NSRIT

ACADEMIC RULES & REGULATIONS

2023

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Academic Rules and Regulations

2023

(Applicable for the students admitted during 2023 – 2024)

Undergraduate Programs

Rigid free curriculum design in accordance with NEP 2020

Nadimpalli Satyanarayana Raju Institute of Technology (NSRIT)
Sontyam, Andhra Pradesh 531173
(An Autonomous Institute, Affiliated to JNTU - Gurajada, Vizianagaram, AP)
Accredited by NAAC with 'A' Grade

Pages i to xxiii

Contents

Year of Introduction	2023
Approved	VIII Meeting of Academic Council
Date of Approval	October 21, 2023

Sign and Seal of the Chairman (ACM)

The Vision

To promote societal empowerment and become an institution of excellence in the field of engineering education and research

The Mission

- To develop the students into outstanding professionals through innovative Teaching - Learning process
- To uphold research through long term Academia - Industry interaction
- To inculcate ethical standards and moral values

Academic Regulations for Undergraduate Certificate, Diploma, Advanced Diploma and B.Sc. in Engineering, B. Tech. (Regular), B. Tech. (Minor) & B. Tech. (Honors)

(For all the candidates admitted from the Academic Year 2023 – 2024 onwards)

B. Tech. (Regular: 160 Credits | Lateral Entrants at the end of the second year after 10 + 3 Years (Diploma): 120) | B. Tech. (Honors: 175 Credits | Lateral Entrants: 135) | B. Tech. (Minor: 160 Credits | Lateral Entrants: 120) | B. Tech. Undergraduate Certificate: 50 | Diploma: 90 | Advanced diploma: 50 (lateral entrants) | B. Sc. in Engineering: 120

1. Preliminary Definitions and Nomenclature

In this regulation, unless the context otherwise requires:

a. **Degree**: The academic award conferred upon a student on successful completion of a programme designed to achieve the defined attributes. It is referred to as Under-Graduate (UG) Degree that is B.Tech. degree

b. **Program**: The cohesive arrangement of courses, co-curricular and extracurricular activities to accomplish predetermined objectives leading to the awarding of a degree. It also means specialization or discipline of B.Tech.

c. **Course**: Theory, Practical or Theory-cum-Practical subject studied in a semester, like Engineering Mathematics, Physics, etc.

d. **"University"** means Jawaharlal Nehru Technological University – Gurajada, Vizianagaram (JNTU – GV)

e. **"Institute"** means Nadimpalli Satyanarayana Raju Institute of Technology (NSRIT)

f. **"NEP 2020"** means National Education Policy 2020

2. Eligibility for Admission

2.1. Admission to the B. Tech. (Regular, Honors, Minor, Undergraduate Certificate, Diploma and B. Sc. In Engineering) shall be made subject to the eligibility and qualifications as prescribed by Andhra Pradesh State Council for Higher Education (APSCHE), Government of Andhra Pradesh. The total number of seats as per the approved annual intake is categorized into two categories viz. Convenor Quota (Cat. – A) and Management Quota (Cat. – B) with a ratio of 70:30 (G. O. No. 52). The admission under Cat. – A shall be done based on the merit score secured through state-wise common state common entrance test i.e., AP Engineering Agricultural, Pharmacy Common Entrance Test (AP – EAPCET). The allotment pertaining to Cat. – B admission, the merit list based on 10+2 shall be taken as a benchmark in compliance with the norms issued by APSCHE. For B. Tech. 8 consecutive academic years from the date of joining

2.2. With regard to the students admitted through Lateral Entry Scheme, the students shall be admitted directly into semester III of the second year of B. Tech. programs. Under this scheme 10% seats of the sanctioned intake will be available in each program of study as supernumerary seats. Admissions to this 2 year B. Tech. lateral entry programme will be through Andhra Pradesh Engineering Common Eligibility Test (ECET). The maximum period to complete B. Tech. under lateral entry scheme is 6 consecutive academic years from the date of joining

3. Duration and Medium of Instruction of the Program

Program of Study	Duration	Total Credits at Exit
Undergraduate Certificate	One year	50
Diploma	Two years	90
Advanced Diploma	Two years	50 (Lateral Entrants)
B.Sc. in Engineering	Three years	120
B. Tech. (Regular)	Four years	160
B. Tech. (Minor)	Four years	160 (Inclusive of 12 Credits)
B. Tech. (Honors)	Four years	175

The program duration for the award of degree in B. Tech. (Regular, Honors and Minor) will be of 4 academic years and each academic year will have two semesters. In case, if the student is unable to complete the program in the above said stipulated duration, he/she shall be permitted to complete the program of study within 8 consecutive academic years from the year of admission into B. Tech. program. For the students admitted through lateral entry scheme the duration of the program is 3 years and 6 years if the student fails to complete the program of study in the stipulated duration of 3 years. The student who fails to meet the requirements for the award of B. Tech. program during the above said extended duration shall forfeit the degree in B. Tech. program of study. The medium of instruction during the program of study is English.

Academic Calendar

As already mentioned, each academic year will have two semesters. Each academic year, an academic calendar will be issued indicating the duration of Instruction Period, Mid-Term Tests, Semester End Examinations, Practical Examinations and eventually evaluation. Normally each semester will have sixteen weeks of instruction exclusive of mid-term tests, practical examinations and two weeks for semester end examinations. In total, each semester will span for a maximum duration of 16 – 20 weeks.

4. Multiple Entry & Multiple Exit Requirement (ME - ME)

The academic regulation provides complete flexibility to leverage the option of ME – ME. The student can have the exit after the completion of first two-, four- consecutive semesters or at both levels. If a student wants to take exit at any level as mentioned above or he/she intend to earn the degree viz., Undergraduate Certificate, Diploma, Advanced Diploma and B. Sc. in Engineering. He/She need to pursue two certification courses each of two credits from the courses available in the curriculum along with one Job Specific Internship / OJT / Apprenticeship with 6 credits, in case if he/she prefers to exit at the end of the first year and second year of study.

In accordance with The Gazette of India, the notification issued by UGC pertaining to the Academic Bank of Credits (ABC) vide File No. 14-31/2018 (CPP – II) dated 28th July, 2021, New Delhi, Page No. 14, Clause 11, the time duration for the entry and exit is as per norms, provided the duration of the course or programme is of two-years or more (Four semesters or more). In case if he/she earns additional credits through National service schemes/ (or) from higher learning institutes (or) higher educational Institutes of repute taking necessary approval during the exit period. He/she should accumulate the credits in ABC if he/she wants to consider for the approval of the degree. A student will be allowed to enter/re-enter only at the odd semester and exit only in even semester. Re-entry at

various levels as lateral entrants in academic programmes will be purely based on the earned credits and proficiency tests conducted at the institute level.

5. Programs of Study

NSRIT offers eight programs of three- and four-year engineering programs duration leading to B. Sc. (Engineering) and Bachelor of Technology (B. Tech.) respectively as follows

i. Civil Engineering (CE)
ii. Computer Science and Engineering (CSE)
iii. Computer Science and Engineering - Artificial Intelligence and Machine Learning – CSE (AI&ML)
iv. Computer Science and Engineering – Data Science - CSE (DS)
v. Electronics and Communication Engineering (ECE)
vi. Electronics Engineering - VLSI Design and Technology[1] (EVT)
vii. Electrical and Electronics Engineering (EEE)
viii. Mechanical Engineering (ME)

6. Structure of Programs

6.1. Categorization of Courses

Each program shall have a common curriculum framework with well defined educational objectives, program outcomes, Program Specific Outcomes, courses outcomes as per the philosophy of Outcome Based Education (OBE) in line with the Vision and Mission of the department offering the program and in turn in accordance with the Vision and Mission of the Institute. The program structure comprise of theoretical courses, practical courses, theory-cum-practical courses, MOOCs, summer and full semester internship, skill oriented courses, project work, seminars and other relevant courses meeting industry requirements. Also, the curriculum is framed with Choice Based Credit System (CBCS). The courses of a particular program are categorized as follows:

a. Foundation courses
b. Professional core courses relevant to the chosen program of study
c. Professional electives
d. Open electives
    i. Inter-Disciplinary Electives
    ii. Trans-Disciplinary Electives
e. On Job Training
f. Skill Oriented Courses (SOC)and Industry Connect Courses (ICC)
g. Mandatory Courses (MC) as prescribed by AICTE / UGC
h. Project, Seminar and Internship
i. Vocational Courses

The outcome based competitive curriculum is prepared in line with the core values of NEP 2020, streaming out single phased education and enabling the learners to tailor their curriculum as per his/her choice of interest. The academic regulation provides flexibility to deliver the courses of national interest like Constitution of India in native languages of the state of Andhra Pradesh. Further the examination can also be facilitated to drop the responses in the same way as mentioned above. In this connection the learners may be given with the choice of selecting the

[1]One time admission during the academic year 2023 - 2024 only as per EoA (AICTE) 2023-2024

language of medium either in English or native language of Andhra Pradesh of the above said courses.

6.2. Nomenclature of Credit Distribution

No.	Nature of Course	Credit	Nomenclature
1	Theory Course / Elective Course (Physical Lecture Hour)	1.0	1 Hour / Credit
2	Theory Course / Elective Course (Digital Lecture Hour)	0.5	0.5 Hour / Credit
3	Practical / Drawing Course	0.5	0.5 Hour / Credit
4	Internship / Idea Incubation / CSP	2.0	-
5	Full Semester Internship	6.0	-
6	Capstone Project	6.0	-
7	MOOCs / Digital learning	1.5	0.5 Hour / Credit
8	Skill Oriented Course / On Job Training	2.0 | 6.0	-
9	Health, Wellness, Yoga, Sports, NSS/NCC /Scouts & Guides/Community Service	0.5	-
10	Vocational Courses	2.0	-
11	Mandatory Course/Technical Paper Writing	0.0 | 2.0 | 3.0	-
12	Counseling/Mentoring	-	-
13	Sports/Hobby Clubs/Activities	-	-

6.3. Structure of Curriculum

Sem.	No. of Theory Courses	No. of Lab Courses, Internship, OJT / OC, Project / CE / CSP	Total Credits
I	6 (5 Theory + 1 SOC)	3/4 + 1 Health, Wellness, Yoga/NSS & NCC + Sports/Hobby Clubs/Activities	19.5/20.5
II	5 Theory	4/3 + 1 Health, Wellness, Yoga, Sports, NSS/NCC /Scouts & Guides/Community Service/Hobby Clubs/Activities	20.5/19.5
III	7 (5 Theory + 1 SOC + 1 MC)	3 + Sports/Hobby Clubs/Activities	20.0
IV	7 (5 Theory + 1 SOC + 1 MC)	3 + Sports/Hobby Clubs/Activities	22.0
V	7 (2 PC + 1 PE + 2 IE/TE + 2 SOC)	2 + 1 Internship # Onsite/Virtual / CSP + Sports/Hobby Clubs/Activities	22.0
VI	7 (3 PC + 2 PE + 1 IE/TE + 1 SOC)	1 + 1 Technical Paper Writing + Sports/Hobby Clubs/Activities	21.0
VII	8 (3 PC + 2 PE + 1 IE/TE + 1 SOC + 1 MC)	2 + 1 Internship # Onsite/Virtual	23.0
VIII	-	Full Semester Internship & Capstone Project	12.0
		Total Credits	**160**

6.4. Credit Distribution for each Category

No.	Category	Credits	
		Regular	Lateral
1	**Foundation Courses**	**41.5**	**08**
	Humanities and Social Science including Management (HS)	08	05
	Engineering Science (ES)	16.5	-
	Basic Sciences (BS)	17	03
2	**Professional Core Courses (PC)**	**62.5**	**58**
3	**Electives**	**39**	**38**
	Program / Professional Electives (PE)	13	13
	Open Electives (Inter-Disciplinary Electives/Trans-Disciplinary Electives)	12	12
	Skill Oriented Courses	14	13
4	**Project, Seminar, CSP and Internship**	**16**	**16**
5	**Health, Wellness, Yoga, Sports, NCC/NSS/Scouts & Guides/Community Service**	**01**	-
6	**Mandatory Courses**	**Non Credit**	**Non Credit**
Minimum credits to be earned for the award of the B. Tech. (Regular) degree		**160**	**120**

6.5. Course Classification

All the courses offered for the undergraduate program in Engineering & Technology (B.Tech. degree programs) are broadly classified as follows:

S. No.	Broad Course Classification	Course Category	Description
1.	Foundation Courses	Foundation Courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Core Courses (PC)	Includes courses related to the discipline/department/branch of engineering parent
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective courses related to the parent discipline/department/ branch of Engineering
		Open ElectiveCourses (OE)	Elective courses which include interdisciplinary and transdisciplinary courses or courses in an area outside the parentdiscipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	Interdisciplinary / Job - Oriented / Domain Courses which are relevant to the industry
4.	Project, Internships & Community Service Project	Project	Capstone Project
		Internships	Summer Internships – Community based and Industry Internships; Industry Oriented Full Semester Internship
5.	Audit Courses	Mandatory non-credit courses	Covering courses of developing desired attitude among the learners

6.6. Assessment Pattern for the Courses

With the true spirit of implementing Outcome Based Education (OBE), each course is designed with customized assessment pattern addressing the various cognitive levels of Revised Bloom's Taxonomy (RBT) with appropriate proportion covering the breadth and depth of the courses.

The Assessment Instrument or question papers shall be designed with a combination of question responses with short answer, long answer and higher order thinking skills through critical thinking and creativity and Multiple Choice Questions that fits best to the assessment of the intended learning outcomes during the process of continuous internal evaluation which includes assignments, mid-term tests and semester end examination.

The course instructor can also take the liberty of setting their own customized question papers along with the distribution of marks leveraging the status of autonomous promoting higher order thinking skills and creativity through case studies or questions related to problems solving skills through open book examinations other than that of the one prescribed in the academic regulation 2023. This shall be deployed by taking necessary approval from the respective Chairman, Board of Studies and the Head of the Institution as well before the commencement of the course while preparing the course plan along with the rubrics indicating the criteria and scale/metric for assessment.

With regard to the assessment pattern for the skill-oriented courses, appropriate assessment instrument shall be developed by the respective course facilitator that suits to assess the skills that

are expected from the courses by taking approval from the respective Chairman, Board of Studies and the Head of the Institution as well before deploying for assessment.

In case of video based grading, suitable rubrics shall be developed and approved for meeting the course outcomes or intended learning outcomes.

In all the cases other than the assessment pattern being prescribed in the academic regulation 2023, the customized and approved assessment pattern shall be submitted to the office of the Controller of Examinations before the commencement of the course.

6.7 Project & Internships

6.7.1 Community Service Project (CSP)

Community Service Project is a type of a learning strategy that integrates meaningful community service with instruction, participation, learning and community development. CSP involves the students in community development and service activities and applies the experience to personal and academic development. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution. As per the guidelines specified in these regulations, each student is expected to undergo CSP for duration of 8 weeks. As per the standard operating procedure (http://nsrit.edu.in/admin/img/cms/Guidelines-for-the-OJT-Internship-Community-Service-Project.pdf) prescribed by the institution and the allotment of CSP is done by the Community Service Wing, and in coordination with the respective program of study for monitoring and assessment. The assessment is to be conducted for 100 marks. The number of credits assigned is 3. Later as per the present practice the marks are converted into grades and grade points to include finally in the SGPA and CGPA.

6.7.2 Summer Internship

As per the guidelines specified (http://www.nsrit.edu.in/admin/img/folder/SOP%20-%20SI.pdf), each student is expected to undergo summer Internship. The curriculum provides a span of four to eight weeks for completing the Internship as furnished in the curriculum. As per the standard operating procedure prescribed by the institution the allotment of Internship is done by the Industry – Institute Linkage cell, and in coordination with the respective program of study for monitoring and assessment.

6.7.3 Full Semester Internship (FSI)

With regard to the FSI (onsite/virtual), the curriculum provides flexibility at two different slots during VII and VIII semesters with a span of 12 to 16 weeks. The students who are opting FSI either during semester VII or VIII shall register for the course during the semester VI through the Head of the department and the same shall be forwarded to the Industry – Institute Linkage Cell through the Office of Controller of Examination (CoE) for allotment; subsequent monitoring and assessment shall be by the respective program of study. To ensure effective implementation of FSI, the Institute shall depute ~50% of the interns during semester VII and the rest during semester VIII. Accordingly, the courses pertaining to the semesters shall be inter-changed. Students will be evaluated by a panel of internal/external subject matter experts (SMEs)

nominated by Chairman / chairperson BoS/HoD of the respective board duly approved by the Head of the Institution. It is mandate for all the learners going either for internship to capture a video demonstrating the self-reflection on the learning outcomes for grading by the course supervisor/guide.

6.7.4 **Capstone Project**

Each student is expected to carry out one capstone project relevant to his/her program of study or interdisciplinary of nature leading to design, development of solutions, and fabrication of system component or a product. On successful completion of the project work, the students should submit a detailed project report along with the working models wherever applicable. Students will be evaluated by a panel of internal/external subject matter experts (SMEs) nominated by Chairman / Chairperson BoS/HoD of the respective board duly approved by the Head of the Institution. In case, if any student is interested in doing industry-oriented project (Individual) at the industries or research organization, he/she shall take up the project duly approved by the Head of the Department and the Head of the Institution well before the commencement of the course. In such cases, the students should inform the respective department well in advance, preferably during semester VI. The students who opted FSI in the semester VII shall take up the courses as prescribed in the curriculum during semester VIII along with the capstone project.

6.8. **Mandatory Courses**

Mandatory courses are those courses which are designed in line with the requirement of AICTE. These courses do not carry any credits and are not accounted for the calculation of CGPA. The students shall register for the courses in the respective semester as specified in the curriculum. All the students (regular and lateral entry students) shall complete the mandatory course by taking two assessments in the form of multiple-choice questions during the continuous assessment. A minimum of 40% of marks is required to complete the course and the status of completion will be indicated in the grade memo and an online certification is also mandatory in the relevant area as specified in the curriculum. In addition to the above, the curriculum provides flexibility to nurture employability skills through mandatory courses and it is compulsory for all students to complete the mandatory courses for the award of the degree and it will not be counted for the calculation of CGPA. The academic regulation permits autonomous learning with mandatory courses promoting self-learning ability among the learners.

6.9. **Massive Open Online Courses (MOOCs) / Digital Learning**

The curriculum provides adequate flexibility for the students to take up MOOCs spanning for duration of 8 to 12 weeks through self-study mode enabling them to learn the courses on independent/autonomous mode with a guidance of faculty mentor to earn necessary credits for the award of the degree and the attendance is not mandatory. However, it is recommended not to exceed 20 credits in case of MOOCs during the course of study. A student is not permitted to register and pursue core courses through MOOCs. The courses shall be opted from MOOCs platform viz. NPTEL, SWAYAM or any other platforms as approved by the respective Chairman/ Chairperson, Board of Studies (BoS). In case of MOOCs through NPTEL, SWAYAM, v-Lab, the credits shall be directly transferred without conducting any further examination from the institution.

In case, if the student fails to earn the certification, he/she has the flexibility to appear for supplementary examination for the same MOOCs for 100 marks without Continuous Internal Assessment as and when the notification is released by the institution incase if he/she is not interested to earn the certification from NPTEL subsequently. Necessary amendments in rules and regulations regarding adoption of MOOCs would be proposed from time to time. For all other MOOCs platforms, the assessment pattern for such courses which are part of the curriculum for the B. Tech. (Regular) degree shall be carried out as similar to other regular descriptive examinations.

B. Tech. (Honors) shall also be in line with the agencies or the platforms offering these courses. Further, if the grade is not specified by the particular agency or platform, the award of the grade follow the institutional SOP and take necessary approval from the Academic Council. MOOCs shall be identified by the respective program taking necessary approval from the Chairman / Chairperson (BoS) and shall be intimated well in advance to the students.

6.10. **Industry Connect Courses**

a. Students can opt for one-credit courses, offered by experts from industry/research organizations which are approved by BoS and Academic Council. Students can register such courses from his/her second year of study as and when these courses are conducted by various departments. A student is also permitted to register for the courses of other departments, provided the student has fulfilled the necessary pre-requisites of the course being offered and subject to the approval of both the Heads of Departments. There is no limit to the number of 1-credit or 2-credit courses a student can register during the programme of study. However, a student can register for only one course in a semester. These courses are evaluated by the respective course coordinator of the programme

b. If a student does not successfully complete the registered industry supported 1-credit or 2-credit courses in a semester, the registration of that course will be considered as cancelled. Further, it will not be treated as arrear and no supplementary examination will be conducted; alternatively, if he/she wishes, he/she can re-register for the same course in the ensuing semesters and successfully complete it as and when it is offered subsequently

c. The students who are opting Industry Connect Courses (ICC), as per the list furnished in the respective curriculum, the credits earned through ICC can be trade off to only Professional Elective, Trans – Disciplinary/Inter – Disciplinary elective in the curriculum for the award of B. Tech. (Regular) Degree. Further, the credits earned through ICC cannot be compensated for the courses of B. Tech. (Honors) and B. Tech. (Minor)

6.11. **Semester Away Programme (SAP) to Promote Research**

The students interested in pursuing the B.Tech. (Regular)/B.Tech. (Honors) shall be permitted to go for the semester away program in higher learning institutions, after taking the necessary approval from both the institutions and the earned equivalent credits may be accumulated, transferred through ABC and redeemed for the award of the B.Tech.(Regular)/B.Tech.(Honors). In the above case, the application should be pre approved by the parent University.

