs**

Introduction: Cartesian, Cylindrical and Spherical Co-ordinate Systems, Field theory Vs. Circuit theory

Static Electric Fields: Coulomb's law, Electric field intensity, Field due to different charge configurations, Electric flux, Electric flux density, Gauss' law and its applications, Divergence theorem, Relation between D and E, Work done in moving a unit positive charge, Electric potential, Absolute potential, Potential difference between two points and its independence in path of integration, Relation between E and V

***Self-Learning Topics (SLTs)**: Equipotential surfaces (Text4: topic 2.06), Electrostatic energy (Text4: topic 2.10), Electrostatic discharge (Text2: topic 4.11)*

UNIT-II	**9 Hrs**

Dipoles: Potential and electric field at a point due to electric dipole, Torque on electric dipole when placed in electric field

Electric field in materials: Conductors in electrostatic fields, Polarization in dielectrics, Dielectric strength & constant, Dielectric loss, Boundary conditions between dielectrics

Boundary value problems: Laplace's and Poisson's equations

Capacitance: Capacitance of parallel plate, Cylindrical and spherical capacitors, Conduction and convection currents, Current density

***Self-Learning Topics (SLTs):** Materials with high dielectric constant (Text2: topic 5.10), Graphene (Text2: topic 5.11), Piezoelectrics (Text2: topic 5.12), RF MEMS (Text2: topic 6.8), Supercapacitors (Text2: topic 6.9)*

UNIT-III	**9 Hrs**

Static Magnetic fields: Concept of magnetic field, Biot- Savart's law, Ampere's circuit law and its applications, Magnetic flux and magnetic flux density, Magnetic field caused by different types of current configurations, Scalar and vector magnetic potentials, Calculation of vector magnetic potentials for simple cases, Vector Poisson's equation

Magnetic Forces: Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic dipole, Magnetization in material

***Self-Learning Topics (SLTs):** Polywells (Text2: topic 7.10), Magnetic Levitation (Text2: topic 8.12), SQUIDs (Text2: topic 8.13)*

UNIT-IV	**9 Hrs**

Inductance: Faraday's law, Lorentz force, Magnetomotive force, Reluctance, Displacement current, Self and mutual inductance of simple configurations

Maxwell's equations: Maxwell's equations for static electric fields and study magnetic fields, Maxwell's equations for time varying fields in point and integral form

Self-Learning Topics (SLTs): *Memresistor (Text2 topic 9.8), Optical Nanocircuits (Text2: topic 9.9), Wave equation – wave propagation in a good conductor and dielectrics (Text4: topic 2.10)*

Course Learning Outcomes (COs):

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

CO1: analyze and evaluate the electrostatic fields generated by various charge distributions by selecting and applying the most appropriate coordinate systems to derive precise solutions

CO2: evaluate the mechanisms of polarization in dielectric materials and derive the capacitance for varying charge configurations by applying fundamental electrostatic principles and assessing the influence of material properties

CO3: critically analyze the generation of static magnetic fields arising from diverse current distributions and evaluate the magnetization behavior in various magnetic materials, synthesizing theoretical principles with practical applications to predict their electromagnetic response

CO4: analyze and derive the inductance for various current configurations, correlating the results with the underlying electromagnetic principles, and critically interpret Maxwell's equations in the context of time-varying fields to evaluate their implications on wave propagation and energy dynamics

Textbook(s):

1. K. A. Gangadhar, *Field Theory*, 8th ed., New Delhi: Khanna Publishers, 2015

References Books:

1. W. H Hayt (Jr.), *Engineering Electromagnetics*, 8th ed., New Delhi: Tata McGraw Hill Education (India) Pvt. Ltd., 2014
2. Mathew. N. O. Sadiku, *Elements of Electromagnetics*, 7th ed., New Delhi: Oxford University press, 2018
3. David J. Griffiths, *Introduction to Electrodynamics*, 4th ed., New Delhi: Pearson Ind. Pvt. Ltd., 2013
4. Edward. C. Jordan & Keith. G. Balmain, *Electromagnetic waves and radiating systems*, 2nd ed., New Delhi: Prentice Hall of India, 1990

Web and Video link(s):

1. *https://archive.nptel.ac.in/courses/108/106/108106073/*
2. *https://youtu.be/FtEShPAFpek?si=LOjq1Bm38bx-6lGl*

Course Articulation Matrix (CAM)		**U24EE403: ELECTROMAGNETIC FIELDS (EMF)**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE403.1**	3	2	1	-	-	-	-	-	-	-	-	3	1
CO2	**U24EE403.2**	3	2	2	-	-	-	-	-	-	-	-	3	1
CO3	**U24EE403.3**	3	2	2	-	-	-	-	-	-	-	-	3	1
CO4	**U24EE403.4**	3	2	1	-	-	-	-	-	-	-	-	3	1
U24EE403		**3**	**2**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

POWER SYSTEM GENERATION AND DISTRIBUTION			
Class: B.Tech. IV -Semester		**Branch:** EEE	
Course Code:	**U24EE404**	**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: principles of conventional and renewable energy sources
LO2: economics of power generation and tariffs
LO3: underground cables and voltage distribution on insulators
LO4: distribution systems and corona

THEORY COMPONENT

UNIT-I	9 Hrs

Generation of Electric Power Conventional Sources: : The energy generation scenario in the global and Indian context, Hydroelectric Stations: – Types of hydroelectric plant – Principle of working– Layout of hydro power station: Steam power plant, Selection of site – Coal handling plant – Ash handling plant : Nuclear power plant: Types of reactors – Location of nuclear power plant

Renewable energy Sources: Introduction to renewable energy sources, Solar Energy, Wind Energy

Self-Learning Topics (SLTs): Steam turbine and generator, Gas Turbine *(Text1: Topics 1.5.1 &1.5.2,)*

UNIT-II	9 Hrs

Economics of Generation: Introduction, Definitions of connected load, Maximum demand, Demand factor, Load factor, Diversity factor, Load duration curve, Number and size of generator units, Base load and peak load plants, Cost of electrical energy-Fixed cost, Running cost & Tariff

Self-Learning Topics (SLTs): Running cost of energy, charge to consumer **(** *Text1: Chapter4- Topic 2.5.2, 2.6) ; Solved problems (Text1: Prob 2.1 2.2 , 2.3 and 2.4)*

UNIT-III	9 Hrs

Insulators: Types, Potential distribution over a string of suspension insulators, Factors affecting the distribution of voltage along the string insulators, Methods of equalizing potential string efficiency, Stringing charts

Transmission line sag calculation: The catenary curve, Sag tension calculations, Supports at different levels, Sag template

Under Ground cables: Electric stress in a cable, Grading of cables, Cable capacitance, Cable inductance, Dielectric loss and heating

Self-Learning Topics (SLTs): *Solved problems (Text2: Prob 3.2, 4.6, 4.7), Practice problems (Text2: Prob 3.20 3.21,3.22)*

UNIT-IV	9 Hrs

Distribution Lines: Distribution systems, DC two wire and three wire systems. Single phase and three phase 3-wire and 4-wire AC systems – Comparison of efficiency, Kelvin's law – Economic size of conductor

Corona: Introduction, Disruptive critical voltage, Corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona

Self-Learning Topics (SLTs): *Design of Rural Distribution* **(***Text2: Chapter10- Topic 10.12* **) ,** *Solved problems (Text2: Prob 10.1, 10.2)*

Course Learning Outcomes (COs):

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

CO1: analyze the operation of fossil fuel-based and renewable generating stations.
CO2: analyse different types of tariffs in power system
CO3: determine distribution of voltage along the string insulators
CO4 : compare AC & DC distribution systems and calculate corona loss in a transmission system

Textbook(s):

1. M.V. Deshpande, *Elements of Electrical Power Station Design*, Third Edition, Wheeler Pub. 2010.

Reference Book(s):

1. C.L. Wadhwa, "*Generation, Distribution & Utilization of Electrical Energy*", *New age International*, 6 th ed., , 2014