6.12. **Technical Paper Writing**

The introduction of technical paper writing aims to foster a research culture aligned with academia. It entails a structured method for presenting scientific and engineering research articles, facilitating learners' comprehension of current trends in the engineering and technology domains.

6.13. **Skill Oriented Courses**

Skill Oriented courses are gaining momentum in higher education, transcending traditional academic approaches to prioritize practical skills and real-world applicability. They span a wide spectrum of fields, including business, technology, healthcare, and the arts. These U.G. programs are instrumental in nurturing hands-on expertise, bolstering students' employability, and preparing them for the ever-changing job landscape. By incorporating internships, industry partnerships, and innovative teaching methods, these courses effectively bridge the gap between theory and practice. In a swiftly evolving job market, U.G. programs centered on skill development empower students with a competitive advantage, enabling them to thrive in their careers and adapt to shifting industry needs.

6.14. **On Job Training (OJT) – Applicable for students who opt for Exit Policy**

On Job Training will be facilitated through Industry – Institute linkage cell of NSRIT as and when the situation demands. However, he/she need to appear for the tests and examinations to meet the academic compliance. The student shall be given an option to choose the industry for OJT which has to be approved by chairman / chairperson BoS of a particular department.

6.15. **Vocational Courses**

The vocational courses are basketed under the category of certification courses 1, 2, 3 & 4.

6.16. **Procedure for Evaluation** (Refer SOP: http://www.nsrit.edu.in/admin/img/folder/SOP-12-12-23.pdf)

Theory (Internal: 30 Marks | External 70 Marks)

Continuous Internal Assessment #1 with duration of 90 Minutes (I & II units)

Descriptive Examination	: 15 Marks
Objective Type Examination	: 10 Marks
Assignment	: 05 Marks

Continuous Internal Assessment #2 with duration of 90 Minutes (III, IV & V units)

Descriptive Examination	: 15 Marks
Objective Type Examination	: 10 Marks
Assignment	: 05 Marks

The final internal marks will be awarded by considering 80% of marks secured in the best of the two continuous internal evaluation and 20% marks secured in the other internal test.

Laboratory Courses (Internal: 30 Marks | External: 70)

Total Internal Marks	**: 30 Marks**
Distribution for Continuous Evaluation	
Continuous Assessment	: 10 Marks

Record	: 10 Marks
Internal Test	: 10 Marks
Total External Marks	**: 70 Marks**
Experiment, Results (30 Marks) & Viva – Voce (20 Marks)	: 50 Marks
Video Assessment (Learning Outcomes)	: 20 Marks (One video shall be uploaded by the student demonstrating the self reflection on that particular laboratory course for grading)

Drawing and Design Related Courses (Internal: 30 Marks | External: 70 Marks)

Total Internal Marks	**: 30 Marks**
Distribution for Continuous Evaluation	
Continuous Assessment	: 15 Marks
Mid - Term Examination	: 15 Marks
Total External Marks	**: 70 Marks**

The final internal marks will be awarded by considering 80% of marks secured in the best of the two continuous internal evaluation and 20% marks secured in the other internal test.

Mandatory Courses

Assessment	: As prescribed in the Academic Regulation
Online certification course	: 01 course (in the relevant area of the pursuing mandatory course and the students need to submit the certification of completion for the award of the degree)

Technical Paper Writing

Internal Review #1	: 10 Marks
Internal Review #2	: 10 Marks
Final Review and Presentation	: 30 Marks

Paper Publications: Students are requested to publish their review articles to either peer-reviewed journals or any one of the reputed conferences and submit the published paper. It is mandatory for the award of the degree. Academic regulation suggests publishing the articles either in UGC – CARE or journals indexed by SCOPUS.

Summer Internship (Internal: 50 Marks)

Interim Assessment and Report Writing	: 20 Marks
Final Presentation	: 30 Marks

Full Summer Internship (Internal: 100 Marks | External: 100 Marks)

Interim Review #1 (Industry Supervisor)	: 20 Marks (Rubrics based)
Interim Review #2 (Industry Supervisor)	: 30 Marks (Rubrics based)
Terminal Presentation	: 15 Marks (Presentation)
Report	: 25 Marks
Video Based Assessment	: 10 Marks

In all the continuous assessment pertaining to internship, the major focus of the assessment will be predominantly on skills and application of knowledge viz. Communication Skills, Team-Work, Organization Skills, Interpersonal Skills, Analytical and Problem Solving Skills, Leadership Skills, Work Ethics and any specific initiatives by the interns.

Skill Oriented Courses (Internal: 30 Marks | External: 70 Marks)

Interim Assessment and Report Writing	: 30 Marks
Total External Marks	**: 70 Marks**
Outcomes	: 40 Marks
Final Presentation	: 20 Marks
Video Based Assessment	: 10 Marks

The outcomes shall be in the form of design, development of working model of a system component or a product and these 40 marks shall be awarded based on Rubrics that addresses Critical Thinking, Creativity, Collaboration and Communication.

Capstone Project (Internal: 60 Marks | External: 140 Marks)

Distribution of Marks (Continuous Internal Assessment)	
Innovativeness of the Project	: 05 Marks
Literature Survey	: 05 Marks
Experimentation/ Simulation	: 05 Marks
Presentation, Interpretation, Product Development & Analysis of Results	: 10 Marks
Interim Review #1(Presentation)	: 05 Marks
Interim Review #2 (Presentation)	: 05 Marks
Terminal Presentation	: 05 Marks
Report	: 05 Marks
Publication in Conference / Journal (CARE)	: 05 Marks
Video Based Assessment	: 05 Marks (Mandatory)
Online Certification	: 05 Marks (Mandatory)
Total Internal Marks	**: 60 Marks**
Total External Marks	**: 140 Marks**

The online certification shall be from MOOCs platform with a minimum duration of 30 – 45 hours and the student need to earn the certification and for which there will not be any further assessment from the institution or program of study.

Community Service Project (External: 100 Marks)

Distribution of Marks	
Project Log	: 20 Marks
Project Implementation	: 30 Marks
Project Report	: 25 Marks
Final Presentation	: 25 Marks

A student shall earn the following percentage of minimum percentage of marks in each theory, practical, design and drawing course in B. Tech. program.

- A minimum of 35% of marks for each course Semester End Examinations (SEE) and
- A minimum of 40% marks for each course considering both CIA and SEE taken together

Massive Open Online Courses (MOOCs) / Digital Learning

In case of MOOCs through NPTEL, SWAYAM, v-Lab, the credits shall be directly transferred without conducting any further examination from the institution. In case, if the student fails to earn the certification, he/she has the flexibility to appear for supplementary examination for the same MOOCs for 100 marks without Continuous Internal Assessment as and when the notification is released by the institution incase if he/she is not interested to earn the certification from NPTEL subsequently.

Theory (External 100 Marks)

7. Attendance Finalization and Result Declaration

7.1. Procedure

The attendance shall be calculated as per this autonomous regulation 2020 for the students to appear for the end semester examinations as per clause 6.2. The Institute shall formulate a committee "Joint Board" constituting of Principal (Chairman), Chairpersons of all Boards of Studies, Controller of Examinations (Member Secretary) and two senior members of faculty. The tenure for the senior members of faculty shall be of 2 years. The member secretary shall place the attendance of all the students before the Joint Board for approval before the finalization and declaration of attendance. The same procedure shall be adopted for declaring the end semester examination results having representation from parent University.

7.2. Attendance Requirements and Result Declaration Procedure

a. A student shall be eligible to appear for the end semester examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the courses in a semester and shortage of attendance below 65% shall in no case be condoned and such cases will not be permitted to appear for the semester end examinations
b. Condonation for shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be permitted based on medical leave (hospitalization / accident / specific illness) and on-duty leave for participation in College / University / State / National / International Sports, NCC/NSS events with prior approval from the competent authority. After taking necessary approval from the Head of the Institution or Competent Authority, the student shall be permitted to appear for the semester end examination by paying the Condonation fee. However, the student who have represented the college in outside world activities shall be exempted in paying the Condonation fee
c. Students, who do not meet the minimum required attendance in a semester, shall be detained in that particular semester and they will not be promoted to the next semester. In such cases, the student need to rejoin/readmit in that particular semester in the subsequent academic year
d. Academic regulations applicable to the semester in which re-admission is sought shall be applicable to the re-admitted student
e. In case if there are any professional electives and/or open electives (Inter-Disciplinary/ Trans-Disciplinary) the same may also be re-registered if offered by the respective program of study.

However, if those electives are not offered in the later semesters, alternatively, the students may opt other electives from the same set of elective courses offered under that category in that particular semester

f. If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class

g. If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student

8. Promotion Policies

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in Clause (7.2).

i. A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms

ii. A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) up to in the courses that have been studied up to III semester

iii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the courses that have been studied up to V semester

And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be

iv. When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted

9. Eligibility for the Award of the Degree

A student shall be declared eligible for the award of the degree in B. Tech. (Regular) program if he/she has fulfilled the following requirements

a. The student should earn the minimum requirement of credits (160 for B. Tech. regular admission and 120 credits for lateral entry) and cleared all the mandatory courses as prescribed in the curriculum within the maximum duration of 8 consecutive academic years (Regular) and 6 consecutive academic years (Lateral entry) from date of admission

b. The student should earn the minimum requirement of credits (175 for B. Tech. Honors and 135 credits for lateral entry) and cleared all the mandatory courses as prescribed in the curriculum within the maximum duration of 8 consecutive academic years (Regular) and 6 consecutive academic years (Lateral entry) from date of admission

c. The student shall not have any pending disciplinary issues

The student shall forfeit his/her Degree and his/her admission stands cancelled if he/she fails to meet the above compliance.

10. Award of Grades

Range of Marks	Letter Grade	Grade Point
>= 90	'O'	10
>= 80 < 90	'A+'	09
>= 70 < 80	'A'	08
>= 60 < 70	'B+'	07
>= 50 < 60	'B'	06
>= 40 < 50	'C'	05
< 40	'F'	0
Absent	'AA'	0
Non completion of a semester (Repeat)	'I'	0
Withdrawal from end semester examination	'W'	0

After completion of the programme, the Cumulative Grade Point Average (CGPA) from the I Semester to VIII Semester (from III to VIII semester for lateral entry) is calculated using the formula:

$$CGPA = \frac{\sum_{i=1}^{n-1}(c_i \times g_i)}{\sum_{i=1}^{n-1} c_i}$$

where 'n' is the number of courses registered for, 'c_i' is the credits allotted to the given course and 'g_i' is the grade point secured in the corresponding course

Equivalent Percentage = (CGPA – 0.5) X 10

11. Classification of the Degree Awarded

a. **B. Tech. (Honors):** In addition to the requirement as cited in (11.c), if the student secures 15 additional credits in accordance with the clause (15), he/she shall be declared with B. Tech. (Honors)

b. **B. Tech. (Minor):** if the student secures 12 credits inclusive of 160 credits for the award of B. Tech. in accordance with the clause (16), he/she shall be declared with B. Tech. (Minor)

c. **B. Tech. (Regular) - First Class with Distinction:** The student who qualifies for the award of the B. Tech. degree in the chosen program of study with 160 credits (Regular) within 4 consecutive academic years without any supplementary appearance from the date of admission and 120 credits (Lateral Entry) within 3 consecutive academic years from the date of admission at his/her first attempt maintaining 7.5 CGPA and above shall be declared to have passed in first class with distinction and should not have been prevented from appearing end semester examinations for the want of attendance requirements

d. **B. Tech. (Regular) - First Class:** The student who qualifies for the award of the B. Tech. degree in the chosen program of study with 160 credits (Regular) and 120 credits (Lateral) within 3 consecutive academic years from the date of admission maintaining 6.5 CGPA and above and less than 7.5 CGPA shall be declared to have passed in first class and should not have been prevented from appearing end semester examinations for the want of attendance requirements

e. **B. Tech. (Regular) - Second Class:** The student who qualifies for the award of the B. Tech. degree in the chosen program of study with 160 credits (Regular) and 120 credits (Lateral) within 6

consecutive academic years from the date of admission maintaining 5.5 CGPA and above and less than 6.5 CGPA shall be declared to have passed in second class

f. **B. Tech. (Regular) - Pass:** All other students who have not covered and qualifies for the award of the degree maintaining 5.00 CGPA and above and less than 5.5 CGPA shall be declared to get Pass with minimum credit requirement for the award of the degree in B. Tech. program
g. **UG Certificate (in Field of study/discipline)** - Programme Duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce
h. **UG Diploma (in Field of study/discipline)** - Programme Duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce
i. **Bachelor of Science (in Field of study/discipline)** i.e., B.Sc. Engineering in (Field of study/discipline)- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits

12. Flexibility to Add or Drop Self Study Courses (SSC)

a. It is mandatory that all the students need to earn the minimum number of the credits for the award of B. Tech. degree in their respective program of study. However, a student can earn more number of credits if he/she opt, by registering additional courses, from the list of courses available in the curriculum of all disciplines, over and above to the existing courses from semester IV – VI. The student shall be permitted to drop any SSC at any point of time and registration for such courses gets cancelled and will not be reflected in Cumulative Grade Memo (CGM)
b. All the courses registered and cleared by a student in this mode will be mentioned in the CGM as additional acquired. However, the CGPA is calculated as per the minimum requirement of the credits for the award of the B. Tech. degree

13. Withdrawal from the Examination

a. A candidate may, for valid reasons, be granted permission by the Head of the Institution to withdraw from appearing for the examination in any course or courses of only one semester examination during the entire duration of the Degree Programme. Also, only ONE application for withdrawal is permitted for that semester examination in which withdrawal is sought
b. Withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination and if it is made prior to the commencement of the examination in that course or courses and also recommended by the Head of the Department
c. Such withdrawal from the examination shall be treated as absent for the 1st attempt to the respective examination and will lose the eligibility for First Class with Distinction
d. If any student is intended to drop FSI subsequent to his/her registration followed by allotment, he/she needs to re-register the course

14. Transitory Regulations

To enable the students to take admission or entry into NSRIT from other Institution either by Transfer, Re-admission, Admission, or Transfer from other engineering Institution affiliated to JNTU-GV /Academic regulation within the Institute, the following regulations shall be followed based on the nature of case as cited above.

- Transfer of candidate from Autonomous / Non-Autonomous Institution affiliated to JNTU-GV
- Within the Institution from one regulation to other academic regulation

a. Transfer of a candidate from Autonomous / Non-Autonomous Institution affiliated to JNTU-GV

Any candidate who is interested to take admission in NSRIT from a non-autonomous engineering institution affiliated to the parent university either in the semester III or thereafter, shall acquire the credits required for graduation as per the Institute autonomous regulations and the candidature shall be treated under following category

Students from non-autonomous institution seeking admission into semester III shall be treated in par with the students taking admission for 2 year program of study (i.e. lateral entry students) and should have cleared all the courses in the semester I and II as per university regulation. The same shall be calculated as per NSRIT regulations if the student is seeking admission into NSRIT from an autonomous institution. The credits earned during semester I and II shared be calculated as per the Institute autonomous regulations and in case if the earned credits during first two semesters are not adequate to take admission in the semester III, the student shall take additional courses approved by the respective Board of Studies and Academic council during semester III at NSRIT on self-study mode and the same procedure shall be followed for taking admission into higher semesters.

b. Within the Institution from one regulation to other academic regulation

A student taking admission under one regulation, say, Academic Regulation 2020 in the first year, shall continue with the same regulation and should earn the necessary credits as mentioned in the academic regulation at the time of joining. However, In case of readmission into a subsequent new regulation, and if the readmission is into any of the semesters from semester I through IV, the student shall follow the current regulations to which he/she taking admission and continue with the same regulation till graduation. In case of any credit shortage, the necessary credits shall be earned on self study mode to compensate the required number of credits. In case of excess credits, it will be treated as over and above.

In both the cases (a) and (b), the details shall be forwarded to the parent university along with the proceedings of the Academic Council.

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the University from time to time.

15. B.Tech. (Honors)

The curriculum provides flexibility to enable the students to register for B.Tech. (Honors) program by earning additional 15 credits which is over and above the requirement for the award of B.Tech. (Regular) degree. He/She shall register in the office of the CoE during semester III provided he/she secures ≥7 CGPA without backlogs in earlier semesters. If he/she wishes to withdraw from B.Tech. (Honors) program at any point of time, the credits obtained will not be compensated for the award of the degree and considered as over and above. The maximum enrollment B. Tech. (Honors) shall be restricted to 20% of the total intake in a particular batch of students.

The additional 15 credits shall be earned by opting the courses offered by the respective program of study which are categorized in the curriculum and these courses shall be offered with a combination of guided learning or taught courses or self-study mode depending on the total number of students registered for that particular course and the Chairperson of the Board of Studies reserves the right to decide the mode of delivery. Above all, if any student fails to maintain the ≥7 SGPA without history of arrears in the subsequent semesters after semester III, the registration for the B. Tech. (Honors) program stands cancelled without any notification. In case of students admitted through lateral entry, the SGPA compliance will be considered from semester III onwards as already mentioned.

16. B.Tech. (Minor)

The curriculum provides flexibility to enable the students to register for B. Tech. (Minor) program by earning 12-credits which is inclusive of the 160 credits required for the award of the B. Tech. (Regular) degree. It is mandate for a student to complete two core courses each of 3-credits to be awarded with a minor degree but may be waived off for the students who have done similar or equivalent courses. If a core course is waived off for a student, the student must take an extra elective course in its place. It is recommended that a student should complete the core courses or equivalents before registering for the electives.

A student needs to complete minimum of two elective courses each of 3-credits to earn the total 12-credits for the award of minor degree. A student can opt the open electives listed in the curriculum offered through various programs of study.

17. Academic Bank of Credits

This academic regulation 2023 provides complete scope of academic flexibility in accordance with The Gazette of India, the notification issued by UGC pertaining to the Academic Bank of Credits (ABC) vide File No. 14-31/2018 (CPP – II) dated 28th July, 2021, New Delhi. The ABC provides a full length academic flexibility while removing rigid curriculum boundaries and creating new possibilities of life-long learning.

In case with students registering under ABC, it is very much mandate and recommended to complete the courses pertaining to professional core and the courses at the lower semesters, especially, the courses pertaining to Mathematics, Physics, Chemistry and few related to Engineering Sciences as specified by the degree awarding institute. As per the document cited above is in line with ABC. The students shall be required to earn at least 50% of credits required for the award of (Regular, Honors, Minor, Undergraduate Certificate, Diploma and B. Sc. in Engineering) from the institute in which the student is enrolled. (As per the clause # 8.3, PP. 13 of the ABC policy document of UGC)

18. Revision of the Academic Regulations and Curriculum

The Joint Board Committee and the Academic Council of the institute reserve the right to revise, change or amend the regulations, the scheme of examinations, the curriculum and the syllabi from time to time if found necessary.

19. Representation of Special Cases

In case of any clarification in the interpretation of the above rules and regulations, they shall be referred to the Joint Board Committee through the Head of the Institution. The Joint Board Committee will offer suitable interpretations/clarifications/amendments required for special case on such references and get them ratified in the next meeting of the Academic Council. The decision of the Academic Council is final.

20. Gap Year

The concept of Gap Year will be considered case to case based on the request from the candidate similar to the guidelines of the University keeping ME – ME into consideration.
Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Clause (14) and they will follow the academic regulations into which they are readmitted.

21. Guidelines for the courses related to Health, Wellness, Sports & Yoga/NSS, NCC, Scouts & Guides & CS

Courses related to Health, Wellness, Sports & Yoga/NSS, NCC, Scouts & Guides & CS are in line with the requirement of the parent University. These courses are awarded with 0.5-credit and are accounted in the calculation of CGPA. The course will be evaluated for a total of 100 marks. A student can select 6 activities of his/her choice with a minimum of 1 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks and 10 marks for Viva – Voce on the respective course. A minimum of 40% of marks is required to complete the course.

22. General Instructions

i. The academic regulations should be read as a whole for purpose of any interpretation
ii. Malpractices rules-nature and punishments are appended
iii. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Head of the Institution is final.
v. The Institution may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Head of the Institution
vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final

23. Guidelines for Lateral Entrants

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year 2024 - 2025 onwards)

1. **Award of the Degree**
   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils thefollowing:
      (i) Pursues a course of study for not less than three academic years and notmore than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years)
      (ii) Registers for 120 credits and secures all 120 credits

   (b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:
      (i) Student secures additional 15 credits fulfilling all the requisites of B.Tech. Program i.e., 120 credits
      (ii) Registering for Honors is optional
      (iii) Honor is to be completed simultaneously with B.Tech. Program

2. Students, who fail to fulfill the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. **Minimum Academic Requirements**
   The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2
   i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and endexamination taken together
   ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester

   And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. **Course Pattern**
   i) The entire course of study is three academic years on semester pattern
   ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered When a student is detained due to lack of credits/shortage of attendance the studentmay be re-admitted when the semester is offered after fulfillment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted

5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

24. Curriculum and Syllabi of various Programs of Study
(Scan to view the Program Curriculum and Syllabi)

Electronics & Communication Engineering

Preamble: The curriculum of B. Tech. (Electronics and Communications Engineering) program offered by the Department of Electronics and Communications Engineering under Academic Regulation 2023 is prepared in accordance with the curriculum framework of AICTE, UGC and Andhra Pradesh State Council of Higher Education (APSCHE). Further this Outcome Based Curriculum (OBC) is designed with Choice Based Credit System (CBCS) enabling the learners to gain professional competency with multi-disciplinary approach catering the minimum requirement (Program Specific Criteria) of Lead Societies like Institute of Electrical and electronics Engineering (IEEE) as per the Engineering Accreditation Commission (EAC) of ABET and NBA. In addition, the curriculum and syllabi are designed in a structured approach by deploying Feedback Mechanism on Curriculum from various stakeholders viz. Industry, Potential Employers, Alumni, Academia, Professional Bodies, Research Organizations and Parents to capture their voice of the respective stake holders.