2. H. Cotton & H. Barber, *The Transmission and Distribution of Electrical Energy*, 3rd ed., ELBS, B.I. Pub.,1985.
3. D.P. Kothari and I.J. Nagrath, *Power System Engineering*-- Tata McGraw-Hill Pub. Co., New Delhi, 3rd ed.,, 2019.
4. Ned Mohan, "*Electric Power Systems*", *Wiley*, 1st ed., 2014
5. Syed A Nasar, "*Electric Power Systems*", *Mcgraw-Hill*, 1st ed, 2006
6. S.N. Singh "*Electric Power Generation, Transmission & Distribution*", *PHI*, 2nd ed., 2009

Web and Video link(s):

1.*NPTEL :: Electrical Engineering-Power System Generation, Transmission and Distribution (Encapsulated from earlier Video)*

2.*NPTEL :: Electrical Engineering - NOC:Power System Engineering*.

Course Articulation Matrix (CAM):		**U24EE404 POWER SYSTEM GENERATION & DISTRIBUTION**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE 404.1**	3	2	2	1	-	1	1	1	1	1	1	1	2
CO2	**U24EE 404.2**	3	2	2	1	-	1	1	1	1	1	1	1	2
CO3	**U24EE403.3**	3	2	2	1	-	1	1	1	1	1	1	1	2
CO4	**U24EE404.4**	3	2	2	1	-	1	1	1	1	1	1	1	2
U24EE404		**3**	**2**	**2**	**1**	**-**	**1**	1	**1**	**1**	**1**	**1**	**1**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

PYTHON PROGRAMMING

Class: B.Tech. IV -Semester		**Branch:** Common to All	
Course Code:	**U24EE 405**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60%**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40%**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: operators, control statements, functions and iterators of Python programming

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

LO3: object-oriented programming, files and database connectivity

LO4: numpy, pandas and matplotlib libraries of Python

THEORY COMPONENT

UNIT-I	**9 Hrs**

Introduction: Features of Python, The future of Python, Writing and executing Python programs

Python Preliminaries: Literal constants, Variables and identifiers, Data types, Input operation, Comments, Reserved words, Indentation, Operators, Expressions in Python, Type conversion

Decision Control Statements: Selection/Conditional branching statements, Loop structures/ iterative statements, Nested loop, the continue statement, the pass statement

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

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

UNIT-II	**9 Hrs**

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

Python Strings: String operations, String formatting operator, Built-in string methods and functions, slice operation, ord() and Chr() Functions, in and not in operators, Comparing strings, Regular expressions and Meta characters

Data Structures: Lists, Tuple, Sets, Dictionaries, Comprehensions, High order functions

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

UNIT-III	**9 Hrs**

Python Object Oriented Programming: Classes and objects, Class method and self-argument, The __init__() method, Class variables and object variables, The __del__() method, Public and private data members, Private methods, Class methods, Static methods, Inheritance, Meat classes, Polymorphism, Operator overloading, Magic Methods

Error and Exception handling: Introduction to errors and exceptions, Handling exceptions, Multiple except blocks, Raising exception, Instantiating exceptions, Built-in and User-defined Exceptions, The finally Block, Re-raising exceptions, Assertions, *Multi threading*

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

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

Self Learning Topics (SLTs): *Calling class method from another class method (Text1: topics 9.10), Built in class variables (Text1: topic 9.12), Garbage Collection (Text1: topic 9.13), Complex objects (Text1: topic 10.4), Multiple Exceptions in a Single Block (Text1: topic 12.4), Handling exceptions in Invoked Function(Text1: topic 12.9)*

UNIT-IV	9 Hrs

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

Data Manipulation with Pandas: Installing and using Pandas, Introducing Pandas objects, data indexing and selection, Handling missing data, Combining datasets, Merge and join, Aggregation and grouping, Vectorized String Operations, Working with Time Series

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

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

LABORATORY COMPONENT

List of Experiments

Experiment-I:

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

Experiment-II

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

Experiment-III

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

Experiment-IV

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

Experiment-V

1. Develop a Python python program on strings for the following
    a. To display substring in a string
    b. To update an existing string
    c. To implement string concatenation
    d. To demonstrate string formatting operator
2. Develop a Python program to demonstrate use of slicing in strings
3. Develop a Python program to compare two strings

4. Reverse string and call this function for performing the operation)
5. Develop a Python program to demonstrate regular expression functions
6. Develop a Python program to demonstrate regular expressions using Meta characters