The Curriculum design, delivery, and assessment, the three major pillars of academic system is completely aligned in line with Outcome Based Education (OBE) to assess and evaluate the learning outcomes facilitating the learners to achieve their Professional and Career Accomplishments. As the institution is registered under ABC, the students have the academic flexibility as per ABC in earning the total credits for the award of B. Tech. degree in Regular, Honors and Minor with specialization.

The Vision

To become recognized forerunner in Electronics and Communication Engineering by producing competent and responsible graduates.

The Mission

- To prepare technically competent graduates by establishing a conducive learner centric academic environment that uses innovative teaching learning processes.
- To create research interests in the graduates by bringing in real time engineering challenges through industry collaborations.
- To make the graduates socially responsible citizens who provide sustainable solutions maintaining ethical and professional standards.

Program Educational Objectives (PEOs)

The PEOs are the educational goals that reflect Professional and Career Accomplishments that a graduate should attain 4 – 5 years of his/her graduation.

The graduates of Electronics & Communication Engineering of NSRIT will

1. Continue to demonstrate the application of domain knowledge in solving real time problems and provide research based sustainable solutions in different specializations of Electronics and Communication Engineering or allied branch of engineering and technology and lead a satisfactory job employment with 21st century skills.
2. Continue to involve themselves in life-long learning by enriching his/her competency in the chosen field of interest through professional experience, advanced studies, learning new age skills that demands dynamism for a continued better prospect to accomplish their professional and career goals.
3. Continue to demonstrate the skill sets that are very much essential to work successfully for a rewarding career in an interdisciplinary environment.

Program Specific Outcomes (PSOs)

1. To demonstrate the ability to design and develop complex systems in the areas of next generation Communication Systems, IoT based Embedded Systems, Advanced Signal and Image Processing, latest Semiconductor technologies, RF and Power Systems
2. To demonstrate the ability to solve complex Electronics and Communication Engineering problems using latest hardware and software tools along with analytical skills to contribute to useful, frugal and eco-friendly solutions.

Category-wise Credit Distribution of Courses

Category		AICTE	APSCHE	NSRIT(A)
HS	Humanities and Social Sciences	8 -9%	8%	3.125%
BS	Basic Sciences	12 – 16%	13%	15.6%
ES	Engineering sciences	10 - 18%	14%	10.3%
PC	Professional core	30 - 36%	34%	38.4%
PE	Professional elective	19 - 23%	21%	15.6%
MI	Inter- / trans - disciplinary Electives			
IN	Internship(s), Project &seminars	8 - 11%	10%	10.3%
SC	Skill oriented courses	-	-	7.5%
MC	Mandatory courses	-	-	-
AC	Audit course	-	-	-

Curriculum with Multiple Entry &Multiple Exit (ME-ME) adhering to NEP 2020
(Academic Regulation 2023 – 2024)

	Credit requirement	Exit credit requirement	Total credit	Level as per NCRF
Undergraduate Certificate| (After the one year of study)	40	10	50	L5
Diploma| (After two year of study)	80	10	90	L6
Advanced Diploma | (After two year of study) - Lateral Entrants	40	10	50	
B.Sc. in Engineering (After three years of study)	120	10	130	L7
B. Tech. (Regular) | (Four years of study)	160	-	160	L8
B. Tech. (Minor)	12 (Inclusive in 160)	-	160	L8
B. Tech. (Honors)	175	15 (160+15)	175	L8

Semester I								Category
No.	Code	Course Title	POs / PSOs	L/D[1]	T[2]	P	Credit	
1	23HSX01	Communicative English	5, 8, 10	2	0	2	2.0	HS
2	23BSX21	Engineering Chemistry	1, 2, 7	3	1	0	3.0	BS
3	23BSX11	Linear Algebra & Calculus	1, 2	3	1	0	3.0	BS
4	23ESX01	Basic Electrical and Electronics Engineering	1, 2, 3	3	0	0	3.0	ES
5	23ME101	Engineering Mechanics	1, 2	3	0	0	3.0	PC
6	23HSX02	Communicative English Lab	9, 10	0	0	2	1.0	HS
7	23BSX22	Engineering Chemistry Lab	1, 4	0	0	2	1.0	BS
8	23ESX04	Electrical and Electronics Engg. Workshop	1, 2, 4	0	0	3	1.5	ES
9	23CE101	Engineering Mechanics & Building Practices lab	1, 4	0	0	3	1.5	PC
10	23ESS01	IT Workshop	1, 2, 3, 4, 5	0	0	2	1.0	SOC
11	23CSP01	NSS/ NCC/Scouts & Guides/Community Service	7, 8, 12	-	-	1	0.5	CSP
						Sub-total	20.5	
Semester II								Category
No.	Code	Course Title	POs / PSOs	L/D[1]	T[2]	P	Credit	
1	23BSX31	Engineering Physics	1, 2, 7	3	1	0	3.0	BS
2	23BSX12	Differential Equations and Vector Calculus	1, 2, 5	3	1	0	3.0	BS
3	23ESX02	Introduction to Programming	1, 2, 3	3	0	0	3.0	ES
4	23ESX03	Basic Civil & Mechanical Engineering	1, PSO #1	3	0	0	3.0	ES
5	23BSX32	Engineering Physics Lab	1, 4	0	0	2	1.0	BS
6	23ESX06	Engineering Workshop	1	0	0	3	1.5	ES
7	23ESX07	Engineering Graphics	1, 10	2	0	2	3.0	ES
8	23ESX05	Computer Programming Lab	1, 2, 3, 4, 5	0	0	3	1.5	ES
9	23WLP01	Health, Wellness, Yoga & Sports	2, 7, 12	-	-	1	0.5	Wellness
						Sub-total	19.5	
Exit mandate at the level of I year for the award of Undergraduate Certificate[3]								
1		Certification #1		Min. 60 hours			2.0	SOC
2		Certification #2		Min. 60 hours			2.0	SOC
3		Job Specific Internship / OJT / Apprenticeship		Min. 60 Days			6.0	OJT

[1] In case of digital learning other than face-to-face learning, double the number of learning hours is mandate for the equivalent credit as per NCRF

[2]Suggested tutorials do not carry credits

[3]Students exiting at the level of first year of study must complete two skill-oriented courses and Job specific Internship/ OJT/ Apprenticeship that tunes to a total of 10 credits

Semester III								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credits	
1	23BSX15	Random Variables and Stochastic Processes	PO1, 2	3	0	0	3.0	BS
2	23HSX03	Universal Human Values– Understanding Harmony and Ethical Human Conduct	PO8, 9, 10	2	1	0	3.0	HS
3	23ES303	Signals and Systems	PO1, 2, PSO1	3	0	0	3.0	ES
4	23EC304	Electronic Devices and Circuits	PO1, 2, 3, PSO1	3	0	0	3.0	PC
5	23EC305	Digital Circuits Design	PO1, 2, 3, PSO1	3	0	0	3.0	PC
6	23EC306	Electronic Devices and Circuits Lab	PO4, 9, PSO2	0	0	3	1.5	PC
7	23EC307	Digital Circuits & Signal Simulation Lab	PO4, 9, PSO2	0	0	3	1.5	PC
8	23DSS01	Python Programming	PO1, 2, 3, PSO1, 2	0	1	2	2	SOC
10	23ACX01	Environmental Science	PO1,12	2	0	0	0	MC
						Sub-total	**20.0**	
Semester IV								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credits	
1	23HSX04	Managerial Economics and Financial Analysis	PO11,12	2	0	0	2.0	HS
2	23ES402	Linear Control Systems	PO3, PSO1	3	0	0	3.0	ES
3	23EC403	Electromagnetic Waves and Transmission Lines	PO1, 2, 3, PSO1	3	0	0	3.0	PC
4	23EC404	Analog Circuits Design	PO1, 2, 3, PSO1	3	0	0	3.0	PC
5	23EC405	Analog and Digital Communications	PO1, 2, 3, PSO1	3	0	0	3.0	PC
6	23EC406	Analog Circuits Design Lab	PO4, 5, 9, PSO2	0	0	3	1.5	PC
7	23EC407	Analog and Digital Communications Lab	PO4, 5, 9, PSO2	0	0	3	1.5	PC
8	23SCX01	Soft Skills	PO8, 9, 10	0	1	2	2.0	SOC
9	23ESX08	Design Thinking and Innovation	PO1, 2	1	0	2	2.0	ES
Mandatory Community Service Centric Internship of 8 weeks duration during summer vacation								
						Sub-total	**21.0**	
Exit mandate at the level of I year for the award of Diploma[1]								
1		Certification #3		Min. 60 hours			2.0	SOC
2		Certification #4		Min. 60 hours			2.0	SOC
3	23SOC02	Job Specific Internship/OJT/Apprenticeship		Min. 60 Days			6.0	OJT

[1]Students exiting at the level of second year study must complete two skill-oriented courses and Job specific Internship/ OJT/ Apprenticeship that tunes to a total of 10 credits

Semester V								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credit	
1	23EC501	Analog & Digital IC Applications		3	0	0	3.0	PC
2	23EC502	Antennas and Wave Propagation		3	0	0	3.0	PC
3	23EC503	Microprocessors and micro controllers		2	0	0	2.0	PC
4	-	Program Elective-I		3	0	0	3.0	PE
5	-	Open Elective-I		3	0	0	3.0	OE
6	23EC506	Analog & Digital IC Applications Lab		0	0	3	1.5	PC
7	23EC507	Microprocessors and micro controllers Lab		0	0	3	1.5	PC
8	23ECS03	PCB Design and Prototype Development		0	1	2	2.0	SOC
9	23SCX01	Tinkering Lab		0	0	2	2.0	ES
10	-	Evaluation of Summer Internship [2]		0	0	-	2.0	INTERN
						Sub-total	**23.0**	
Semester VI								Category
No.	Code	Course Title	POs / PSOs	L	T	P	Credit	
1	23EC601	Digital Signal Processing		3	0	0	3.0	PC
2	23EC602	Microwave and Optical Communications		3	0	0	3.0	PC
3	23EC603	VLSI Design		3	0	0	3.0	PC
4	-	Program Elective II		3	0	0	3.0	PE
5	-	Program Elective III		3	0	0	3.0	PE
6	-	Open Elective-II		3	0	0	3.0	OE
7	23EC607	Microwave and Optical Communications		0	0	3	1.5	PC
8	23EC608	VLSI Design Lab		0	0	3	1.5	PC
9	23ECS04	AI and Signal Processing		0	1	2	2.0	SOC
10	-	Technical Paper Writing and IPR[3]		2	0	0	-	SOC
		Mandatory Industry Internship of 8 weeks duration during summer vacation						
						Sub-total	**23.0**	
Exit mandate at the level of third year for the award of Bachelor of Science in Engineering[4]								
1	-	Certification #3	-	Min. 60 hours			2.0	SOC
2	-	Certification #4	-	Min. 60 hours			2.0	SOC
3	23SOC02	Job Specific Internship / OJT / Apprenticeship	-	Min. 60 Days			6.0	OJT

[2]The work pertaining to Community Service Centric Internship and summer Internship shall be completed at the end of the semesters IV & VI respectively. The assessment shall be carried out during the semesters V and VII. It is mandate for all the students to undergo 4-6 weeks of industrial training and appear for assessment during Semester V with report.

[3]The students are expected to identify one research area in the recent trends, collect recent research articles, prepare a technical research review paper and publish in renowned annual conferences/ journals, preferably indexed in Scopus or UGC care.

[4]Students exiting at the level of third year of study must complete two skill-oriented courses and Job specific Internship/ OJT/ Apprenticeship that tunes to a total of 10 credits.

Semester VII								Category
No.	Code	Course Title	POs / PSOs	L	T	P	Credits	
1	23EC701	Data Communications and Networking		3	0	0	3.0	PC
2	20HSX06	Entrepreneurship Development		2	0	0	2.0	PC
3	-	Professional Elective IV		3	0	0	3.0	PC
4	-	Professional Elective V		3	0	0	3.0	PE
5	-	Open Elective III		3	0	0	3.0	PE
6	-	Open Elective IV		3	0	0	3.0	OE
7	23EC708	Industrial IOT & Automation		0	1	2	2.0	PC
8	23MCX04	Gender Sensitization		2	0	0	-	SOC
9	-	Evaluation of Industry Internship		-	-	-	2.0	INTERN
						Sub-total	**21.0**	
Semester VIII								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credits	
1	-	Full Semester Internship[5]	All POs & PSOs	-	-	12	6.0	INTERN
2	-	Capstone Research Project		-	-	12	6.0	INTERN
						Sub-total	**12.0**	
						Total	**160.0**	

[5]Students opting for FSI in VII semester have to take up courses of VII semester in VIII semester. The students are expected to do a capstone project parallelly demonstrating their POs & PSOs and submit a separate report

List of Electives

Program Elective #1									
No	Code	Title	PO	L/D	T	P	C		
1	23EC001	Computer Architecture and Organization	-	3	0	0	3.0	PE	
2	23EC002	Electronic Measurements and Instrumentation	-	3	0	0	3.0	PE	
3	23EC003	Embedded Systems	-	3	0	0	3.0	PE	
4	23EC004	Low Power VLSI Design		3	0	0	3.0	PE	
5	23EC005	Sensors and Actuators		3	0	0	3.0	PE	
Program Elective #2									
6	23EC006	Information theory and coding	-	3	0	0	3.0	PE	
7	23EC007	Satellite Communications	-	3	0	0	3.0	PE	
8	23EC008	Cellular and Mobile Communications/ Data Communications and Networking	-	3	0	0	3.0	PE	
9	23EC009	Radar Engineering	-	3	0	0	3.0	PE	
10	23EC010	Wireless Sensor Networks	-	3	0	0	3.0	PE	
Program Elective #3									
11	23EC011	Detection and Estimation Theory	-	3	0	0	3.0	PE	
12	23EC012	Machine Learning	-	3	0	0	3.0	PE	
13	23EC013	Optimization Techniques	-	3	0	0	3.0	PE	
14	23EC014	Digital Image Processing	-	3	0	0	3.0	PE	
15	23EC015	Speech Processing	-	3	0	0	3.0	PE	
Program Elective #4									
16	23EC011	Artificial Intelligence	-	3	0	0	3.0	PE	
17	23EC012	Introduction to Robotics	-	3	0	0	3.0	PE	
18	23EC013	Cyber Security	-	3	0	0	3.0	PE	
19	23EC014	Internet of Things	-	3	0	0	3.0	PE	
20	23EC015	5G Communications	-	3	0	0	3.0	PE	
Program Elective #5									
The curriculum provides academic flexibility to choose any of the domain specific courses from MOOCs as approved by the respective Board of Studies and Academic Council. The students can take up this course on self- study mode. The course shall be of 45–60 hours duration (3-credits) and the assessment shall be as per the academic regulation 2023.									PE

Inter – disciplinary Elective #1[6]			Pre-requisite[7]							
26	23CEO01	Environmental Pollution and control	-	-	-	3	0	0	3.0	MI-ES
27	23CSO01	Operating systems			-	3	0	0	3.0	MI--CS
28	23AIO01	Introduction to Python	23ESX02		-	3	0	0	3.0	MI-AI
29	23DSO01	Introduction to Database Management Systems	23BS11		-	3	0	0	3.0	MI-DS
30	23ECO01	Semiconductor Devices and Circuits	23BSX31	23ESX01	-	3	0	0	3.0	MI-EC
31	23EEO01	Basic of DC Machines	23ESX01		-	3	0	0	3.0	MI-EE
32	23MEO01	Nano Technology	23BSX21		-	3	0	0	3.0	MI-ME
Inter – Disciplinary Elective #2			Pre-requisite							
33	23CEO02	Air pollution	-	-	-	3	0	0	3.0	MI-ES
34	23CSO02	Software Engineering			-	3	0	0	3.0	MI--CS
35	23AIO02	Fundamentals of artificial intelligence			-	3	0	0	3.0	MI-AI
36	23DSO02	Introduction to Data science	23BSX15		-	3	0	0	3.0	MI-DS
37	23ECO02	Digital Electronics	23ESX01		-	3	0	0	3.0	MI-EC
38	23EEO02	Basics of AC Machines	23ESX01		-	3	0	0	3.0	MI-EE
39	23MEO02	Bio Materials	23BSX21		-	3	0	0	3.0	MI-ME

Inter – Disciplinary Elective #3			Pre-requisite							
40	23CEO03	Climate change Mitigation and Adoptation	23MCX04	23CE008	-	3	0	0	3.0	MI-ES
41	23CSO03	Database Management Systems			-	3	0	0	3.0	MI--CS
42	23AIO03	Machine Learning for Engineers	23BSX15		-	3	0	0	3.0	MI-AI

[6] Inter-disciplinary elective/trans-disciplinary electives shall be factored under B.Tech. minor. To travel in a particular minor track, two pre-requisite courses should be completed to a tune of six credit out of four or equivalent courses that suits the pre-requisite.

[7] Pre-requisite courses are those that are offered in core or in elective pertaining to minor offered by the respective program of study. It is not the program core of the parent department

43	23DSO03	Introduction to Big Data			-	3	0	0	3.0	MI-DS
44	23ECO03	Analog Electronic Circuits	23BSX31		-	3	0	0	3.0	MI-EC
45	23EEO03	Basics of Power Electronics			-	3	0	0	3.0	MI-EE
46	23MEO03	Micro Electro Mechanical System	23ESX03		-	3	0	0	3.0	MI-ME
Inter – Disciplinary Elective #4			Pre-requisite							
47	23CEO04	Sustainability and pollution Prevention Practices	23MCX04	23CE008	-	3	0	0	3.0	MI-ES
48	23CSO04	Computer Networks			-	3	0	0	3.0	MI--CS
49	23AIO04	Fundamentals of Deep Learning			-	3	0	0	3.0	MI-AI
50	23DSO04	Introduction to Data Visualization			-	3	0	0	3.0	MI-DS
51	23ECO04	Communication Systems	23BSX31		-	3	0	0	3.0	MI-EC
52	23EEO04	Introduction to Electric vehicles			-	3	0	0	3.0	MI-EE
53	23MEO04	Surface Engineering	23BSX31		-	3	0	0	3.0	MI-ME
Trans – Disciplinary Stream #1 (Liberal Arts)										
1	23HSM01	Psychology			-	3	0	0	3.0	MI
2	23HSM02	English for Media			-	3	0	0	3.0	MI
3	23HSM03	Journalism and Mass media			-	3	0	0	3.0	MI
4	23HSM04	Tourism			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #2 (Statistics)										
1	23HSM05	Statistical Methods			-	3	0	0	3.0	MI
2	23HSM06	Statistical Inference			-	3	0	0	3.0	MI
3	23HSM07	Statistical Quality Control			-	3	0	0	3.0	MI
4	23HSM08	Introduction to Time Series			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #3 (General Management)										
1	23MBM01	General Management			-	3	0	0	3.0	MI
2	23MBM02	Organization Behavior			-	3	0	0	3.0	MI
3	23MBM03	Entrepreneurship and Business Venture Planning			-	3	0	0	3.0	MI
4	23MBM04	Cross Culture Management			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #4 (Human Resource Management)										
1	23MBM05	Human Resource Planning			-	3	0	0	3.0	MI
2	23MBM06	Compensation Management & Employee Welfare Laws			-	3	0	0	3.0	MI
3	23MBM07	Performance Management and Talent Management			-	3	0	0	3.0	MI
4	23MBM08	Talent Management			-	3	0	0	3.0	MI
B. Tech. (Honors)										
Category I										
1	23ECH01	Low Power VLSI Design			-	3	0	0	3.0	HO
2	23ECH02	DSP Processors and Architectures			-	3	0	0	3.0	HO
3	23ECH03	Information Theory and Coding			-	3	0	0	3.0	HO
Category II										
4	23ECH04	Hardware Design using Verilog			-	3	0	0	3.0	HO
5	23ECH05	Advanced Digital Signal Processing			-	3	0	0	3.0	HO
6	23ECH06	Advanced Digital Communications			-	3	0	0	3.0	HO
Category III										
7	23ECH07	Design of Digital Integrated Circuits			-	3	0	0	3.0	HO
8	23ECH08	Pattern Recognition			-	3	0	0	3.0	HO
9	23ECH09	Advanced 3G and 4G Mobile Communications			-	3	0	0	3.0	HO
Category IV										
10	23ECH10	Simulation and Testing Methods for VLSI Design			-	3	0	0	3.0	HO
11	23ECH11	Digital Signal & Image Processing using MATLAB			-	3	0	0	3.0	HO
12	23ECH12	5G Mobile and Wireless Technology			-	3	0	0	3.0	HO
Category V: MOOCs										
Industry Connect Courses										
1	23ICC01	Competitive Programming			-	2	0	8	6.0	ICC
2	23ICC02	Web Technologies – Theory to Practice			-	2	0	8	6.0	ICC
3	23ICC03	Java and Springboard			-	2	0	8	6.0	ICC
4	23ICC04	Robotics Process Automation (RPA)			-	2	0	8	6.0	ICC
5	23ICC05	Information Security and Forensics			-	2	0	8	6.0	ICC
6	23ICC06	Battery Technologies for EV			-	2	0	8	6.0	ICC
7	23ICC07	Blockchain Technology			-	2	0	8	6.0	ICC
8	23ICC08	Network Administration			-	2	0	8	6.0	ICC

9	23ICC09	Product Engineering	-	2	0	14	9.0	ICC
10	23ICC10	Machine Learning Engineer	-	2	0	8	6.0	ICC
11	23ICC11	Data Scientist	-	2	0	8	6.0	ICC
12	23ICC12	Industrial IoT	-	2	0	8	6.0	ICC
Certification #1& #2								
1	23SOC07	Plumbing	-	0	0	3	3.0	SOC
2	23SOC08	Air conditioning and refrigeration	-	0	0	3	3.0	SOC
3	23SOC09	Mobile troubleshooting	-	0	0	3	3.0	SOC
4	23SOC10	Computer assembling	-	0	0	3	3.0	SOC
5	23SOC11	Digital marketing	-	0	0	3	3.0	SOC
6	23SOC12	Lathe	-	0	0	3	3.0	SOC
7	23SOC13	Electrical winding	-	0	0	3	3.0	SOC
8	23SOC14	Masonry	-	0	0	3	3.0	SOC
9	23SOC16	Automobile servicing (Basics)	-	0	0	3	3.0	SOC
Certification #3 & #4								
1	23SOC17	Industrial Safety	-	0	0	3	3.0	SOC
2	23SOC18	Equipment Maintenance and Repairing	-	0	0	3	3.0	SOC
3	23SOC19	Computer Aided Analysis and Design	-	0	0	3	3.0	SOC
4	23SOC20	Battery Management System (BMS)	-	0	0	3	3.0	SOC
5	23SOC21	Design of Machine Elements	-	0	0	3	3.0	SOC
6	23SOC22	Computer Servicing	-	0	0	3	3.0	SOC
7	23SOC23	Front Office Management	-	0	0	3	3.0	SOC
8	23SOC24	Facility Management Service	-	0	0	3	3.0	SOC
9	23SOC25	Hotel Management	-	0	0	3	3.0	SOC

Specialization

B. Tech. (Honors)

1. VLSI System Design
2. Digital Signal & Image Processing
3. Advanced Communication Systems

B. Tech. Minor in Trans disciplinary Stream

1. Liberal Arts
2. Statistics
3. General Management
4. Human Resource Management.

B. Tech. Minor in Inter disciplinary Stream.

1. Electronics Engineering

HS **23HSX01 Communicative English** **2 0 0 2**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO 5	PO 8	PO 10	DoK
23HSX01.1	Make use of the setting, subject, and specific details from social or transactional discussions	1	1	3	L1 - L3
23HSX01.2	Identify grammatical frameworks to construct sentences and select the appropriate word forms	1	1	3	L1 - L3
23HSX01.3	Examine discourse markers to talk coherently about a subject in informal conversations	1	1	3	L1 - L3
23HSX01.4	Assessing the reader's or listener's overall comprehension of reading, listening, and summary materials	1	1	3	L1 – L6
23HSX01.5	Justify intelligible essays, resumes, and paragraphs	1	1	3	L1 – L6

All the Cos are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning.

Unit I: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye **9 Hours**
"Tomorrow is waiting" by Holli Mintzer - Strange Horizons
Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing one self and others
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information
Writing: Mechanics of Writing - Capitalization, Spellings, Punctuation – Parts of Sentences
Grammar: Parts of Speech, Basic Sentence Structures – forming question
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words

COs: CO1

Self Learning Topic: The Time Machine – H.G. Wells

Unit II: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian & Contemporary) **9 Hours**
Patterns of a Murmuration, in billions of data points by Jy Yang - Clares World
The Brook by Alfred Tennyson (Poem)
Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts
Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together
Writing: Structure of a paragraph – Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions
Vocabulary: Homonyms, Homophones, Homographs

COs: CO2

Self Learning Topic: In Watermelon Sugar –Brautigan

Unit III: BIOGRAPHY: Elon Musk/Steve Jobs **9 Hours**

"The Life cycle of Software Objects" is a novella by American writer Ted Chiang, originally published in 2010 by Subterranean Press.
Listening: Listening for global comprehension and summarizing what is listened to
Speaking: Discussing specific topics in pairs orsmall groups and reporting what is discussed
Reading: Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs-tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

COs: CO3

Self Learning Topic: The Reader – Bernhard Schlink

Unit IV: Inspiration: TheToys of Peace by Saki **9 Hours**
A Story Told by a Machine The Circuitous Path to AI Writing
Listening: Making predictions while listening to conversations/transactional dialogues without video; listening with video
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions
Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/ relationships, communicate processesor display complicated data
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

COs: CO4

Self Learning Topic: The Prime of Life – Simone De Beauvoir

Unit V: MOTIVATION: The Power of Intra personal Communication (An Essay) **9 Hours**
The interplay of AI, modern lives and literature by Mimi Mondal - Hindusthan Times
Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension
Writing: Writing structured essays on specific topics
Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

COs: CO5

Self Learning Topic: Do Androids Dream of electric ship? PhilipK.Dick The City and the Stars – Aarthur C. Clarke

Board of Studies	Basic Science & Humanities (English)	
Approved in: BoS No. II	October 06, 2023	
Approved in ACM: ACM No.VIII	October 21, 2023	
Expert talk (To be delivered by SMEs from industries)	**COs**	**POs**
Workshop on Drama and enactive sessions	CO5	PO5, PO8, PO10
Seminar with Language expert	CO3	PO5, PO8, PO10

Text Books

1. Path finder: Communicative English for Undergraduate Students,1st Edition, Orient Black Swan, 2023 (Units 1, 2 & 3)
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5)

Reference Books

1. Dubey, ShamJi & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen, Academic writing: A Handbook for International Students Routledge, 2014
3. Murphy, Raymond, English Grammar in Use, 4th Edition, Cambridge University Press, 2019
4. Lewis, Norman, Word Power Made Easy – The Complete Handbook for Building a Superior Vocabulary, Anchor, 2014

Web References

Grammar

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

Vocabulary

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	15
L2	20	30
L3	10	30
L4	10	15
L5	05	05
L6	05	05
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List the major characters in the story
2. Who is the author of the poem "The Brook"?
3. What is the specific natural element that the poem revolves around?
4. Who is Elon Musk?
5. Can you name some of the companies founded or co-founded by Elon Musk?

L2: Understand

1. Can you summarize the plot of the story in your own words?
2. Explain the significance of the Brook's journey in the poem
3. What emotions or feelings does the poem evoke in you as a reader?
4. Explain the significance of SpaceX in Elon Musk's career and the aerospace industry
5. What are some of the major technological advancements associated with Elon Musk's companies?

L3: Apply

1. How would you apply the lessons from this story to your own life?
2. Can you apply the poem's themes to a different natural setting or body of water that you are familiar with?
3. Describe a real-life situation or natural phenomenon that parallels the Brook's journey in the poem
4. Apply Elon Musk's philosophy on sustainable energy to a current environmental issue
5. Describe a scenario in which the principles of innovation and risk-taking, as demonstrated by Elon Musk, could be applied in a different industry

L4: Analyze

1. How does the setting contribute to the overall mood of the story?
2. How does the poem's structure, including its rhyme scheme and meter, contribute to the overall meaning and mood of the poem?
3. Explore the role of sound and sensory imagery in conveying the Brook's essence
4. How has Elon Musk's leadership style contributed to the success of his companies?
5. Compare and contrast the goals and missions of SpaceX and Tesla, Inc.

L5: Evaluate

1. Evaluate the impact of the surprise ending in the story
2. Evaluate the effectiveness of the poem in conveying its themes and emotions
3. How might different readers interpret the poem's meaning based on their personal experiences or perspectives?
4. Do you agree with Elon Musk's vision for a sustainable future and his approach to achieving it? Why or why not?
5. Assess the ethical considerations surrounding some of Elon Musk's projects, such as Neuralink or the Hyperloop

L6: Create

1. Create a modern-day version of the story, updating the setting and circumstances while retaining the central theme of sacrifice
2. Write a short paragraph or poem that continues the story of the brook after the poem ends
3. Compose a piece of music inspired by the imagery and emotions conveyed in "The Brook"
4. Write a short essay discussing the potential long-term effects of Elon Musk's ventures on the global economy and society
5. Develop a concept for a new technology or project that aligns with Elon Musk's innovative spirit and goals

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Chairman
Board of Studies (B S & H)

BS 23BSX23 Chemistry 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	PO7	DoK
23BSX23.1	Compare types of polymers and their applications in various technological fields	3	2	1	L1 - L3
23BSX23.2	Interpret the Nernst equation for electrode potential and classify various types of energy storage devices	3	2	1	L1 - L3
23BSX23.3	Compare the molecular orbital energy level diagram of different molecular species	3	2	1	L1 - L3
23BSX23.4	Apply the principle of Band diagrams in the application of conductors and semiconductors.	3	2	1	L1 - L3
23BSX23.5	Explain the principles of spectrometry, chromotography in separation of solid and liquid mixture	3	2	1	L1 - L3

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Polymer Chemistry **9 Hours**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization with specific examples and mechanisms of polymer formation. Plastics –Thermo and Thermosetting plastics, preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6, 6, carbon fibres. Elastomers–Buna-S, Buna-N–preparation, properties and applications. Conducting polymers – polyacetylene, polyaniline–mechanism of conduction and applications. Bio-Degradable polymers-Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA). **COs: CO1**

Self – Learning Topic: Advanced polymer methods

Unit II: Electrochemistry and Applications **9 Hours**

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry-potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC) with examples. **COs: CO2**

Self – Learning Topic: Fundamentals and applications of electrochemistry

Unit III: Structure and Bonding Models **9 Hours**

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ2, applications to hydrogen,molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 andCO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order. **COs: CO3**

Self – Learning Topic: Shapes and significance of atomic orbitals

Unit IV: Modern Engineering materials **9 Hours**

Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic and colour. Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures. Supercapacitors: Introduction, Basic Concept-Classification – Applications. Nano chemistry: Introduction, classification of nanomaterials, properties and Quantum Dots, applications of Fullerenes, carbon nano tubes and Graphines nanoparticles. **COs: CO4**

Self – Learning Topic: Metal organic complexes

Unit V: Instrumental Methods of Chemical Analysis **9 Hours**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications **COs: CO5**

Self – Learning Topic: The fundamental principles of instrumental measurements

Board of Studies		Basic Science & Humanities (Chemistry)	
Approved in: BoS No. II		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Principles and methodologies involved in the manufacturing of different eco-friendly polymers, FRP materials	CO1	PO1, PO2, PO7
2	Demonstration on principles and applications of Chemical energy sources	CO2, CO3	PO1, PO2, PO7

Textbooks

1. Jain and Jain, "Engineering Chemistry", 16th Edition, Dhanpatrai Publications, 2013
2. Peter Atkins, Julio de Paula and James Keeler, Atkins "Physical Chemistry", 10th Edition, Oxford University Press, 2010
3. Shikha Agarwal., "Engineering Chemistry: Fundamentals and Applications",13th Edition, 2012

Reference Books

1. Lee J. D., "Concise Inorganic Chemistry", 5th Edition, Oxford University Press, 2008
2. Skoog and West, "Principles of Instrumental Analysis", 6th Edition, Thomson, 2007

Web References

1. http://link.springer.com/chemistry
2. http://www.thphys.chemistry.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	30
L2	50	50
L3	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is a polymer?
2. How do polymers dissolve in solvents?
3. Define thermoplastic polymers and give two examples
4. What are single electrode potentials?
5. What is electromagnetic spectrum?

L2: Understand

1. Explain the free radical polymerization mechanism
2. Differentiate between addition polymerization and condensation polymerization
3. Explain the standard electrode potential by taking calomel electrode as an example
4. Demonstrate one or two applications of Zinc-air cell with chemical equations
5. Demonstrate the construction, working principle and one or two applications of electrochemical sensor with a neat schematic diagram

L3: Apply

1. Why would it be desirable to synthesize a polymer with a high degree of crystallinity? You are working for a company that produce a small appliances that use gears. Originally theyare using metal gears but have now decided to use plasic gears. Is the decision is acceptable? Justify it
2. Based on everyday experience, name one method of corrosion protection which you have observed in use?
3. Various studies on the annual cost of corrosion always conclude that corrosion amounts to 3-5% of nations gross national product, no matter in what year the study was under taken. Does this means that corrosion science and engineering are not making any headway. Justify with your answer
4. Describe one aspect of the operation of a semiconductor using principles from chemistry (Ex: Intrinsic, Extrinsic)

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Chairman
Board of Studies (BS & H)

BS 23BSX11 Linear Algebra and Calculus 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	DoK
23BSX11.1	Solve homogenous & non- homogenous linear system of equations	3	2	L1 – L4
23BSX11.2	Use Cayley- Hamilton theorem to find inverse & powers of a matrix and identify the nature of the quadratic forms using eigen values and eigen vectors	3	2	L1 – L4
23BSX11.3	Solve a given inequality using mean value theorems	3	2	L1 – L4
23BSX11.4	Make use of functions of several variables which is useful in optimization	3	2	L1 – L4
23BSX11.5	Analyze double and triple integrals using Beta and Gamma functions	3	3	L1 – L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Solving Homogeneous and Non-Homogeneous Systems of linear equations **9 Hours**

Rank of a matrix by echelon form, normal form. Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method

COs: CO1

Self – Learning Topic: Rank by using minors

Unit II: Eigen Values and Eigen Vectors, Cayley - Hamilton theorem and Quadratic forms **9 Hours**

Eigen values, Eigen vectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

COs: CO2

Self – Learning Topic: Applications of Eigen Values and Eigen Vectors

Unit III: Calculus (Mean value theorems) **9 Hours**

Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems on the above theorems.

COs: CO3

Self – Learning Topic: Applications on the above theorems

Unit IV: Partial Differentiation and applications (Multi Variable Calculus) **9 Hours**

Partial Derivatives, Total derivatives, Chain Rule, Change of variables, Taylor's and Maclaurin's series expansion of functions ot two variables, Jacobians, maxima and minima of functions of two variables, method of lagrange multipliers.

COs: CO4

Self – Learning Topic: Jacobian of Implicit functions

Unit V: Beta and Gamma Functions & Multiple Integrals **9 Hours**

Gamma, Beta Functions and their Properties - Relation between Beta and Gamma Functions - Evaluation of Improper Integrals. Evaluation of Double triple Integrals - Direct Method

COs: CO5

Self – Learning Topic: Dirichlet's Integrals

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Introduction to MATLAB	CO1-CO5	PO2, PO5
2	Applications of Singular Value Decomposition	CO2	PO3

Text Books

1. Grewal, B. S. "Higher Engineering Mathematics", 44th Edition, 12th reprint, Khanna Publishers, 2022
2. Ramana, B. V. "Higher Engineering Mathematics",1st Edition, 35th Reprint,Tata McGraw Hill Education, 2019

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2021
2. Bali, N. P. "Engineering Mathematics",1st Edition, Lakshmi Publications, 2017
3. Peter O' Neil, "Advanced Engineering Mathematics",1st Edition, Cengage, 2010
4. Iyengar, T. K. V. Prasad, M. V. S. S. N., Ranganatham S. & B. Krishna Gandhi**,** "Engineering Mathematics – II", 3rd Edition, S. Chand Publications, 2020

Web References

1. http://nptel.ac.in/courses/
2. https://onlinecourses.nptel.ac.in
3. https://www.classcentral.com/course/swayam-basic-linear-algebra-13003
4. https://ocw.mit.edu/courses

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. State Cayley-Hamilton theorem
2. State Euler's theorem
3. Define the rank of a matrix
4. What is an orthogonal transformation?
5. What is the necessary condition for a non-homogenous system AX=B to be consistent
6. What is the index of a quadratic form?
7. State Rolle's Theorem

L2: Understand

1. Check whether x = r cosθ and y= r sinθ are functionally dependent.
2. Check the consistency of the system x+ y+ z =4, 2x+3y-2z=3, x+7y-7z=5
3. Find whether the homogenous system x+y-3z+2w=0,2x-y+2z-3w=0,3x-2y+z-4w=0,-4x+y-3z+w=0 possess a non-trivial solution
4. If $u= x^2+y^2+z^2$, v= xy + yz + zx, w = x + y + z, show that u, v, w are functionally dependent and find the relationship between them

5. Verify Rolle's theorem for $f(x) = (x+2)^3(x-3)^4$ in [-2,3]

L3: Apply

1. Find non-singular matrices P and Q such that PAQ is in the normal form for $A=\begin{bmatrix}\mathbf{2} & \mathbf{3} & \mathbf{-1}\\ \mathbf{0} & \mathbf{1} & \mathbf{2}\\ \mathbf{3} & \mathbf{-4} & \mathbf{-2}\end{bmatrix}$
2. Reduce the matrix A to echelon form where $A = \begin{bmatrix}\mathbf{1} & \mathbf{2} & \mathbf{4} & \mathbf{-3}\\ \mathbf{-2} & \mathbf{7} & \mathbf{5} & \mathbf{2}\\ \mathbf{4} & \mathbf{13} & \mathbf{0} & \mathbf{-4}\\ \mathbf{6} & \mathbf{5} & \mathbf{-3} & \mathbf{3}\end{bmatrix}$
3. Find the shortest distance from origin to the surface $xyz^2 = 2$
4. Find the points on the surface $z^2 = x\,y + 1$ that are nearest to the origin

L4: Analyze

1. Consider the matrix $A = \begin{bmatrix}2 & 0 & 0\\ -1 & 3 & 2\\ 1 & -1 & 0\end{bmatrix}$.If the characteristic polynomial of T is
   a. $C_T(\lambda) = (\lambda-1)^p(\lambda-1)^q$ then P =____q =_____
2. Find the minimal polynomial? what can be concluded from minimal polynomial?
3. Find a matrix S (if one exists) that diagonalizes [T]. What is the diagonal form of A of [T] produced
   i. by the matrix. **Answe**r: $S = \begin{bmatrix}a & b & a\\ b & b & -c\\ -b & a & b\end{bmatrix}$ then a =____ b =____ c =_____
4. The matrices $A = \begin{bmatrix}a & 1\\ -2 & d\end{bmatrix}$ and $B = \frac{1}{25}\begin{bmatrix}a & 1\\ -2 & d\end{bmatrix}$ have same Eigen values then find the values
   a. of **a** and **d**
5. 5.Consider the matrix $A = \begin{bmatrix}a & 1 & 1\\ 1 & a & 1\\ 1 & 1 & a\end{bmatrix}$ for what ranges of values of a the matrix is positive definite?
6. Compare Rolles theorem with LMVT and identify which is the the generalized onest
7. Test whether the pair of functions $\frac{x+y}{1-xy}$ and $tan^{-1}x + tan^{-1}y$ are functionally dependent and if so find the relation between them?

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Board of Studies (BS & H)

ES **23ESX01 Basics of Electrical and Electronics Engineering** **3 0 0 3**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23ESX01.1	Understand basic concepts of electrical circuits	3	2	-	1	L1, L2
23ESX01.2	Explain the operation of various machines and instruments	3	1	-	1	L1,L2
23ESX01.3	Understand the operation of different power plants	3	2	2	1	L1,L2
23ESX01.4	Analyze the working of electronic devices	3	-	-	1	L1 - L4
23ESX01.5	Examine the working of electronics circuits and devices	3	-	-	1	L1 - L4
23ESX01.6	Analyze various digital logic gates	3	2	2	1	L1 - L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: DC & AC Circuits **9 Hours**

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, voltage and current relationship with phasor diagrams in R, L, and C circuits, concept of Impedance, active power, reactive power and apparent power, concept and measurement of power factor (Simple numerical problems). **COs: CO1**

Self- Learning Topic: Applications of electrical circuits

Unit II: Machines and Measuring Instruments **9 Hours**

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge **COs: CO2**

Self - Learning Topic: Applications of electrical machines

Unit III: Energy Resources, Electricity Bill & Safety Measures **9 Hours**

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various power generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers. **COs: CO3**

Equipment Safety Measures: Working principle of fuse and miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, safety precautions to avoid shock.