Experiment-VI

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

Experiment-VII

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

Experiment-VIII

1. Develop a python program to demonstrate multiple exception handling
2. Develop a python program to demonstrate multiple exception rising
3. Develop a python program to demonstrate multiple finally block
4. Develop a python program to demonstrate Assertions
5. Develop a python program on file operations for the following
    a. To open and read data from a file
    b. To write data into a file
    c. To compute number of characters, words, lines in a file

Experiment-IX

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

Experiment-X

1. Develop a Python program to demonstrate NumPy array
2. Develop a Python program to demonstrate Slice operation
3. Develop a Python program to demonstrate Reshaping of an array
4. Develop a Python program to demonstrate Ufunctions
5. Develop a Python program to demonstrate Broadcasting of numpy arrays
6. Develop a Python program to demonstrate Aggregate operations

Experiment-XI

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

Experiment-XII

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

6. Develop a Python program to demonstrate a geographic basemap

Textbook(s):

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

Reference Book(s):

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

Web and Video link(s):

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

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

https://onlinecourses.nptel.ac.in/noc25_cs69/ *NPTEL Video Lecture on The Joy of Computing using Python By Prof. Sudarshan Iyengar , IIT Ropar*

Laboratory Manual (for laboratory component):

1. *Python Programming Laboratory Manual and Record Book,* Department of CSE, KITSW.

Course Learning Outcomes (COs):

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

CO1: develop python programs using control statements, operators and functions
CO2: apply collections, namespaces, packages, strings and regular expressions in application development
CO3: apply object-oriented programming principles in real-time problem solvin
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): U24EE405: PYTHON PROGRAMMING

CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	**U24EE405.1**	1	2	2	2	2	1	-	-	-	1	1	2	2
CO2	**U24EE405.2**	2	2	2	2	2	1	-	-	-	1	1	2	2
CO3	**U24EE405.3**	2	2	2	2	3	1	-	-	-	1	1	2	2
CO4	**U24EE405.4**	2	2	2	2	3	1	-	-	-	1	1	2	2
CO5	**U24 EE405.5**	1	2	2	2	2	1	1	1	1	1	2	2	2
CO6	**U24 EE405.6**	2	2	2	2	2	1	1	1	1	1	2	2	2
CO7	**U24 EE405.7**	2	2	2	2	3	1	1	1	1	1	2	2	2
CO8	**U24EE405.8**	2	2	2	2	3	1	1	1	1	1	2	2	2
U24 EE 405		**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)		**U24VS306B SOFT AND INTERPERSONAL SKILLS LABORATORY**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24VA306B.1**	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	**U24VA306B.2**	-	-	-	-	-	-	2	3	3	-	1	-	-
CO3	**U24VA306B.3**	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	**U24VA306B.4**	-	-	-	-	-	-	1	2	3	-	1	-	-
U24VA306B		-	-	-	-	**-**	-	**1.5**	**2.25**	**3**	**-**	**1**	**-**	-
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ENVIRONMENTAL STUDIES

Class: B.Tech. IV Semester		**Branch:** Common to all branches	
Course Code:	**U24CY411**	**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

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		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
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	-	-
U24CY411		**1.50**	**1.50**	**1.50**	**1.00**	**-**	**1.25**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**-**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

WORKING, SERVICING, AND REPAIR OF ELECTRICAL APPLIANCES

Class: B.Tech. IV -Semester		**Branch:** EEE	
Course Code:	U24EE412X	**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: electrical codes, Standards and safety regulations

LO2: essential electrical and electronics concepts

LO3: operational principles of electrical Instruments

LO4: cause of faults and acquire skills in testing, repairing of electrical appliances

THEORY COMPONENT

UNIT-I	4 Hrs

Introduction to Electrical Codes and Standards: Overview of electrical codes and their importance, Key organizations and standards (NEC, IEC, IEEE, NFPA) Comparison between NEC and IEC standards, NEC requirements for wiring, grounding, and protection, Updates and changes in the latest edition of the NEC, Electrical Safety and Regulations, Importance of electrical safety and regulations, and different electrical accessories like lamp holders, Various switches, Sockets.