Self - Learning Topic: Importance of electrical safety measures

Unit IV: Semiconductor Devices **9 Hours**

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN junction Diode — Zener Effect — Zener Diode and its characteristics. Bipolar Junction Transistor — CB, CE, CC configurations and characteristics — Elementary – Treatment of Small Signal Amplifier. **COs: CO4**

Self - Learning Topic: Applications of Zener diode

Unit V: Basic Electronic Circuits and Instrumentation **9 Hours**

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of

Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system. **COs:CO5**

Self - Learning Topic: Applications of rectifiers and amplifiers

Unit VI: Digital Electronics **9 Hours**

Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs). Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters. **COs: CO6**

Self - Learning Topics: Application of logic gates

Board of Studies		Electrical and Electronics Engineering	
Approved in: BoS No. VI		October 07, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Operation of Brush-less DC motor and its applications to industry	CO 2	PO1, PO2, PO3, PSO1
2	Operation of servo motor and its applications to industry	CO 2	PO1, PO2, PO3, PSO1

Text Books

1. Kulshreshtha D. C., "Basic Electrical Engineering", Revised 1st Edition, McGraw Hill, 2021
2. Rajendra Prasad, "Fundamentals of Electrical Engineering", 3rd Edition, PHI Publishers, 2020
3. Kotari D. P. and Nagrath I. J., "Basic Electrical Engineering", 3rd Edition ,Tata McGraw Hill, 2020
4. Boylestad R. L., & Louis Nashlesky, "Electronic Devices & Circuit Theory", Pearson Education, 2021

Reference Books

1. Mehta V. K. & Rohit Mehta, "Principles of Electrical Machines", 4th Edition, S. Chand Publications, 2019
2. Sedha R. S., "A Text Book of Electronic Devices and Circuits", 3rd Edition, S. Chand & Co., 2014
3. Madhu Sahu K. B., "Basic Electrical Engineering", 4th Edition, Scitech Publications (India) Pvt. Ltd., 2019
4. Paynter R. T., "Introductory Electronic Devices & Circuits – Conventional Flow Version", 2nd Edition, Pearson Education, 2009

Web References

1. https://www.classcentral.com/course/swayam-electrical-machines-iitd-14030
2. https://onlinecourses.nptel.ac.in/noc20_ee60/preview
3. https://onlinecourses.swayam2.ac.in/nou22_ec03/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	70	30
L3	-	30
L4	-	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

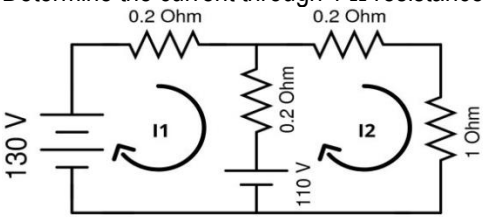
1. What is ohm's law?
2. Define RMS and peak values
3. What is form factor?
4. List any 2 types of rectifiers
5. List any 4 applications of operational amplifiers

L2: Understand

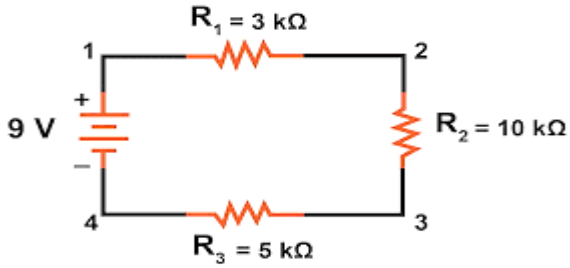
1. Explain in detail about Kirchhoff's current and voltage Law
2. Explain working principle of DC shunt generator
3. Explain the operation of single phase transformer

L3: Apply

1. Determine the current through 1 Ω resistance by using Kirchhoff's voltage law / Mesh analysis



2. By applying Kirchhoff's voltage law find current through R_3



L4: Analyze

1. Capacitors can be used for the filtering of ripples at the output of a rectifier. Suggest some other device which can work as a better filter
   a. Design the filter circuit
   b. Find the filter coefficients
   c. Analyse the form factor and ripple factor values of the rectifier by comparing them with the values of a rectifier which uses a capacitor for filtering
2. After completing the design and fabrication of an SSI-based digital system, a designer finds that one more inverter is required. However, the only spare gates in the system are a 2 input OR, a 3 input AND, and 2 input XNOR. How should the designer realize the inverter function without adding another IC?
3. For the manufacturing of a p-n junction diode we use either Germanium or Silicon semiconducting materials. Analyse the behaviour of a diode if it is made of a compound form of semiconducting materials like GaAs
   a. What change do you observe in the doping levels during the formation of p-region and n-region?
   b. What change do you observe in the V-I characteristics when compared with the characteristics of a conventional diode?

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Board of Studies (EEE)

PC **23EC201 Network Analysis** **3 0 0 3**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	PO3	DoK
23EC201.1	Demonstrate concept of network reduction techniques and theorems	3	3	2	L1 - L3
23EC201.2	Illustrate steady state analysis of AC circuits	3	2	2	L1 - L3
23EC201.3	Explain the effect of transients on electrical circuits	3	2	1	L1 - L3
23EC201.4	Interpret the concept of coupled and magnetic circuits	3	2	1	L1 - L3
23EC201.5	Illustrate different parameters on two port networks	3	2	1	L1 - L3

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Circuit Components and Theorems **9 Hours**

Types of circuit components, Types of sources and source transformations, mesh analysis and nodal analysis, problem solving with resistances only including dependent sources also. Principal of duality with examples.
Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens - problem solving using dependent sources also. **COs: CO1**

Self - Learning Topic: Series and Parallel R, L, C circuits

Unit II: Steady State Analysis of A.C Circuits **9 Hours**

Impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R, L, C, R-L, R-C, R-L-C, problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also. **COs: CO2**

Self - Learning Topic: Application of RC, RL circuits

Unit III: Transients **9 Hours**

First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation and AC excitation, Response as related to S plane rotation o roots **COs: CO3**
Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform.

Self - Learning Topic: Basic Homogeneous and Non Homogeneous equations

Unit IV: Resonance **9 Hours**

Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies. **COs:CO4**
Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

Self - Learning Topic: Series and parallel resonant circuit

Unit V: Two-port Networks **9 Hours**

Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, relationships between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also. **COs: CO5**
Image and iterative impedances. Image and iterative transfer constants. Insertion loss. Attenuators and pads.

Lattice network and its parameters.

Self - Learning Topic: Fundamentals of admittance and impedance

Board of Studies		Electrical and Electronics Engineering	
Approved in : BoS No. VI		October 07, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Affect of Ferranti effect on transmission lines	CO 5	PO1, PO2, PO3
2	Affect of resonance on networks	CO 4	PO1, PO2, PO3

Text Books

1. Sudhakar. A, Shyammohan S. Palli, "Circuits and Networks: Analysis and Synthesis", 5th Edition, Tata McGraw Hill, 2021
2. Hayt and Kimmarle, "Electric Circuit Analysis", 9th Edition, Tata McGraw Hill, 2020
3. Van Valkenburg M. E., "Network Analysis", 3rd Edition, Prentice Hall of India, 2021

Reference Books

1. David Irwin J., and Mark Nelms. R," Basic Engineering Circuit Analysis", 8th Edition, Wiley, India, 2021
2. John D Ryder, "Network Lines and Fields" 2nd Edition, Asia Publishing House, 2019

Web References

1. http://nptel.ac.in/courses/108/109/108/105/
2. https://onlinecourses.nptel.ac.in/102/105/106

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	30
L2	30	40
L3	50	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Differentiate between independent and dependent sources
2. State superposition theorem
3. State reciprocity theorem
4. List any two differences between RC and LC admittance functions

L2: Understand

1. Explain the Kirchhoff's current and voltage law
2. Explain the dot convention in coupled circuits
3. Explain parallel connection of 2 port networks
4. Explain co-efficient of coupling

L3: Apply

1. A coil having a resistance of 10 ohms and an inductance of 0.2 H is connected in series with a 100 μF capacitor are fed with 230 V, 50 Hz AC supply. Calculate (i) active and reactive components of current (ii) voltage across

the coil. Draw the phasor diagram

2. A constant inductance L is in parallel with a series R-C circuit in which R varies from zero to infinity. This combination is connected to a constant voltage, constant frequency supply. Show that the circuit takes a constant current from the source at all power factors between zero lagging and zero leading, if $X_c = X_L/2$. Draw the relevant locus diagram

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Board of Studies (EEE)

HS 23HSX02 Communicative English Lab 0 0 2 1

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	
		PO10	PO9
23HSX02.1	Recognize the various facets of English language ability, with a focus on LSRW abilities	3	1
23HSX02.2	Use numerous activities for language learners to practice communication skills	3	1
23HSX02.3	To improve listening and speaking comprehension, analyze the sounds, stress, rhythm, intonation, and syllable division of English speech	3	1
23HSX02.4	Assess your professionalism when taking part in group discussions and debating	3	1
23HSX02.5	Develop compelling messaging and get ready for upcoming interviews	3	1

List of Experiments

1. Vowels & Consonants **COs: CO1,CO2**
2. Neutralization/Accent Rules **COs: CO1,CO2**
3. Communication Skills & JAM **COs: CO3,CO4**
4. Role Play or Conversational Practice **COs: CO3,CO4**
5. E-mail Writing **COs: CO4,CO5**
6. Resume Writing, Cover letter, SOP **COs: CO4,CO5**
7. Group Discussions-methods & practice **COs: CO4,CO5**
8. Debates- Methods & Practice **COs: CO4,CO5**
9. PPT Presentations/ Poster Presentation **COs: CO4,CO5**
10. Interviews Skills **COs: CO4,CO5**

Reference Books

1. Meenakshi Raman, Sangeeta-Sharma, 4th Edition, Technical Communication, Oxford Press, 2022
2. Grant Taylor: English Conversation Practice, 1st Edition,Tata McGraw-Hill Education India, 2001
3. Hewing's, Martin, Cambridge Academic English (B2), Cambridge University Press, 2012
4. Balasubramanyam T., A Text Book of English Phonetics for Indian Students, 3rd Edition, Trinity, 2022

Suggested Software

- Walden Infotech
- Young India Films

Web Resources

Spoken English

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent

12. https://www.youtube.com/user/letstalkaccent/videos
13. https://www.youtube.com/c/EngLanguageClub/featured
14. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
15. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

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Board of Studies (BS & H)

BS 23BSX24 Chemistry Lab 0 0 2 1

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	
		PO1	PO4
23BSX24.1	Determine the free ions in conductance of solutions	3	3
23BSX24.2	Analyze the various spectral of some organic compounds	3	3
23BSX24.3	Prepare advanced polymer materials	3	3
23BSX24.4	Measure the strength of an acid present in secondary batteries	3	3
23BSX24.5	Illustrate the functioning of the instruments such as Potentiometric meters	3	3

List of Experiments

1.	Estimation of Ferrous Iron by Dichrometry	**COs: CO1-CO3**
2.	Conductometrictitration of strong acid Vs. strong base	**COs: CO1,CO5**
3.	Conductometrictitration of weak acid Vs. strong base	**COs: CO1,CO5**
4.	Determination of copper (II) using standard hypo solution (Iodimetric titration)	**COs: CO1-CO3**
5.	Potentiometry - determination of redox potentials and emfs	**COs: CO1,CO5**
6.	Determination of Strength of an acid in Pb-Acid battery	**COs: CO1,CO4**
7.	Preparation of a Bakelite	**COs: CO3**
8.	Measurement of 10Dq by spectrophotometric method	**COs: CO2**
9.	Verify Lambert-Beer's law	**COs: CO2**
10.	Wavelength measurement of sample through UV-Visible Spectroscopy	**COs: CO2**
11.	Identification of simple organic compounds by IR	**COs: CO2**
12.	Preparation of nanomaterials by precipitation method	**COs: CO3**

References

1. Mendham J., Denney R. C., Barnes J. D., Thosmas M. and Siva Sankar B. Vogel's "Quantitative Chemical Analysis" 6th Edition, Pearson Publishers, 2000
2. Lab Manual for Chemistry, Department of Basic Science and Humanities, NSRIT, 2023

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Board of Studies (BS & H)

ES **23ESX04 Electrical and Electronics Engineering Workshop** **0 0 3 1.5**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		
		PO1	PO2	PO4
23ESX04.1	Verify Kirchhoff's laws and theorems	3	2	3
23ESX04.2	Determine various parameters of electrical measuring instruments	3	2	3
23ESX04.3	Determine the basic characteristics of electrical machines	3	2	3
23ESX04.4	Illustrate the characteristics of various electron devices	3	2	3
23ESX04.5	Examine the operation of a logical circuit	3	2	3

List of Experiments

Part-A: Basic Electrical Engineering Lab

1. Verification of KCL and KVL **COs: CO1**
2. Verification of superposition theorem **COs: CO1**
3. Measurement of resistance using Wheat Stone bridge **COs: CO2**
4. Magnetization characteristics of DC shunt generator **COs: CO3**
5. Conduct brake test on DC shunt motor **COs: CO3**
6. Speed control of DC shunt motor by field and armature control **COs: CO3**
7. Perform Swinburne's test on DC machine **COs: CO3**
8. Measurement of power and power factor using single - phase wattmeter **COs: CO2**
9. Measurement of earth resistance using Megger **COs: CO2**
10. Calculation of electrical energy for domestic premises **COs: CO2**

Part-B: Basic Electronics Engineering Lab

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias **COs: CO4**
2. Plot V-I characteristics of Zener diode and its application as voltage regulator **COs: CO4**
3. Implementation of half wave and full wave rectifiers **COs: CO4**
4. Plot input & output characteristics of BJT in CE and CB configurations **COs: CO4**
5. Frequency response of CE amplifier **COs: CO4**
6. Simulation of RC coupled amplifier with the design supplied **COs: CO5**
7. Verification of truth table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs **COs: CO5**
8. Verification of truth tables of S-R, J-K& D flip flops using respective ICs **COs: CO5**

Web References

1. https://www.vlab.co.in/broad-area-electrical-engineering

References

1. Kulshreshtha D. C., "Basic Electrical Engineering", Revised 1st Edition, McGraw Hill, 2021
2. Sedha R. S., "A Text Book of Electronic Devices and Circuits", 3rd Edition, S. Chand & Co, 2014
3. Lab Manual for "Electrical and Electronics Engineering Workshop", Department of Electrical and Electronics Engineering & Department of Electronics and Communication Engineering, NSRIT

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Board of Studies (EEE)

PC **23EC202 Network Analysis and Simulation Lab** **0 0 3 1.5**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		
		PO1	PO2	PO4
23EC202.1	Verify Kirchhoff's laws and network theorems	3	2	3
23EC202.2	Calculate time constants of RL & RC for first and second order systems	3	2	3
23EC202.3	Illustrate frequency response of RL, RC networks	3	2	3
23EC202.4	Determine Q factor and bandwidth for resonant circuit	3	2	3
23EC202.5	Verify various two port network parameters	3	2	3

List of Experiments

1. Study of components of a circuit and Verification of KCL and KVL **COs: CO1**
2. Verification of mesh and nodal analysis for AC circuits **COs: CO1**
3. Verification of Superposition, Thevenin's & Norton theorems for AC circuits **COs: CO1**
4. Verification of maximum power transfer theorem for AC circuits **COs: CO1**
5. Verification of Tellegen's theorem for two networks of the same topology **COs: CO1**
6. Study of DC transients in RL, RC and RLC circuits **COs: CO2**
7. To study frequency response of various 1st order RL & RC networks **COs: CO3**
8. To study the transient and steady state response of a 2nd order circuit by varying its various parameters and studying their effects on responses **COs: CO2**
9. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit **COs: CO4**
10. Determination of open circuit (Z) and short circuit (Y) parameters **COs: CO5**
11. Determination of hybrid (H) and transmission (ABCD) parameters **COs: CO5**
12. To measure two port parameters of a twin-T network and study its frequency response **COs: CO5**

Web References

1. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/?sub=1&brch=75

References

1. Sudhakar. A, Shyammohan S. Palli, "Circuits and Networks: Analysis and Synthesis", 5th Edition, Tata McGraw Hill, 2021
2. Hayt and Kimmarle, "Electric Circuit Analysis", 9th Edition, Tata McGraw Hill, 2020
3. Lab Manual for "Network Analysis", Department of Electrical and Electronics Engineering, NSRIT

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SOC 23SOC01 IT Workshop

0 0 2 1

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
23SOC01.1	Perform Hardware troubleshooting	3	2	-	-	2	2	1
23SOC01.2	Explain the world wide web and Internet	3	2	2	-	2	2	2
23SOC01.3	Develop a working knowledge of HTML, CSS	2	2	-	-	3	2	2
23SOC01.4	Demonstrate the usage of MS-Word, MS-Excel spreadsheets	3	3	3	2	3	2	2
23SOC01.5	Show the use of MS-PowerPoint for presentations and experiment with ChatGPT AI tool	3	2	2	1	3	2	2

List of Experiments

PC Hardware **COs: CO1**

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web **COs: CO2**

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

HTML and Introduction to CSS **COs: CO3**

Task 1: Coding Basics: Introduction to HTML syntax, HTML, head, title, & body tags headings, paragraphs, & lists, strong & em tags, doctype, lang attribute, meta tag & Unicode character set

Task 2: Coding Links: Absolute & Relative URLs, Anchor tags & hrefs Linking to other websites, Linking to pages within a website Opening a link in a new browser window/tab

Task 3: Adding Images: Break tag, image tag & source attribute using the width, height, & alt attributes, using horizontal rules

Task 4: Introduction to Cascading Style Sheets (CSS): Style tag, tag selectors, font-size, font-family, color, & line-height properties, hexadecimal color codes

WORD **COs: CO4**

Task 1: Creating project abstract Features to be covered: Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 2: Creating a Newsletter: Features to be covered: Table of Content, Newspaper columns, Images from files and clipart, drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel **COs: CO4**

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered: Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP **COs: CO4**

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

Power point **COs: CO5**

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI Tools – ChatGPT **COs: CO5**

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model

completes them.
Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3.1: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.
Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Task 3.2: Futuristic Predictions: Have fun by asking the model to predict future technological advancements, societal changes, or even hypothetical scenarios. Compare its responses with your own ideas.
Ex: Prompt: "Predict how artificial intelligence will transform everyday life in the next 20 years."

References

1. Vikas Gupta, "Comdex Information Technology Course tool Kit", 6th Edition, Dreamtech Press, 2005
2. Cheryl A. Schmidt, "The Complete Computer Upgrade and Repair Book", 3rd Edition, Dreamtech Press, 2002
3. ITL ESL, "Introduction to Information Technology", 2nd Edition, Pearson, 2012
4. Kate J. Chase, "PC Hardware and A+ Handbook", Microsoft Press, 2004
5. Lab Manual for IT-Workshop, Department of Computer Science & Engineering, NSRIT

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Board of Studies (CSE)

CSP **23CSP01 NSS /NCC /Scouts & Guides /Community Service Project** **0 0 1 0.5**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		
		PO7	PO8	PO12
23CSP01.1	Understand the importance of discipline, character and service motto	3	1	1
23CSP01.2	Outline the needs and problems of the community	3	1	1
23CSP01.3	Solve some societal issues by applying acquired knowledge, facts, and techniques	3	2	1
23CSP01.4	Explore human relationships by analyzing social problems	2	1	1
23CSP01.5	Determine to extend their help for the fellow beings and downtrodden people	2	2	1

Unit I: Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance. **3 Hours**

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc. **COs: CO1**
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

Unit II: Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition. **3 Hours COs: CO2**
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.

Write a summary on any book related to environmental issues

Unit III: Community Service **3 Hours**

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc. **COs: CO3**
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs, etc.

General Guidelines

1. Institutes must assign slots in the Timetable for the activities
2. Institutes are required to provide instructor to mentor the students

Assessment Pattern

1. Evaluated for a total of 100 marks
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject

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Board of Studies (B S & H)

BS 23BSX31 Engineering Physics 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	PO7	DoK
23BSX31.1	Choose the experimental evidence of wave nature of light to understand interference in thin films, diffraction and polarization	3	2	1	L1 - L3
23BSX31.2	Apply the laws of physics, classify various types of lasers & optical fibers	3	2	1	L1 - L3
23BSX31.3	Interpret the concepts and applications of magnetic and dielectric materials	3	2	1	L1 - L3
23BSX31.4	Identify and summarize the crystal structures and XRD techniques	3	2	1	L1 - L3
23BSX31.5	Interpret the microscopic behaviour of matter with quantum mechanics, summarise various types of solids based on band theory and identify the type of semiconductor using Hall effect	3	2	1	L1 - L3

All the COs are mapped to PO12 as few self-learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Wave Optics **9 Hours**

Interference: Introduction**,** Interference in thin films by reflection–Newton's rings (Theory, Experimental study), applications (wavelength of a source and refractive index of a liquid). Diffraction: Concept of diffraction difference between Fresnel's and Fraunhofer diffraction-Fraunhofer diffraction at single slit (quantitative), diffraction at double slit Diffraction grating. Raleigh's criteria, Resolving Power of grating. Polarization: Types of polarization, polarization by reflection, refraction and Double refraction–Nicol's prism construction and working Wave plates: half wave plate and quarter wave plate **COs: CO1**

Self – Learning Topic: Young's double slit experiment

Unit II: Lasers and Fiber Optics **9 Hours**

Laser: Concept of laser, Characteristics of laser, Spontaneous and Stimulated emission of radiation, Einstein's Coefficients, pumping mechanisms, Ruby laser, Helium Neon Laser-Applications of Laser (Communications, R&D, Medicinal, etc.)

Fiber Optics: Introduction to Optical fiber, Principle and structure of optical fiber, classification of optical fibers (based on modes and refractive index profile). Acceptance angle, Acceptance cone Numerical Aperture-Applications of optical fiber. (Communications, Medicinal etc.) **COs: CO2**

Self – Learning Topic: Concepts of 3 level and 4 level LASER systems

Unit III: Magnetic Materials and Dielectric Materials **9 Hours**

Introduction, magnetic dipole moment, Magnetic Susceptibility-Magnetic permeability–Classification of Magnetic materials–Dia, Para, Ferro, Weiss Domain theory(qualitative) Hysteresis curve, Soft and Hard magnetic materials–Applications. Dielectric Materials: Dielectric Polarization–Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic, Ionic and Orientational polarizations (qualitative), Lorentz internal field (qualitative), Claussius-Mossoti Equation-Applications of dielectrics **COs: CO3**

Self – Learning Topic: Relation between D, E and P & Dielectric losses

Unit IV: Crystallography and X-Ray Diffraction **9 Hours**

Crystallography: Introduction, Space lattice, Basis, Unit cell, Bravais lattices–Crystal systems–structures and packing fractions of SC, BCC and FCC X-Ray Diffraction: Directions and planes in crystals–Miller indices–Separation between successive (h k l) planes–Bragg's law. Bragg's spectrometer, X-ray diffraction methods (powder and Laue) **COs: CO4**

Self – Learning Topic: Concept of Brillouin zones

Unit V: Quantum Mechanics and Semiconductor Physics **9 Hours**

Quantum Mechanics: Introduction De-Broglie's concept of Matter waves–Physical significance of wave function-Schrodinger Time Independent and time dependent wave equations–Particle in a one-dimensional potential box Semiconductor physics: Origin of energy band formation in solids, classification of materials into conductors, semiconductors and insulators using band diagram, Intrinsic and Extrinsic semiconductors. Hall Effect, Hall coefficient and applications of Hall Effect **COs: CO5**

Self – Learning Topic: Density of states - Fermi energy

Board of Studies		Basic Science & Humanities (Physics)	
Approved in: BoS No. II		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	LASER as a source in optical fiber communications	CO2	PO1, PO2, PO7
2	Merits and demerits of X-ray diffraction	CO4	PO1, PO2, PO7

Text Books

1. Avadhanulu M. N. & K Shirasagar P.G., "A Text Book of Engineering Physics", 1st Edition S. Chand Publications, 2011
2. Palanisamy P. K., "Engineering Physics", 4th Edition ,SciTech Publishers, 2014
3. Pillai S.O., "Applied Physics", 2nd Edition, New Age international Publishers, 2008

Reference Books

1. Charles Kittle, "Introduction to solid state physics", 5th Edition ,Willey India Pvt. Ltd., 2012
2. Arumugam M., "Applied Physics", 4th Edition , Anuradha Agencies, 2013
3. Bhattacharya D. K., "Engineering Physics", 2nd Edition , Oxford University Press, 2010
4. Sanjay D Jain and Girish G Sahasrabudhe "Engineering Physics", 1st Edition ,University Press, 2010
5. Pandey B. K. & Chaturvedi S., "Engineering Physics", 1st Edition, Cengage Learning, 2012
6. Srinivasan M. R., "Engineering Physics", 2nd Edition , New Age international Publishers, 2014

Web References

1. http://link.springer.com/physics
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com
5. https://nptel.ac.in

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	50	50
L3	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define interference
2. Define types of polarization
3. State Dielectric polarization and electric susceptibility
4. Define types of polarization in dielectrics
5. Define Spontaneous emission of radiation

L2: Understand

1. Explain the construction and working principle of Nicol's prism
2. Demonstrate working principle of He-Ne laser with energy level diagram
3. Outline de Broglie concept of matter waves
4. Discuss polarization by reflection
5. Explain the Raleigh's criteria

L3: Apply

1. Suggest a dielectric material with high dielectric constant, high operating voltage range and also which can be eco friendly for the preparation of a capacitor. Justify your answer
2. Suggest a soft magnetic material with low retentivity and coercivity, and also which can be eco friendly for the preparation of an electromagnet. Justify your answer
3. Even though based on quantum mechanical principles quantum free theory is a partly successful theory. Justify the statement

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BS 23BSX12 Differential Equations and Vector Calculus 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	PO5	DoK
23BSX12.1	Solve the first order differential equations related to various engineering fields	3	2	1	L1 - L4
23BSX12.2	Solve the second order differential equations related to various engineering fields	3	2	1	L1 - L4
23BSX12.3	Identify solution methods for partial differential equations that model physical processes	3	2	1	L1 - L4
23BSX12.4	Apply Gradient, Divergence, Curland Laplacian to scalar and vector point functions	3	2	1	L1 - L4
23BSX12.5	Interpret Gradient, Directional Derivative, Divergence, Curl and Green's, Stoke's and Gauss theorems	3	2	1	L1 - L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Differential Equations of First Order and first degree **9 Hours**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits, Orthogonal trajectories

COs: CO1

Self – Learning Topic: Orthogonal trajectories

Unit II: Linear differential equations of higher order (Constant Coefficients) **9 Hours**

Linear differential equations, linear differential equations with constant coefficients, The operator D, the inverse operator $\frac{1}{D}$, $\frac{1}{D-a}$, $\frac{1}{D+a}$, Homogeneous & Non-Homogeneous Differential equations, Complimentary Function, Particular Integral, General solution, Wronskian, Method of Variation of parameters, Applications to L-C-R circuit problems

COs: CO2

Self – Learning Topic: Simple Harmonic motion

Unit III: Partial Differential equations **9 Hours**

Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

COs: CO3

Self – Learning Topic: Classification of second order partial differential equations

Unit IV: Vector Differentiation **9 Hours**

Scalar and vector point functions, vector operator del, del applied to scalar point functions - Gradient, del applied to vector point functions-Divergence and Curl, Laplacian operator, vector identities (without proofs).

COs: CO4

Self – Learning Topic: Geometrical meaning of all operators

Unit V: Vector Integration **9 Hours**

Line integral – circulation - work done, surface integral - flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

COs: CO5

Self – Learning Topic: Applications of the above theorems

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Solving one-dimensional wave equation and two-dimensional equations using MATLAB	CO3	PO1, PO2, PO5
2	Applications of vector calculus in different branches of Engineering	CO4	PO1, PO2

Text Books

1. Grewal B. S., "Higher Engineering Mathematics", 44th Edition,12th Reprint, Khanna Publishers, 2022
2. Ramana B. V.,"Higher Engineering Mathematics",1st Edition, 35th Reprint, Tata McGraw Hill Education, 2019

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics",10th Edition, Wiley India, 2021
2. Bali N .P., "Engineering Mathematics",1st Edition, Lakshmi Publications, 2017
3. Peter O' Neil, "Advanced Engineering Mathematics",1st Edition, Cengage Publications, 2010
4. Iyengar T. K. V., Prasad M. V. S. S. N., Ranganatham S. and Krishna Gandhi B., "Engineering Mathematics - I", 2nd Revised Edition, S. Chand Publications, 2021
5. Iyengar T. K. V., Prasad M. V. S. S. N., Ranganatham S. and Krishna Gandhi B., "Engineering Mathematics - III", 8th Revised Edition, S. Chand Publications, 2020

Web References

1. http://nptel.ac.in/courses/
2. https://onlinecourses.nptel.ac.in
3. https://nptel.ac.in/courses/111/108/111108144/
4. https://ocw.mit.edu/courses

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define a partial differential equation
2. What is a Bernoulli's equation?
3. What is the general form of Leibnitz's equation in y?
4. What is the sufficient condition for the exactness of Mdx+Ndy=0
5. Solve the PDE z=px+qy-2√pq
6. Solve(D^2+2DD1+1)z=0
7. Find the unit normal vector at (1,2,2) to the surface $\mathbf{x^2 + y^2 + z^2}$= 9
8. Define a line integral and explain its significance in physics or engineering contexts
9. Define a homogeneous linear partial differential equation with constant coefficients

L2: Understand

1. Solve $(D^2-DD1+D1-1)z= \cos(x+2y)+e^{y-x}$
2. Find the directional derivative of the function $\emptyset = xy^2 + yz^3$ at the point (2,-1,1) in the direction of the normal to the surface x logz − y2 + 4 = 0 at (-1,2,1)
3. If $F=x^2yz$, G= xy -3z² Then find div(grad F x grad G)
4. Find the surface integral of F = xyi + z²j + 2yzk over the tetrahedron bounded by x=0, y=0, z= 0 and the plane x+ y+ z =1
5. Solve Dx + $2\mathbf{D}'$u = u, u (x ,0) = 6 $\mathbf{e^{-3x}}$ by the method of separation of variables
6. Solve $(1+y^2)$ dx +$(x-e^{\tan^{-1}x})$ dy=0
7. Solve (D^2+3D+2) y = 4 cos2x
8. Explain the process of forming a partial differential equation by eliminating arbitrary constants and arbitrary functions from a given expression
9. Explain how the Wronskian is used to determine linear in dependence of solutions
10. Explain the geometric interpretation of the dot product and cross product of two vectors. How are these operators used in vector calculus

L3: Apply

1. Find the area of the circle $x^2+ y^2 =a^2$ using double integral in polar coordinates
2. Find the volume of the sphere $x^2 +y^2+z^2=a^2$ using spherical coordinates
3. Find by double integration the area lying between the parabolas $y^2=4ax$ and $x^2=4ay$
4. Find the scalar potential of the vector F= (x^2-yz) i + (y^2-zx) j + (z^2-xy)k, if exists
5. Evaluate by Gauss divergence theorem $F=(x^3-yz)$i−2x²yj−zk taken over the surface of the cube formed by the planes $x=y=z=a$
6. Analyze the implications of having complex roots in the characteristic equation of a second order differential equation
7. Given the PDE $\boldsymbol{u_x}$ + 2$\boldsymbol{u_x}$ =0, solve it using Lagrange's method to find the general solution

L4: Analyze

1. If f(x, y, z) $= 4x^2$+7xy +3xz^2, what is the direction in which the function f(x, y, z) increases more rapidly at the point P=(1.0.2)
2. List some physical examples of scalar and vector fields
3. From Stoke's theorem, analyze the form of Green's function for a curve lying in
   i. xy - plane ii. zx - plane
4. Asses the circulation of the field F = yī + (x+2y) j̄ around the closed path $x^2 +y^2=4$ where circulation in counter clockwise direction
5. Evaluate $\int(x + \sqrt{y})$ dS along a curve C, where c is given by C = $C_1 + C_2$ such that $C_1 = \{x = t. y = t2\}$ from (0,0) to (1,1) and $C_2 = \{x = t. y = t\}$ from (1,1) to (0,0)

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Board of Studies (BS & H)

ES 23ESX02 Introduction to Programming 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs					DoK
		PO1	PO2	PO3	PSO1	PSO2	
23ESX02.1	Illustrate basics of computers, problem solving approach and algorithmic thinking	3	3	2	3	2	L1, L2
23ESX02.2	Demonstrate the control structures, branching and looping statements	3	3	3	3	2	L1 – L3
23ESX02.3	Make use of arrays, pointers and string fundamentals	3	3	3	3	2	L1 – L3
23ESX02.4	Develop Modular program aspects in solving complex problems	3	3	3	3	2	L1 – L3
23ESX02.5	Identify the use of userdefined data types and files	3	3	3	3	2	L1 – L3

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Programming and Problem Solving **9 Hours**

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem. Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

COs : CO1

Self - Learning Topics: Compilation and Interpretation

Unit II: Basics of C Programming **9 Hours**

Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion. Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else-if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

COs: CO2

Self - Learning Topic: Escape Sequence

Unit III: Arrays, Pointers and Strings **9 Hours**

Introduction, Operations on Arrays, Two Dimensional Arrays, Multidimensional Arrays. Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer. Strings: String Fundamentals, String handling functions.

COs: CO3

Self - Learning Topic: String pattern matching

Unit IV: Functions **9 Hours**

Introduction to Function: Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Arrays as Function Arguments, Pointers as Function Arguments, Command Line Arguments, Variable Storage Classes. Recursion.

COs: CO4

Self - Learning Topic: Implementation of recursion

Unit V: User Defined Data types, File Handling **9 Hours**

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type — Enum variables, Using Typedef keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

COs: CO5

Self - Learning Topics: Binary files and operations on binary files

Board of Studies		Computer Science and Engineering	
Approved in: BoS No. VI		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs / PSOs**
1	Logic building using C Programming	CO1 – CO6	PO1, PO2, PO3, PO12, PSO1, PSO2
2	Real time applications of C Proramming	CO2 – CO6	PO1, PO2, PO3, PO12, PSO1, PSO2

Text Books

1. Behrouz A. Forouzan., Richard F. Gilberg, "A Structured Programming Approach Using C", 3rd Edition, Cengage, 2007
2. Dromey R. G., "How To Solve It By Computer", 1st Edition, Pearson Education, 2014
3. Byron Gottfried, "Programming with C", 3rd Edition, Tata McGraw Hill, 2017
4. Herbert Schildt, "C The Complete Reference", 4th Edition, TMH, 2017
5. Ajay Mittal, "Programming In C A-Practial Approach", 1st Edition, Pearson, 2010

Reference Books

1. Balagurusamy E., "Computing fundamentals and C Programming", 2nd Edition, McGraw-Hill Education, 2017
2. Rema Theraja, "Programming in C", 2nd Edition,OUP India, 2016
3. Prasad F. E. V, "C Programming: A Problem-Solving Approach", Giliberg, Cengage Learning, 2010
4. Yashavant Kanetkar, "Let Us C", 16th Edition, BPB, 2017

Web References

1. https://www.geeksforgeeks.org/c-programming-language
2. https://www.tutorialspoint.com/cprogramming/index.html
3. https://www.javatpoint.com/c-programming-language-tutorial

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	30	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What do you mean by flowchart?
2. What are the components in the flowchart?
3. What are various storage classes in C?
4. What is a string?
5. Write a C program to copy one string to another
6. Write a C program to read and display the content of a file
7. What is recursive function?
8. What are the constraints for defining a recursive function with an example?
9. Why switch statement is more advantageous than nested if-else statement?
10. What is meant by a variable in C programming?
11. Write a C program to count number of vowels and consonants in a string using pointers

L2: Understand

1. Explain about enumerated types with example
2. Explain counter controlled and exit controlled loops with examples
3. Write a program to compare two strings for equality without using strcmp() function
4. Demonstrate about declaration and initialization of string in C. How strings are displayed with different formats? Explain with examples
5. Illustrate a C program to find the sum of first and last digit of a number
6. Illustrate a C program to merge two files into single file
7. Explain different looping statement with syntax and example
8. Explain function prototype and different methods to call the function
9. Explain in detail about array of structure and pointer to structure with example
10. Discuss the usage of bitwise logical operators used in C? Compare them from logical operators with suitable program
11. Explain about call by value and call by reference with reference to functions with example
12. Explain the term dynamic memory allocation and the terms malloc(), calloc() and realloc() functions

L3: Apply

1. Write a C program to check whether the given number is palindrome or not
2. Write a C program to solve the factorial of a given number using for loop
3. Write an algorithm, flowchart and pseudo code to identify largest of given 3 numbers using conditional operator
4. Write a C program to perform the operation of multiplication of two matrices
5. Write a C program to interchange the largest and smallest elements in an array
6. Write a C program by applying pointers to count number of vowels and consonants in a string
7. Write a C program to select any arithmetic operations using switch cases
8. Write a C program to find given number is Armstrong or not
9. Write a C program to check whether the given string is palindrome or not
10. List file handling functions. Utilize file handling functions with an example
11. Design a modular banking application using C programme that can facilitate transactions such as deposit and withdrawal of funds
12. How can you design an efficient algorithm to generate a list of the first n prime numbers? Can you analyse the time complexity of your algorithm? Implement and test your program to ensure it works correctly for a range of input values
13. Write a C program that finds the second largest element in an array of integers. Explain how you handle different cases such as empty array, array with only one element, array with duplicate elements, etc
14. Write a C program that simulates a simple calculator that can perform addition, subtraction, multiplication, and division operations on two operands. Explain how you handle user input, error checking, and precedence of operators
15. Write a C program that reads a text file and counts the number of words, lines, and characters in it. Explain how you handle different types of delimiters and end-of-file conditions

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Chairman
Board of Studies (CSE)

ES 23ESX03 Basics of Civil and Mechanical Engineering 3 0 0 3

At the end of the course, student will be able to

Code	Course Outcomes	Mapping with POs PO1	Mapping with POs PSO1	DoK
23ESX03.1	Comprehend the evolution of civil engineering, scope, functions and various building elements and materials	3	2	L1, L2
23ESX03.2	Demonstrate the principles of surveying	3	2	L1, L2
23ESX03.3	Calculate the required quantity of water and the purification process involved, solid waste management along with the sewage systems	3	2	L1, L2
23ESX03.4	Outline the role of mechanical engineering in the society and study of various metals and materials	3	2	L1, L2
23ESX03.5	Demonstrate the different manufacturing process, working principles of thermal systems	3	2	L1, L2
23ESX03.6	Illustrate the working principles of various power plants, Power transmission systems and fundamentals of robotics	3	2	L1, L2

All the COs are mapped to PO12 as few self-learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Civil Engineering **9 Hours**

History and development of civil engineering – scope for the civil engineering – Functions of civil engineering. Characteristics of good building materials like stone, brick, tile, timber, cement aggregate and concrete. General concepts relating to Buildings: Selection of site – Basic functions of buildings – Major components of buildings. Foundations - Purpose of a foundation – Bearing capacity of soils – types of foundations and their uses.

COs: CO1

Self - Learning Topic: Representation of the building plan

Unit II: Surveying **9 Hours**

Surveying: Definition and purpose – classification – Basic principles – Measurement of length by chains and tapes – Calculation of area of a plot – Introduction to Bearings, basic problems of Bearing - Levelling instruments used for levelling, calculation of the instrument height. Types of Highways, Types of pavements, Cross-section of the pavements, Camber

COs: CO2

Self - Learning Topics: Rise & fall method, Materials used for the various pavements

Unit III: Water supply & Sanitary Engineering **9 Hours**

Sources of water supply – Quantity of water requirements – Purification of water involving sedimentation, filtration and disinfection. Definition of terms – Collection and disposal of solid wastes – Sewage systems – Septic tanks – Oxidation ponds.

COs: CO3

Self - Learning Topics: Methods of water distribution, types of filters

Unit IV: Introduction to Mechanical Engineering **9 Hours**

Role of mechanical engineering in industries and society - Technologies in different sectors such as energy, Manufacturing, Automotive, Aerospace, and Marine sectors.
Engineering Materials – Metals - Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

COs: CO4

Self - Learning Topic: Nanomaterials

Unit V: Manufacturing Processes & Thermal Engineering **9 Hours**

Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.
Thermal Engineering – Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning

COs: CO5

cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

Self - Learning Topic: Surface finishing

Unit VI: Power plants, mechanical power transmission and Robotics **9 Hours**

Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants.
Mechanical Power Transmission **-** Belt Drives, Chain, Rope drives, Gear Drives and their applications.
Introduction to Robotics – Joints & links, configurations, and applications of robotics. **COs: CO6**

Self - Learning Topic: Kinematics of robotics

Board of Studies		Civil Engineering & Mechanical Engineering	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Importance of the safe bearing capacity of soils	CO1	PO1, PO7
2	Real time applications of mechanical systems	CO4 - CO6	PO1

Text Books

1. Shanmugam G. and Palanisamy M. S., "Basic Civil and the Mechanical Engineering", 4th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2013
2. Bhavikatti S. S.," Basic Civil Engineering", 3rd Edition, New Age International Publishers, 2022
3. Ganesan V., "Internal Combustion Engines", Tata McGraw Hill Publications (India) Pvt. Ltd., 2017
4. Rattan S. S., "A Tear book of Theory of Machines", Tata McGraw Hill Publications, (India) Pvt. Ltd., 2012

Reference Books

1. Punmai B. C.," Surveying Volume-1", 16th Edition, Laxmi Publications Pvt Ltd, 2006
2. Duggal S. N., "Environmental Engineering-1", 8th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2013
3. Appuu Kuttan K. K, "Robotics" Volume-I, 1st Edition, I. K. International Publishing House Pvt. Ltd., 2013
4. Jyothish Kumar L, Pulak M Pandey, "3D printing & Additive Manufacturing Technology", 2nd Edition, Springer Publications, 2018
5. Mahesh M Rathore, "Thermal Engineering", 5th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2010
6. Rao P. N, "Manufacturing Technology" – Vol. 1, 4th Edition, Tata McGraw Hill publications (India) Pvt. Ltd., 2017
7. Rao P. N, "Manufacturing Technology" – Vol. 2, 4th Edition, Tata McGraw Hill publications (India) Pvt. Ltd., 2018

Web References

1. https://www.youtube.com/watch?v=f2uuyKh02n4
2. https://www.youtube.com/watch?v=jdVgwbXZef8
3. https://nptel.ac.in/courses/112/103/112103019/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	60	60
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the properties of good stone?
2. What are the basic principles of surveying?
3. What are the sources of water supply?
4. What are ferrous metals?
5. List any two joining process
6. Define Robot
7. What is meant by pulverization?