UNIT-II	4 Hrs

Basic electrical and Electronics concepts and terminology:

Passive Components: Resistor, Capacitor, Inductor, Connectors, Fuses- Circuit Symbol, Working principle, Types, Specification, Application.

Active Components: Diodes, BJT, SCR Circuit Symbol, Working principle, Specification, Application.

Batteries: Battery Chemistry, Circuit Symbol, Working principle, Types and Specification. **Cables:** Twisted pair cable, Co-axial cable, fibre optic cable- Specification, Applications. **Switches:** Circuit Symbol, Working principle, Types, specification, Application.

UNIT-III	4 Hrs

Operational principles of various Electrical Instruments: Working principle of MI and MC, Galvanometer, Voltmeter, Ammeter, Digital meter, Multimeter, Clamp meter, Safety equipment, Tachometer, Earth resistance tester - Megger, Wattmeter, Energy meter.

UNIT-IV	4 Hrs

Testing and Repairs of Electrical Appliances: Testing & control equipment - line tester, electronic line tester, series test lamp for single phase, parallel test lamp for single phase.

Principle, working, various parts and their use, types, specification, maintenance and troubleshooting of Tube Light, Electric Iron, Water Heater & Geyser, Room Heater, Hair dryer, Fan Regulator, Table lamp, Basic load calculations and circuit design, Inspection.

LABORATORY COMPONENT

List of Experiments

1. Installation of a single-phase incoming supply system.
2. Testing & repairing of Tube -light, Torch, Table Lamp.
3. Study of Passive Components: Resistor, Capacitor, Inductor, Connectors, Cables & Fuses.
4. Study of Active Components: Diodes, BJT, Optocoupler, DIAC, TRIAC, SCR etc.
5. Installation and testing of earthing systems: Megger.
6. Study of transformer: Step –up, Step- down, Auto, with Center tap.
7. Installation and testing of circuit protection devices (Line tester MCBs, RCDs ELCB (Earth Leakage Circuit Breaker)
8. Study of Batteries: Physical (Solar & Thermal), Chemical (Fuel cell, Rechargeable, Non-Rechargeable)
9. Study of switches & Relays: Mechanical, Electronic & Electro-mechanical
10. Experimenting the Dismantling, reassembling, testing & repairs of Electric Iron

Textbook(s):

1. Vincent Del Toro, *Textbook of Principles of Electrical Engg.*, Prentice Hall of India Pvt.

Ltd., 2nd Edi, 1989, New Delhi.

Reference Book(S):

1. E. Fitzgerald, Arvin Grabel, David E. Higginbotham, *Textbook of Basic Electrical Engineering*, TMH Publishing Co., 2nd edition, 1981, USA.
2. Boylestad & Nashelsky, *Electronic Devices & Circuit Theory*, Pearson, 11th edition 2012, USA.

Web and Video link(s):

1. **https://www.youtube.com/watch?v=2WanS_yo5oY, *YOUTUBE Video lecture on Basic* Electronics Repair Course.**
2. **https://www.youtube.com/watch?v=jVFDcTCIetQ, *YOUTUBE Video lecture on* How to Repair LED Bulb at Home.**

Laboratory Manual (for laboratory component):

1. *Working, Servicing, And Repair of Electrical Appliances Lab Manual and Record Book (LMRB)*, Department of EEE, KITSW

Course Learning Outcomes (COs):

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

CO1: apply the electrical Codes, Standards and safety regulations
CO2: apply the basic electrical and electronics concepts
CO3: analyse the operational principles of electrical Instruments
CO4: identify the causes of faults and acquire skills for testing and repairing electrical appliances
(based on psychomotor skills acquired from laboratory component)
CO5: interpret various component specifications used in power supply systems
CO6: evaluate the performance of various parts in household electrical appliances and suggest improvements.
CO7: evaluate the effectiveness of testing and repair techniques for electrical appliances
CO8: analyse the performance of electrical instruments