L2: Understand

1. Identify the requirements in the selection of site for a construction
2. Illustrate the way to find the levels at various points of the plain area which is irregular in shape
3. Demonstrate the procedure which you want to follow in collecting and disposing the waste in your own community
4. How to calculate the area for the given plot by the use of conventional practice?
5. How to calculate the quantity of water requires for the given area?
6. Explain the role of mechanical engineer in manufacturing industry
7. Classify various engineering materials
8. Compare two stroke and four stroke IC engines
9. Explain the working principle of Hydro - electric power plant
10. Differentiate between two stroke and four stroke engines
11. Explain the working of overfeed and underfeed fuel beds
12. Explain the auxiliaries of a diesel power plant with neat sketch

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Chairmans
Board of Studies (CE & ME)

BS 23BSX32 Engineering Physics Lab 0 0 2 1

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO4
23BSX32.1	Relate the principle of physics in engineering field and compare the results with theoretical calculations	3	3
23BSX32.2	Demonstrate modern engineering physics techniques and tools in real time applications in engineering studies	3	3
23BSX32.3	Develop the laboratory skills in handling of electrical and optical instruments	3	3
23BSX32.4	Demonstrate the interference and diffraction phenomena of light	3	3
23BSX32.5	Analyse the effect of sound on physical parameters	3	3

List of Experiments

1.	Determination of Radius of Curvature of Plano Convex Lens by Newton's rings	**COs: CO1-CO4**
2.	Determination of wavelength of a source using Diffraction Grating Normal incidence method	**COs: CO1-CO4**
3.	Determination of thickness of thin Object- Air wedge method	**COs: CO1-CO4**
4.	Determination of wavelength of Laser source	**COs: CO1-CO4**
5.	Verify the relation between frequency and volume- Using Volume resonator	**COs: CO1,CO5**
6.	Determination of Rigidity modulus of material (wire)- (torsional pendulum)	**COs: CO1,CO2**
7.	Verify magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus	**COs: CO1-CO3**
8.	Determination of dispersive power of prism	**COs: CO1-CO3**
9.	Determine acceleration due to gravity and radius of gyration using compound pendulum	**COs: CO1,CO2**
10.	To find the Energy Band gap of a Semiconductor using p - n junction	**COs: CO1-CO3**
11.	Study the characteristics of a Thermistor and obtain its temperature coefficient	**COs: CO1-CO3**
12.	Determination of dielectric constant using charging discharging method	**COs: CO1-CO3**
13.	Determination of resolving power of a grating	**COs: CO1-CO4**
14.	Verification of laws of stretched string by using Sonometer	**COs: CO1,CO5**
15.	Estimation of Planck's constant using photo electric effect	**COs: CO1-CO4**
16.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve)	**COs: CO1-CO4**
17.	Verification of Brewster's law	**COs: CO1,CO2, CO4**
18.	Determination of frequency of electrically maintained tuning fork by Melde's experiment	**COs: CO1-CO3**

Note: In the above experiments at least 10 assessment experiments should be completed in a semester, out of which 2 experiments may be conducted in virtual mode

References

1. Balasubramanian S., Srinivasan M. N. ,"A Text Book of Practical Physics"- S. Chand Publishers, 2017
2. Lab Manual for Engineering Physics, Department of Basic Science and Humanities, NSRIT, 2023

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Board of Studies (BS & H)

ES **23ESX06 Engineering Workshop** **0 0 3 1.5**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1
23ESX06.1	Demonstrate the workshop tools and their operational capabilities	1
23ESX06.2	Employ workshop tools for various joints and fitting.	1
23ESX06.3	Interpret the development of sheet metal using tin smithy tools	1
23ESX06.4	Illustrate the house wiring	1
23ESX06.5	Make use of moulding tools prepare a pattern	1

List of Experiments

Student shall **do two experiments** from five trades

Demonstration: Safety practices and precautions to be observed in workshop.

1	Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints. a) Half –Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint	**COs:CO1, CO2**
2	Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets. a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing	**COs:CO1, CO2**
3	Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises. a) V-fit b) Dove tail fit c) Semi-circular fit d) Bicycle tyre puncture and change of two-wheeler tyre	**COs:CO1, CO2**
4	Electrical Wiring: Familiarity with different types of basic electrical circuits and make the following connections. a) Parallel and series b) Two-way switch c) Go-down lighting d) Tube light e) Three phase motor f) Soldering of wires	**COs:CO1, CO3**
5	Foundry Trade: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.	**COs:CO1, CO4**

Add-on Experiments

1	Welding Shop: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint	**COs: CO1**
2	Plumbing: Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters	**COs: CO1**

References

1. Lab Manual for Engineering Workshop, Department of Mechanical Engineering, NSRIT

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Chairman
Board of Studies (ME)

ES **23ESX07 Engineering Graphics** **1 0 3 3**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO10	PSO1	DoK
23ESX07.1	Demonstrate the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.	3	3	2	L1 - L3
23ESX07.2	Construct the orthographic projections of points and lines in front and top views.	3	3	2	L1 - L3
23ESX07.3	Construct the systems of projection of planes and solids with respect to the observer, object and the reference planes	3	3	2	L1 - L3
23ESX07.4	Develop the concepts of sectional views to represent details of solids in simple positions.	3	3	2	L1 - L3
23ESX07.5	Develop the ability to draw isometric views and orthographic views and should be able to convert isometric views to orthographic views and vice versa.	3	3	2	L1 - L3

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction of Geometrical Constructions **9 Hours**

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

COs: CO1

Self - Learning Topic: Construct polygons by special methods

Unit II: Introduction of Orthographic Projections **9 Hours**

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

COs: CO2

Self - Learning Topic: Traces of lines

Unit III: Projections of Planes and Solids **9 Hours**

Projections of planes: Regular planes perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes

Projections of solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of solids with axis inclined to one reference plane and parallel to other

COs: CO3

Self - Learning Topic: Auxiliary views of planes

Unit IV: Projection and Section of solids **9 Hours**

Projections of Solids Projection of Solids with axis inclined to one reference plane and parallel to other Sections of Solids**:** Perpendicular and inclined section planes, Sections of solids in simple position only. **COs: CO4, CO5**

Self - Learning Topic: Development of surfaces

Unit V: Conversion of Views **9 Hours**

Conversion of Views: Conversion of isometric views to orthographic views and vice versa.

Computer graphics: Creating 2D & 3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination). **COs: CO5**

Self - Learning Topic: Isometric Projection

Board of Studies		Mechanical Engineering	
Approved in: BoS No. VI		October 07, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Real time applications of engineering graphics	CO4 - CO5	PO1, PO10
2	Spatial Visualization	CO4 - CO5	PSO1

Text Books

1. Bhatt N.D.," Engineering Drawing", 53rd Edition, Chariot Publications, 2018
2. Agarwal and Agarwal," Engineering Drawing", 3rd Edition, Tata McGraw Hill Publishers, 2017
3. Sham Tickoo," Auto CAD 2017", Engineers & Designers", 23rd Edition, Dream tech Press, 2016

Reference Books

1. Narayana K. L. and Kannaiah P.," Engineering Drawing", 5th Edition, Scitech Publishers, 2017
2. Varghese P.I," Engineering Graphics", Mc Graw Hill Publishers, 2013
3. Venugopal K. Prabhu Raja V.," Engineering Drawing + Auto Cad", 5th Edition, New Age Publications, 2011

Web References

1. https://nptel.ac.in/courses/112/103/112103019/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	10
L2	40	30
L3	40	60
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

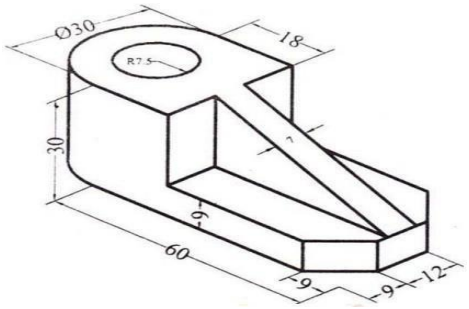
1. Divide a straight-line AB of 60 mm long into eight numbers of equal parts
2. How to draw an Octagon given the length of side 25 mm
3. Draw an equilateral triangle of 75 mm side and inscribe a circle in it
4. Show a regular pentagon in a circle of 100 mm diameter

L2: Understand

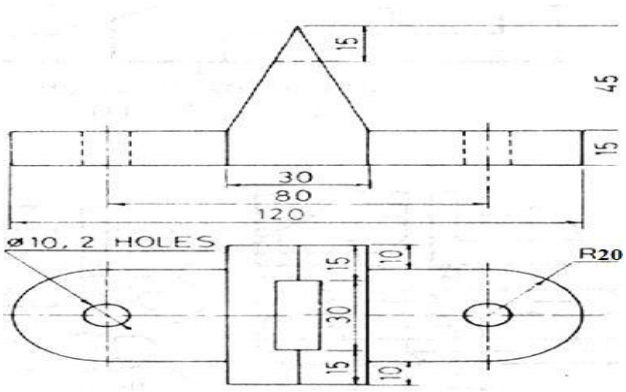
1. Cconstruct a cycloid for a generating circle of radius 30 mm. Also draw a tangent and normal at any point on the cycloid
2. A line AB is on HP and its one end A is 20 mm in front of VP. The line makes an angle of 45° with VP and its front view is 60 mm long. Draw the projections of the line and determine the true length
3. A regular hexagon of 40 mm side has a corner in the HP. Its surface inclined at 45° to the HP. And the top view of the diagonal through the corner which is in the HP. makes an angle of 60° with the VP. Demonstrate its projections
4. A pentagonal pyramid has an edge of the base in the VP and inclined at 30° to the HP, while triangular face containing that edge makes an angle of 45° with the VP. Illustrate the three views of the pyramid. Length of side of the base is 30 mm, while that of the axis is 65 mm

L3: Apply

1. A thin circular plate of 45mm diameter with its centre 35 mm above HP and 40 mm in front of VP is perpendicular to VP and inclined to HP at angle of 30°. Develop the projections of the plate
2. A square pyramid of base 40 mm and height 60 mm is on HP with one of its base edges so that the axis is making 45° with HP and the base edge making 30° with VP. Construct the projections
3. Construct a scale of 1.5 inches = 1 foot to show inches and long enough to measure up to 4 feet
4. Draw (i) Front View (ii) Top View (iii) Left Hand Side View



5. Build the Isometric view



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Chairman
Board of Studies (ME)

ES 23ESX05 Computer Programming Lab 0 0 3 1.5

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
23ESX05.1	Demonstrate the use of basic language features	2	2	2	1	3	2	1
23ESX05.2	Apply the right control structure for solving the problem	3	3	3	3	3	3	2
23ESX05.3	Implement simple programs to solve computing problems using user defined functions	3	3	3	3	3	3	2
23ESX05.4	Develop programs using arrays and pointers	3	3	3	3	3	3	2
23ESX05.5	Experiment with user defined data types and file operations	3	3	3	3	3	3	2

List of Experiments

1. Write C programs to familiarization with programming environment **COs: CO1**
2. Write simple C programs with printf(), scanf() functions **COs: CO1**
3. Write C programs to simple computational problems using arithmetic expressions **COs: CO1**
4. Write C programs to computational problems using the operator' precedence and associativity **COs: CO1**
5. Write C programs involving if-then-else structures **COs: CO2**
6. Write C programs on while and for loops **COs: CO2**
7. Write C programs on 1D array manipulation, linear search **COs: CO4**
8. Write C programs on matrix, string operations **COs: CO4**
9. Write C programs on functions, call by value, scope and extent **COs: CO3**
10. Write C programs to implement recursive functions **COs: CO3**
11. Write C programs on simple functions using call by reference, dangling pointers **COs: CO4**
12. Write C programs on pointers, structures and dynamic memory allocation **COs: CO4**
13. Write C programs on bitfields, self-referential structures **COs: CO4**
14. Write C programs to implement file operations **COs: CO5**
15. Domain Specific Applications
    - (i) Write a program to implement employee management system **COs: CO5**
    - (ii) Write a program to implement election system **COs: CO4**
    - (iii) Calculate the Eluer's load for a column with various end conditions **COs: CO2**
    - (iv) Calculate the Shear force and Bending Moments for a beam under the various loading condition **COs: CO2**
    - (v) Write a C program for resolution of forces **COs: CO3**
    - (vi) Write a C program for calculation of coefficient of discharge **COs: CO2**
    - (vii) Write a C program to find the efficiency of the DC motor for different values of time T **COs: CO2**
    - (viii) Write a C program to derive the transfer function of a DC motor for given values **COs: CO2**

Exercise problems

1. Basic Linux environment and its editors like Vi, Vim & Emacs etc.
2. Exposure to Turbo C, gcc
3. Writing simple programs using printf(), scanf()
4. Write a C program to find sum and average of 3 numbers

5. Conversion of Fahrenheit to Celsius and vice versa
6. Simple interest calculation
7. Finding the square root of a given number
8. Finding compound interest
9. Area of a triangle using heron's formulae
10. Distance travelled by an object
11. Evaluate the following expressions
    a. A+B*C+(D*E)+F*G
    b. A/B*C-B+A*D/3
    c. A+++B---A
    d. J= (i++)+(++i)
12. Find the maximum of three numbers using conditional operator
13. Take marks of 5 subjects in integers, and find the total, average in float
14. Write a C program to find the max and min of four numbers using if-else
15. Write a C program to generate electricity bill
16. Find the roots of the quadratic equation
17. Write a C program to simulate a calculator using switch case
18. Write a C program to find the given year is a leap year or not
19. Find the factorial of given number using any loop
20. Find the given number is a prime or not
21. Compute sine and cos series
22. Checking a number palindrome
23. Construct a pyramid of numbers
24. Find the min and max of a 1-D integer array
25. Perform linear search on 1D array
26. The reverse of a 1D integer array
27. Find 2's complement of the given binary number
28. Eliminate duplicate elements in an array
29. Addition of two matrices
30. Multiplication two matrices
31. Write a C program to concatenate two strings without built-in functions
32. Write a C program to find reverse a string using built-in and without built-in string functions
33. Write a C function to calculate NCR value
34. Write a C function to find the length of a string
35. Write a C function to transpose of a matrix
36. Write a C function to demonstrate numerical integration of differential equations using Euler's method
37. Write a recursive function to generate Fibonacci series
38. Write a recursive function to find the lcm of two numbers
39. Write a recursive function to find the factorial of a number
40. Write a C program to swap two numbers using call by reference
41. Demonstrate Dangling pointer problem using a C program
42. Write a C program to copy one string into another using pointer
43. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers
44. Write a C program to find the sum of a 1D array using malloc()
45. Write a C program to find the total, average of n students using structures
46. Enter n students data using calloc() and display failed students list
47. Write a C program to implement realloc()
48. Read student name and marks from the command line and display the student details along with the total marks
49. Create and display a singly linked list using self-referential structure
50. Demonstrate the differences between structures and unions using a C program
51. Write a C program to shift/rotate using bitfields
52. Write a C program to copy one structure variable to another structure of the same type
53. Write a C program to write and read text into a file
54. Write a C program to write and read text into a binary file using fread() and fwrite()
55. Write a C program to copy the contents of one file to another file

56. Write a C program to merge two files into the third file using command-line arguments
57. Write a C program to find no. of lines, words and characters in a file
58. Write a C program to print last n characters of a given file

References

1. Ajay Mittal, “Programming in C – A Practical Approach”, 1st Edition, Pearson, 2010
2. Behrouz A. Forouzan, Richard F. Gilberg, “A Structured Programming Approach Using C”, 3rd Edition, Cengage, 2007
3. Forouzan, Gilberg, Prasad, "C Programming: A Problem - Solving Approach", 1st Edition, Cengage Learning, 2011
4. Lab Manual for Computer Programming, Department of Computer Science & Engineering, NSRIT

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Chairman
Board of Studies (CSE)

Wellness **23WLP01 Health And Wellness, Yoga and Sports** **0 0 1 0.5**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		
		PO2	PO7	PO12
23WLP01.1	Be physical fit to perform daily routine without undue fatigue	3	1	1
23WLP01.2	Be mentally alert and socially cohesive	3	1	1
23WLP01.3	Consider success and failure equally	3	2	1
23WLP01.4	Develop positive personality	2	1	1
23WLP01.5	Improve leadership qualities	2	2	1

Unit I: Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups. **3 Hours**

Activities

i) Organizing health awareness programmes in community
ii) Preparation of health profile **COs: CO1**
iii) Preparation of chart for balance diet for all age groups

Unit II: Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation,stress management and yoga, Mental health and yoga practice. **3 Hours**

Activities

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar **COs: CO2**

Unit III: Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games. **3 Hours**

Activities

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.Practicing general and specific warm up, aerobics **COs: CO3**
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running

General Guidelines

1. Institutes must assign slots in the timetable for the activities of Health/Sports/Yoga
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students

Assessment Pattern

1. Evaluated for a total of 100 marks
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject

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Chairman
Board of Studies (B S & H)

BS 23BSX15 RANDOM VARIABLES AND STOCHASTIC PROCESSES 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	PO1	PO2	DoK
23BSX15.1	Mathematically model the random phenomena and solve simple probabilistic problems	3	2	L1 –L4
23BSX15.2	Identify different types of random variables and compute statistical averages of single random variable.	3	2	L1 – L4
23BSX15.3	Understand multiple random variable concepts, compute statically average of multiple random variables	3	2	L1 –L4
23BSX15.4	Characterize the random processes in the time	3	2	L1 – L4
23BSX15.5	Characterization in frequency domain and analyze the LTI systems with random inputs.	3	3	L1 – L4
All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning				

Unit I:	**The Random Variable**	**9 Hours**
Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Conditional Distribution, Conditional Density, Properties. *Self Learning Topic: Rayleigh distribution*		**COs: CO1**
Unit II:	**Operations on One Dimensional Random Variable –Expectations**	**9 Hours**
Introduction, Expected Value of a Random Variable, function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, , Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable. *Self Learning Topic: , Non-monotonic Transformations of Continuous Random Variable,* Chebyshev's Inequality		**COs: CO2**
Unit III:	**Multiple Random Variables & Operations on Multiple Random Variables**	**9 Hours**
Vector Random Variables,Joint Distribution Function,Properties of Joint Distribution,Marginal Distribution Functions ,Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables,Central Limit Theorem:Unequal Distribution, Equal Distributions. Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, properties, Transformations of Multiple Random Variables *Self Learning Topic:* N Random Variables case		**COs: CO3**
Unit IV:	**Random Processes–Temporal Characteristics**	**9 Hours**
The Random Process Concept, Classification of Processes, Deterministic and Non deterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, Nth-order and Strict- Sense Stationarity, Time Averages and Ergodicity, Auto correlation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions. *Self Learning Topic: Poisson Random Process, Gaussian Random Processes*		**COs: CO4**
Unit V:	**Random Processes-Spectral characteristics, Linear Systems With Random Inputs**	
The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Auto correlation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power		**9 Hours**

Density Spectrum and Cross-Correlation Function.Random Signal Response of Linear Systems:System Response–Convolution,Mean and Mean-squared Value of System Response, Auto correlation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response	
Self LearningTopic: Cross-Power Density Spectra of Input and Output.	**COs: CO5**

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in : BoS No.		IV	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Descriptive statistics Using MATLAB	CO1-CO5	PO2, PO5
2	Time Series Analysis using R	CO2	PO3

Textbooks

1. Probability, Random Variables & Random Signal Principles, PeytonZ.Peebles, TMH,4th Edition,2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI,4th Edition,2002.
3. Probability and Random Processes with Applications to Signal Processing, Henry Stark and JohnW.Woods, Pearson Education, 3rd Edition, 2001.

Reference Books:

1. Schaum's Outline of Probability, Random Variables,and Random Processes,1997.
2. An Introduction to Random Signals and Communication Theory, B.P.Lathi, International Textbook, 1968.
3. Probability Theory and Random Processes, P.Ramesh Babu, McGrawHill, 2015.

Online Learning ResourcesWeb References:

4. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf
5. https://onlinecourses.nptel.ac.in/noc20_cs82/preview
6. https://archive.nptel.ac.in/courses/111/106/111106086/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define Random Variable
2. How to find skewness by moments
3. State Central Limit Theorem
4. What is stationary random process
5. Write any two properties of power spectrum density

.**L2: Understand**

1. Assume that the height of clouds above the ground at some locaction is a Gaussian random variable X with a_X =1830m and σ_X = 460m. Find the probability that clouds will be higher than 2750m(about 9000ft)
2. What are the properties of joint distribution function
3. Let X be a random variable that has mean value $\overline{X}$=E[X] =3 and variance $\sigma^2{}_X$ = 2 find the second moment of X about the origin
4. A wide-sense stationary noise process $N(t)$ has an auto-correlation function $R_{NN}(\tau) = Pe^{-3|\tau|}$ where P is a constant .Find power spectrum?
5. Suppose b is a positive constant and we test the function $g(x,y) = \begin{cases} be^{-x}cosy, 0 \le x \le 2 \text{ and } 0 \le y \le \frac{\pi}{2} \\ 0 \qquad \text{all other } x \text{ and } y \end{cases}$

   Check whether it is a valid probability density function?

L3: Apply

1.A jopint space of two random variables X and Y has four elements (1,1),(2,2),(3,3),(4,4).Probabilities of these elements are 0.1,0.35,0.05,and 0.5 respectively.
(a) Determine the through logic and sketch the distribution function of $F_{X,Y}(x,y)$
(b) Find the probability of the event $\{X \le 2.5, Y \le 6\}$
(c) Find the probability of the event $\{X \le 3\}$
2.Consider random processes $X(t) = A\cos(\omega_0 t + \Theta)$ and $Y(t) = B\cos(\omega_1 t + \phi)$ Where A,B, ω_0, ω_1 are constants ,while Θ, ϕ are statistically independent random variables each uniform on $(0, 2\pi)$
(a) show that $X(t)$ and $Y(t)$are jointly wide-sense stationary
(b) If $\Theta = \phi$ show that $X(t)$ and $Y(t)$ are not jointly wide-sense stationary unless $\omega_0 =, \omega_1$

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Chairman,

Board of Studies

HS

23HSX03 Universal Human Values

2 1 0 3

Version 01.00

Pre-requisite: -

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs			DoK
		PO8	PO9	PO10	
23HSX03.1	Develop holistic vision of life	3	2	1	L1, L2, L3
23HSX03.2	Improve socially responsible behavior	3	2	1	L1, L2, L3
23HSX03.3	Familiarize environmentally responsible work	3	2	1	L1, L2, L3
23HSX03.4	Develop ethical human conduct	3	2	1	L1, L2, L3
23HSX03.5	Identify Competence and Capabilities for Maintaining Health and Hygiene	3	2	1	L1, L2, L3
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning					

Unit I	**Introduction to Value Education**	**9 hours**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations Practice Session: Sharing about Oneself, Exploring Human Consciousness, Exploring Natural Acceptance		**COs: CO1**
Unit II	**Harmony in the Human Being**	**9 hours**
Understanding Human being as the Coexistence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health Practice Session: Exploring the difference of Needs of Self and Body, Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body		**COs: CO2**
Unit III	**Harmony in the Family and Society**	**9 hours**
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order Practice Session: Exploring the Feeling of Trust, Exploring the Feeling of Respect, Exploring Systems to fulfill Human Goal		**COs: CO3**
Unit IV:	**Harmony in the Nature/Existence**	**9 hours**
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence Practice Session: Exploring the Four Orders of Nature, Exploring Co-existence in Existence		**COs: CO4**
Unit V	**Implications of the Holistic Understanding – a Look at Professional Ethics**	**9 hours**
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession Practice Session: Exploring Ethical Human Conduct, Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order		**COs: CO5**

Board of Studies		BASIC HUMANITIES AND SCIENCES	
Approved in : BoS No.		IV	
Approved in : ACM No.		IX	
Expert talk		COs	POs
1	Seminar with Socialists	CO1	PO8

Text Books

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1. The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2. The Teacher's Manual Teachers'**:** Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book)
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
6. Small is Beautiful - E. F Schumacher

Internal Assessment Pattern

CognitiveLevel	InternalAssessment#1(%)	InternalAssessment#2(%)
L1	20	20
L2	50	50
L3	30	30
Total(%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Value education?
2. Write any two naturally accepted situations as your real-life experiences.
3. What is the basic unit of human interaction?
4. What is self-regulation?