Course Articulation Matrix (CAM):		**U24EE412X WORKING, SERVICING, AND REPAIR OF ELECTRICAL APPLIANCES**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE412X.1**	2	2	1	2	-	-	1	-	1	-	1	2	1
CO2	**U24EE412X.2**	2	2	1	-	-	-	1	-	1	-	1	2	1
CO3	**U24EE412X .3**	3	3	2	1	1	1	1	-	1	-	1	2	1
CO4	**U24EE412X.4**	3	3	3	1	1	1	1	-	1	-	1	2	1
CO5	**U24EE412X.5**	2	2	1	-	-	-	1	-	1	-	1	2	1
CO6	**U24EE412X.6**	2	2	2	-	-	-	1	-	1	-	1	2	1
CO7	**U24EE412X.7**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO8	**U24EE412X.8**	3	3	1	1	1	1	1	-	1	-	1	2	1
U24EE412X		**2.5**	**2.25**	**1.5**	**1.2**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

ELECTRICAL DESIGN, DRAWING AND ESTIMATION

Class: B.Tech. IV -Semester		**Branch:** EEE	
Course Code:	**U24EE413X**	**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: basic electrical design concepts i.e., Symbols and Signs Conventions

LO2: electrical drawings, schematics and wiring diagrams using standard electrical symbols and conventions

LO3: orthographic projections of Simple Electrical Parts

LO4: design/drawing of application circuit used in an intelligent building

THEORY COMPONENT

UNIT-I	**4 Hrs**

Symbols and Signs Conventions:

Various Electrical Symbols used in Domestic and Industrial Installation and Power System as per BIS, understand and interpret engineering drawings.

UNIT-II	**4 Hrs**

Panels/Distribution Boards:

Design and drawing of panels/Distribution board using MCBs, main switches and change over switches for domestic and commercial installation.

UNIT-III	**4 Hrs**

Orthographic projections of Simple Electrical Parts: Pin type and shackle type insulator (Pin Type 11kV/66kV), Bobbins of a small transformer, Stay insulators/Suspension type insulators, Free hand sketching of M.C.B. and E.L.C.B Placed on Distribution Board.

UNIT-IV	**4 Hrs**

Design/Drawing of application circuit used in an intelligent building: Stage lighting, Safety system, Centralized air-conditioning system, Computer Networking.

LABORATORY COMPONENT

List of Experiments

1. Electrical load calculation.
2. Preparation of single-line diagram.
3. Wiring of Fluorescent Lamp.
4. Wiring diagram for residential lighting installation.
5. Earthing and grounding system design.
6. Wiring of Lamps for stair case system.
7. Design of a Power Distribution Circuit.
8. Electrical System Protection Design.
9. Design and Calculation of Transformer Rating.
10. Designing of sub-Distribution panel.

Textbook(s):

1. Surjeet Singh, *Electrical Design and Drawing*, Dhanpat Rai & Co, 1st edition, 2001, New Delhi.

Reference Book(S):

1. Ankit Agarwal Madhvi Gupta, *Electrical Engineering Design, Drawing & Estimation,* S.K. Kataria & Sons, 1st edition, 2017, New Delhi.

Web and Video link(s):

1. www. udemy.com - Udemy course on Electrical Designing & Drafting Course (Division 1) by Er. Sadiq Hussain.

Laboratory Manual (for laboratory component):

2. *Electrical Design, Drawing and Estimation Lab Manual and Record Book (LMRB),* Department of EEE, KITSW.

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: apply the basics of electrical design, drawing conventions, and electrical symbols

CO2: develop electrical system designs for residential, commercial, and industrial installations

CO3: design the Orthographic projections of Simple Electrical Parts

CO4: analyse the Design/Drawing of application circuit used in an intelligent building

(based on psychomotor skills acquired from laboratory component)

CO5: analyze the effectiveness of protection and safety systems in electrical installations

CO6: create electrical layout drawings and project documentation

CO7: evaluate electrical designs and installations for compliance with industry standards and safety codes

CO8: analyse real-world case studies and design electrical systems for various installations

Course Articulation Matrix (CAM):		**U24EE413X ELECTRICAL DESIGN, DRAWING AND ESTIMATION**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE413X.1**	2	2	1	2	-	-	1	-	1	-	1	2	1
CO2	**U24EE413X.2**	2	2	1	-	-	-	1	-	1	-	1	2	1
CO3	**U24EE413X .3**	3	3	2	1	1	1	1	-	1	-	1	2	1
CO4	**U24EE413X.4**	3	3	3	1	1	1	1	-	1	-	1	2	1
CO5	**U24EE413X.5**	2	2	1	-	-	-	1	-	1	-	1	2	1
CO6	**U24EE413X.6**	2	2	2	-	-	-	1	-	1	-	1	2	1
CO7	**U24EE413X.7**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO8	**U24EE413X.8**	3	3	1	1	1	1	1	-	1	-	1	2	1
U24EE413X		**2.5**	**2.25**	**1.5**	**1.2**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

TESTING AND MAINTENANCE OF DC MACHINES

Class: B.Tech. IV -Semester		**Branch:** EEE	
Course Code:	**U24EE414X**	**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: basics of Safety, Legal and Regulatory Aspects

LO2: methods of Testing Electrical Equipment

LO3: importance of testing and maintenance of DC machines

LO4: factors influencing DC machine maintenance and foundation design

THEORY COMPONENT

UNIT-I	**4 Hrs**

Safety & Prevention of Accidents: Introduction, Definition of terminology used in safety; safety, hazard, accident, major accident, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipment working with electrical installation.

UNIT-II	**4 Hrs**

General Introduction: Introduction, Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing: a. Direct, b. Indirect, c. Regenerative, Concept of routine, preventive & breakdown maintenance.

UNIT-III	**4 Hrs**

Testing of DC machines:

DC Generator Tests: Characteristics of DC Generators

DC Motor Tests: Brake test, Speed control methods

Advanced Tests: Hopkinson's test and Retardation test

UNIT-IV	**4 Hrs**

Maintenance and Installation: Factors involved in designing the DC machine foundation, Requirement of different dimensions of foundation for static machines, Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.

LABORATORY COMPONENT

List of Experiments

1. Dismantle and reassemble a DC machine and identify parts.
2. Dismantle and reassemble various types of starters and identify parts.
3. Run a separately excited and self-excited DC generator at rated conditions and plot OCC, and identify critical speed and resistance. Deduce the same for different speeds.
4. Plot the efficiency curve of self and separately excited dc generators at rated condition.
5. Develop the internal and external characteristics of dc shunt generator at constant speed.
6. Plot efficiency curves of dc series generator at different loads.
7. Plot the efficiency curves of DC compound generator at different loads in (i) Long shunt configuration (ii) short shunt configuration
8. Choose the field control method to control the speed of the DC shunt motor and plot the field current v/s speed curve.
9. Apply Swinburne's test on a DC shunt machine to predetermine its efficiency (when working as a motor and generator)
10. Apply direct loading technique on a DC shunt motor to plot performance curves (torque Vs speed, output vs efficiency, speed and input current)

Textbook(s):

2. S. Rao, "*Testing Commissioning Operation & Maintenance of Electrical Equipment*", Khanna Publishers, 2nd edition, 2016, New Delhi.

Reference Book(S):

3. P. S. Bimbhra, *Electrical Machinery*, Khanna Publishers, 2nd edition, 2021, New Delhi.
4. Tarlok Singh, *Installation Commissioning & Maintenance of Electrical Equipments*, S. K.

Kataria & Sons, 2nd edition, 2017, New Delhi.

Web and Video link(s):

1. https://www.youtube.com/watch?v=IoVF97M-be0&list=PLsGHIZ2Ko8OgTopXTlGg0C2I0JyQ1C-NJ, *YOUTUBE Video lecture on Testing and Commissioning of Electrical Equipments by JD'S Studies.*

Laboratory Manual (for laboratory component):

3. *Electrical testing and maintenance of DC machine Lab Manual and Record Book (LMRB),* Department of EEE, KITSW

Course Learning Outcomes (COs):

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

(based on cognitive skills acquired from theory component)

CO1: select appropriate safety terminology when addressing electrical hazards and accidents

CO2: design a comprehensive testing and maintenance procedure for electrical systems, based on ISS standards

CO3: develop a new maintenance procedure and testing plan for DC machines to improve performance

CO4: evaluate the suitability of DC machine foundation design and handling procedures for heavy equipment based on safety standards

(based on psychomotor skills acquired from laboratory component)

CO5: analyse the construction of DC machines and develop magnetic curves

CO6: evaluate the performance characteristics of various types of DC generators

CO7: apply various speed control techniques in dc motors to plot the speed curve and testing of dc machines

CO8: analyse the performance characteristics of various types of DC motors

Course Articulation Matrix (CAM):		**U24EE414X TESTING AND MAINTENANCE OF DC MACHINES**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24EE414X.1**	2	2	1	2	-	-	1	-	1	-	1	2	1
CO2	**U24EE414X.2**	2	2	1	-	-	-	1	-	1	-	1	2	1
CO3	**U24EE414X .3**	3	3	2	1	1	1	1	-	1	-	1	2	1
CO4	**U24EE414X.4**	3	3	3	1	1	1	1	-	1	-	1	2	1
CO5	**U24EE414X.5**	2	2	1	-	-	-	1	-	1	-	1	2	1
CO6	**U24EE414X.6**	2	2	2	-	-	-	1	-	1	-	1	2	1
CO7	**U24EE414X.7**	3	3	1	1	1	1	1	-	1	-	1	2	1
CO8	**U24EE414X.8**	3	3	1	1	1	1	1	-	1	-	1	2	1
U24EE414X		**2.5**	**2.25**	**1.5**	**1.2**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

COMMON COURSES

PRACTICUM

Class: B.Tech.I/II/III/IV - Semester	**Branch:** Common to all branches		
Course Code:	**U24ELXYY**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-4-4**	**CIE Marks:**	**100 (%)**
Total Number of Teaching Hours:	**-**	**ESE Marks :**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

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

i. Practicum is a mandatory semester project work.
ii. Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)
iii. Allotment of Practicum topics for students:

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

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

- 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 time table 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)

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

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

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

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

(iv) 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

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 teachers 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 problems

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):		**U24ELXYY PRACTICUM**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24ELXYY.1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO2	**U24ELXYY.2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO3	**U24ELXYY.3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO4	**U24ELXYY.4**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
U24ELXYY		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

Course code U24ELXYY: *X represents semester, YY represents ETA course serial number*

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY (SEA /SAA)			
Class: B.Tech. I to VI -Semesters	**Branch:** Common to all branches		
Course Code:	**U24VAXYY(SE/SA)ZZZ**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE :**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: holistic development through activity-based learning to gain real-life experience which effectively helps individuals 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, organization and documentation

LO4: making a well-documented report and an effective oral presentation of 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 analyze 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**

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

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

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

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

v. ***Report writing:*** After successful demonstration/presentation, student shall write a 2 to 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):		**U24VAXYY(SE/SA)ZZZ- Courses listed under SEA/ SAA**													
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**U24VAXYY.1**	-	-	-	-	-	2	2	2	2	2	2	2	-	-
CO2	**U24VAXYY.2**	-	-	-	-	-	2	2	2	2	2	2	2	-	-
CO3	**U24VAXYY.3**	-	-	-	-	-	2	2	2	2	2	2	2	-	-
CO4	**U24VAXYY.4**	-	-	-	-	-	2	2	2	2	2	2	2	-	-
U24VAXYY		-	-	-	-	-	2	2	2	2	2	2	2	**-**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW															

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

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

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

EXPERT TALK SERIES

Class: B.Tech. I -Semester	**Branch:** Common to all branches		
Course Code:	**U24AEXYY**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-1-1**	**CIE Marks:**	**100 %**
Total Number of Teaching Hours:	**-**	**ESE Marks :**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

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

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

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

LO4: making a well-documented report describing 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, and 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 the 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 marksin 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):		**U24AEXYYEXPERT TALK SERIES**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	U24AEXYY.1	1	1	1	1	1	1	1	2	1	2	1	1	1
CO2	U24AEXYY.2	1	1	1	1	1	1	1	2	1	2	1	1	1
CO3	U24AEXYY.3	1	1	1	1	1	1	1	2	1	2	1	1	1
CO4	U24AEXYY.4	1	1	1	1	1	1	1	2	1	2	1	1	1
U24AEXYY		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

Course code U24AEXYY: *X represents semester, YY represents ETA course serial number*