L2: Understand

1. Briefly explain the self-exploration as the process for value education.
2. Explain the basic unit of interaction.
3. Explain 'respect' as the right evaluation.

L3: Apply

1. Discuss the role of a family dynamics play in shaping an individual's understanding of values and holistic well-being.
2. In what aways can holistic understandings of societal issues influence the values we prioritize as individuals and communities?
3. Discuss how can educational institutions integrate value-based teachings to cultivate a holistic understanding of societal harmony within students?

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Chairman Board of Studies

PC **23EC303 Signals and Systems** **3 0 0 3**

Version 01.00

Pre-requisite: Basic Mathematics

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with Pos			DoK
		PO1	PO2	PSO2	
23EC303.1	Define the mathematical model of continuous / Discrete time signals and systems	2	3	3	L1, L2
23EC303.2	Determine and analyze the output response of LTI systems	2	3	3	L1 - L3
23EC304.3	Derive the frequency domain representation of signals and systems	2	3	3	L2 - L4
23EC305.4	Determine the output response of continuous time/ discrete time LTI systems	2	3	3	L2 - L4
23EC306.5	Understand the conditions under which a band-limited signal can be sampled and perfectly reconstructed from its samples.	2	3	3	L2 - L4

Unit I:	**Signals & Systems**	**9 hours**
Definition of signal & system, basic operations on signals, classification of signals, basic continuous time signals and continuous time systems, classification of discrete time signals and systems. Analogy between vectors and signals, Orthogonality, mean square error, complete set of orthogonal functions. Vector spaces, Inner Product spaces, Schwartz inequality, Hilbert spaces, Bessel's inequality and Parseval's relations.		**COs: CO1**
Unit II:	**Linear Time Invariant (LTI) Systems**	**9 hours**
Time-Domain representation & Characterization of LTI systems, Impulse response representation, Convolution integral & Convolution sum, properties of LTI systems, Stability criteria for LTI systems, Elements of Continuous time & Discrete-time LTI systems. Circular Convolution. Concepts of Correlation of signals, properties, applications.		**COs: CO2**
Unit III:	**Fourier Representation of Signals**	**9 hours**
Fourier representation of Signals, Continuous -time Fourier series and their properties, Application of Fourier series to LTI systems, Fourier Transform & its properties, Applications of Fourier Transform to LTI systems, Discrete-time Fourier Transform & its properties, Relationship to other transforms. Hilbert transform and its properties.		**COs: CO3**
Unit IV:	**Laplace Transform and Z-Transforms**	**9 hours**
Laplace Transforms: Introduction & Definition, Region-of- convergence, Properties of Laplace transform, Inverse Laplace Transform, Applications of Laplace Transform in analysis of LTI systems, Unilateral Laplace transform & its applications to solve differential equations, Analysis of Electric circuits. **Z-Transform:** The Z-Transform, Region-of-convergence, properties of Z-Transform, Inverse Z-Transform, Transform Analysis of Discrete-time LTI systems, Unilateral Z-Transform & its applications to LTI systems described by difference equations.		**COs: CO4**
Unit V:	**Sampling**	**9 hours**
Graphical & Analytical proof of Band-limited signals, Low pass and band pass sampling theorems, sampling and reconstruction of band limited signals, Aliasing, Anti-aliasing filter, Illustrative Problems.		**COs: CO5**

Board of Studies	ECE	
Approved in: BoS No.	VII	
Approved in: ACM No.	IX	
Expert talk (To be delivered by SMEs from industries)	COs	POs
1		
2		

Textbooks

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", 2nd Edition, PHI, 2009.
2. Signals, Systems & Communications - B.P. Lathi, B S Publications, 2003.
3. S.Haykin and B.VanVeen "Signals and Systems, Wiley, 1998.

Reference Books

1. Signals and Systems – K Deergha Rao, Springer International Edition, 2018.
2. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press, 2015
3. Hwei Hsu, "Schaum's Outline of Signals and Systems", 4thEdition, TMH, 2019.
4. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.

Web References

1. https://www.tutorialspoint.com/dip/signals_and_system_introduction
2. https://web.stanford.edu/~boyd/ee102/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/lecture-notes/
4. https://nptel.ac.in/courses/117101055

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	30	30
L3	20	20
L4	30	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define and sketch sinusoidal signal
2. Define Signal and System
3. What are orthogonal functions?
4. Define Hilbert transform of a signal x (t)
5. Recall Direchlet's conditions
6. State differentiation in time domain property of Fourier transforms
7. List any three properties of convolution Integral
8. When is a function x(t) said to be Laplace transformable?

L2: Understand

1. Explain, how Impulse Response and Transfer Function of a LTI system are related?
2. Compare Laplace, Fourier and z- transforms
3. Summarize the properties of ROC of Laplace Transform
4. Relate rise time and Bandwidth
5. Organise the continuous time version of a sinusoidal signal and bring out the relation between sinusoidal and complex exponential signals
6. List the advantages and Limitations of Laplace transform
7. Obtain the Fourier transform of the unit step function
8. Obtain the Laplace transform of the signal x (t) $=e^{-at}$ u (t) + e^{-bt} u(-t)
9. Interpret the scaling and time shifting properties of Laplace transform

L3: Apply

1. Build the relation between unit step and signum functions
2. Develop Square wave from time shifting property of unit step signal
3. Develop relation between Rise time and Bandwidth
4. Compare one-sided and two-sided z-transforms and its region of convergence
5. Solve the Laplace transform and ROC of $x(t) = e^{-5t}[u(t) - u(t-5)]$
6. Make use of Convolution property, develop discrete signals from continuous time signals
7. Develop Fourier transform from Fourier Series
8. Express complex exponential Fourier coefficients in terms of trigonometric Fourier coefficient

L4: Analyze

1. Explain briefly the extraction of a signal from noise by filtering
2. Compare impulse sampling, natural sampling and flat top sampling with relevant diagrams
3. Outline differentiation property of Fourier transform
4. Obtain the Fourier transform of the impulse function δ(t)
5. Explain the aliasing effect using relevant diagrams and suggest remedies to avoid aliasing
6. Analyse the autocorrelation function and energy spectral density function of $x(t) = e^{-at}u(t)$
7. Examine the relationship between autocorrelation function and energy spectral density of an energy signal

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Chairman Board of Studies

PC 23EC304 Electronic Devices and Circuits

3 0 0 3
Version 01.00

Pre-requisite: Basics of Electrical and Electronics Engineering

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23EC304.1	Explain the operation and characteristics of PN junction diode and special diodes	3	-	-	3	L1, L2
23EC304.2	Compute the flow of current in different configurations of the transistor	3	3	3	3	L2, L3, L4
23EC304.3	Design using different FET Transistors	3	3	3	3	L1, L2
23EC304.4	Demonstrate the concept of DC biasing and transistor stabilization leading to the design of amplifiers	3	3	3	3	L2, L3, L4
23EC304.5	Analyz small signal low frequency transistor amplifiers	3	3	3	3	L2, L3, L4

Unit I:	**P-N Junction Diode Characteristics**	**9 hours**
Qualitative theory of the p-n junction, open circuited p-n Junction, the p-n junction as a Diode, Diode act as a Rectifier, V-I characteristics and its temperature dependence, the current components in a p-n Diode, Diode Resistance and Diode Capacitance, piece-wise linear model, Diode current equation, Quantitative analysis of Half-wave and Full-wave Rectifiers with and without filters, Breakdown mechanisms, Zener diode, Zener diode as a voltage Regulator, LED, LCD, photo diode, solar cell.		**COs: CO1**
Unit II:	**Bipolar Junction Transistor (BJT) Characteristics**	**9 hours**
The junction transistor-construction, symbols and operation, transistor current components, transistor current equation, transistor configurations, characteristics of CB, CE and CC configurations and their comparison, the early effect, punch through/reach through, transistor as an amplifier, Ebers-Moll model of a transistor, large signal, dc and small signal CE values of current gain, analytical expressions for transistor characteristics, typical transistor-junction voltages, transistor as a switch, transistor switching times, maximum voltage rating, photo transistor.		**COs: CO2**
Unit III:	**Field Effect Transistor (FET) Characteristics**	**9 hours**
The Junction Field-effect Transistor (JFET)-types, construction and operation, the pinch-off voltage, JFET characteristics, JFET parameters, JFET equivalent circuits, JFET applications, comparison between BJT and JFET, Metal-oxide-Semiconductor FET (MOSFET)- types, Construction, operation and characteristics, comparison between JFET and MOSFET, introduction to MOS, CMOS and Bi-CMOS logics, nMOS, CMOS and Bi-CMOS inverter circuits and their operation.		**COs: CO3**
Unit IV:	**Transistor Biasing and Thermal Stabilization**	**9 hours**
Need for biasing, the operating point, load line analysis, BJT biasing- methods, fixed bias, collector to base bias, self-bias, bias stability, stabilization against variations in VBE, IC, and β, stability factors, (S, S', S''), bias compensation, thermal runaway, thermal stability, Biasing of FETs, Introduction to two-port network, transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier using h-parameters (exact analysis & approximate analysis).		**COs: CO4**
Unit V:	**Small Signal Transistor Amplifier Circuits**	**9 hours**
Low Frequency BJT & FET Amplifier Circuits: Analysis of CB, CE and CC amplifiers using h-parameter model, comparison of BJT transistor amplifiers, FET small signal model, analysis of CG, CS and CD amplifiers, comparison of FET amplifiers. High Frequency BJT & FET Amplifier Circuits: Transistor at high frequencies, Hybrid- π model, Hybrid-π conductance's, Hybrid-π capacitances, Hybrid-π parameters in terms of h-parameters, CE short circuit current gain, current gain with resistive load, high frequency analysis of FET common source and common drain amplifier circuits.		**COs: CO5**

Board of Studies		ECE	
Approved in: BoS No.		VII	
Approved in: ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Integrated Electronics – JacobMillman, C. Halkias, C.D.Parikh , Tata Mc-Graw Hill Education (India) Private Limited, Second Edition, 2011.
2. Electronic Devices and Circuits- J. Millman, C. Halkias, Mc-Graw HillEducation (India) Private Limited, Fourth Edition, 2015.

Reference Books

3. Electronic Devices and Circuits- S Salivahanan, N Suresh Kumar, Tata Mc-Graw Hill, Third Edition, 2012.
4. Electronic Devices and Circuit Theory-R.L. Boylestad and LouisNashelsky, Pearson Publications, Tenth Edition.

Web References

1. www.elprocus.com/p-n-junction-diode-theory-and-working/
2. http://fourier.eng.hmc.edu/e84/lectures/ch4/node3.html
3. http://nptel.ac.in/courses/117103063/11

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	30	30
L3	30	30
L4	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define cut-in Voltage.
2. What is diffusion capacitance?
3. What is break down voltage?
4. List any three applications of SCR
5. Define pinch off voltage
6. What is rectifier?
7. Define ripple factor
8. Give any two applications of full wave rectifier
9. Give the classification of filters
10. Write any two disadvantages of half wave rectifier

L2: Understand

1. Draw and explain V-I characteristics of PN junction diode

2. Describe the construction and operation of tunnel diode
3. With neat circuit diagram describe the operation of bridge rectifier
4. Explain why Zener diode is used in reverse bias with the help of characteristics
5. Draw and explain the input and output Characteristics of Common base configuration
6. With neat sketches explain the V-I characteristics of NPN transistor in common emitter configuration
7. Write a short note on (i) Thermal Runaway (ii) Thermal stability
8. Explain the Drain and transfer characteristics of n-Channel JFET
9. With the help of diagram explain self-bias method of JFET
10. Explain thermistor compensation technique

L3: Apply

1. Show that the efficiency of half wave rectifier is 40.6%
2. Show that the efficiency of full wave rectifier is 81.2%
3. Obtain an expression of stability factor for fixed bias
4. With suitable expressions explain self-bias of BJT
5. Obtain the expression for voltage divider bias method of JFET
6. With the help of circuit diagram explain voltage divider bias method of JFET
7. Give the comparison of BJT, JFET and MOSFET
8. Obtain the expressions for voltage gain and current gain of small signal low frequency common emitter amplifier
9. Obtain the expressions for voltage gain and current gain of small signal low frequency common source amplifier

L4: Analyze

1. Derive the equation for ripple factor for half wave rectifier with capacitor filter
2. Determine the peak load voltage, peak current and power dissipation in a 495Ω load resistor connected to a bridge rectifier circuit that has a 26 V ac input. The rectifier diodes are germanium
3. Derive the equation for ripple factor of half wave rectifier with LC filter
4. Derive the expression for stability factor for voltage divider bias of BJT
5. Derive the expression for stability factor for self-bias of JFET
6. For the fixed bias circuit RB = 150 kΩ and RB = 100 kΩ. Calculate IB, IC and VCE if VCC = 12 V, RC =1.1 kΩ and β = 100 and also state the region of operation
7. Analyse the h-parameters from transistor characteristics
8. Discuss the analysis for small signal model of JFET
9. Analyse the h-parameters of common base amplifier
10. Investigate the h-parameters of common drain amplifier

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PC **23EC305 Digital Circuits Design** **3 0 0 3**

Version 01.00

Pre-requisite: Basics of Boolean Algebra

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with Pos				DoK
		PO1	PO2	PO3	PSO2	
23EC305.1	Understand the number systems and its logical Operations and reducing the logical functions	3	3	-	3	L1, L2
23EC305.2	Design simple combinational logic circuits using logic gates	3	3	2	3	L2, L3
23EC305.3	Classify and Design sequential logic circuits, various Registers and Counters using Flip-Flops and Analyze various Sequential Logic Circuits.	3	3	2	3	L2, L3, L4
23EC305.4	Analyze the concepts of finite state machines and Compare various Programmable logic devices.	3	3	2	3	L2, L3, L4
23EC305.5	Design and Model combinational and sequential circuits using HDLs.	3	3	3	3	L2, L3

Unit I:	**Boolean algebra, logic operations, and minimization of Boolean functions**	**9 hours**
Number Systems and Codes, Representation of unsigned and signed integers, Floating Point representation of real numbers, Laws of Boolean Algebra, Theorems of Boolean Algebra, Realization of functions using logic gates, Canonical forms of Boolean Functions, Minimization of Functions using Karnaugh Maps, QM algorithm.		**COs: CO1**
Unit II:	**Combinational Logic Circuits**	**9 hours**
Combinational circuits, Design with basic logic gates, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, magnitude comparator, multiplexers, demultiplexers, decoders, encoders and priority encoders.		**COs: CO2**
Unit III:	**Sequential Logic Circuits**	**9 hours**
Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, registers, shift registers, universal shift register, design of synchronous and asynchronous counters, ring counter, Johnson counter.		**COs: CO3**
Unit IV:	**Finite State Machines and Programmable Logic Devices**	**9 hours**
Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector, Introduction to logic families, Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs.		**COs: CO4**
Unit V:	**Hardware Description Language**	**9 hours**
Introduction to Verilog- gate level, behavioral level and structural level modeling of logic circuits, specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop, Verilog Operators, using Verilog constructs for storage elements, Blocking and Non-blocking Assignments, flip-flop with clear capability, Using Verilog Constructs for Registers and Counters.		**COs: CO5**

Board of Studies		ECE	
Approved in: BoS No.		VII	
Approved in: ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. M. Morris Mano, "Digital Design", 3rd Edition, PHI. (Unit I to IV)
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, McGraw-Hill (Unit V)

Reference Books

1. Charles H. Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishers.
2. ZviKohavi and NirajK.Jha, "Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2ndEdition, Prentice Hall PTR.
4. D.P. Leach, A.P. Malvino, "Digital Principles and Applications", TMH, 7th Edition.

Web References

1. https://nptel.ac.in/courses/117/105/117105080/
2. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
3. http://webstor.srmist.edu.in/web_assets/srm_mainsite/files/2017/15CS20

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	-
L2	40	40
L3	30	30
L4	15	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Find the decimal number equivalent of fractional octal number
2. List any two postulates of Boolean algebra
3. What you mean by non-weighted code?
4. Name any two functions of encoders
5. What is Flip flop?
6. Define a finite state machine
7. List the three differences between Synchronous and asynchronous counter
8. What is mean by weighted code?
9. Define VHDL

L2: Understand

1. Explain how combinational logic circuit 4:1 multiplexer works
2. Represent the following Boolean expression to min-terms and max-terms AB+BC'+ABD'+ACD
3. Represent a T flip flop using JK flip flop
4. Explain binary adder
5. Show the logic diagram of SR flip-flop with four NOR gate
6. Explain the operation of D-flip-flop
7. What are the elements of the VHDL

L3: Apply

1. Build the Boolean function F (x, y, z) = ∑ m (0, 1, 2, 4, 5, 7) by using 4 to 1 Multiplexer
2. Develop a full adder using half adder
3. Construct a 16:1 multiplexer using 8:1 multiplexer

4. Solve the following Boolean functions, using four-variable maps: F (w, x, y, z) = ∑ (1, 4, 5, 6, 12, 14, 15)
5. Develop 4-bit ring counter using D flip-flop
6. Write the VHDL program for Universal Gates

L4: Analyze

1. Distinguish combinational logic circuits and sequential logic circuits.
2. Compare mealy and Moore machine
3. Classify the counters
4. Analyze the characteristics of counters and registers
5. List out the statements of Boolean Theorems

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PC **23EC306 Electronic Devices and Circuits Lab**

0 0 3 1.5

Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		
		PO4	PO9	PSO2
23EC306.1	Identify and demonstrate different semiconductor devices andmeasuring instruments	3	3	3
23EC306.2	Experiment with the semiconductor devices and observe thecharacteristics	3	3	3
23EC306.3	Design and analyze different types of rectifier circuits using PN Junction Diodes and interpret the results	3	3	3
23EC306.4	Summarize the characteristics of BJT and FET	3	3	3
23EC306.5	Design different amplifiers and evaluate their frequencyresponses	3	3	3

List of Experiments

PART A: Electronic Workshop Practice

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices like Diode, LED, BJT, FET and MOSFET.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

.

PART B: List of Experiments: (Minimum Twelve Experiments has to be performed)

1. P-N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias& Reverse bias)
   Part B: Silicon Diode (Forward Bias only)
2. Zener Diode Characteristics
   Part A: V-I Characteristics
   Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with c-filter)
   Part A: Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics (CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics
5. FET Characteristics (CS Configuration)
   Part A: Drain Characteristics
   Part B: Transfer Characteristics
6. Transistor Biasing
   Part A: Operating Point
   Part B: Load line analysis
7. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
8. Design and analysis of self-bias circuit using FET/MOSFET.
9. CRO Operation and its Measurements
10. Determination of h-parameters of a given BJT using hybrid model.

11. Frequency response of BJT-CE Amplifier
12. Frequency response of Emitter Follower-CC Amplifier
13. Frequency response of FET-CS Amplifier
14. Frequency response of FET-CD Amplifier

PART C:

Hardware Required: Regulated Power supplies, Analog/Digital Storage Oscilloscopes, Analog/Digital Function Generators, Digital Multimeters, Decade Résistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components

Software Required: Software like Multisim/ PSPICE or Equivalent EDA Tool.

References

1. Lab Manual for Electronic Devices and Circuits Lab, Department of Electronics and CommunicationEngineering, NSRIT

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PC **23EC307 Digital Circuits & Signal Simulation Lab** **0 0 3 1.5**

Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		
		PO4	PO9	PSO2
23EC307.1	Identify and Verify the Logic Gates	3	2	1
23EC307.2	Design and Verify the Various Combinational Logic Circuits usingBasic Logic Gates	3	2	1
23EC307.3	Design Registers and Counters using Flip-Flops	3	2	2
23EC307.4	Develop Various Sequential Logic Circuits	3	2	3
23EC307.5	Simulate and Verify the Combinational and Sequential Logic Circuits	3	2	3

List of Experiments :

PART A

1. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table.
2. Verify the of functionality of 3 to 8-line Decoder
3. 4 variable logic function verification using 8 to1 multiplexer.
4. Design and verify the functionality of full adder circuit, full subtractor.
5. Draw the circuit diagram of a single bit comparator and verify the output.
6. Design and verify the functionality of different flipflops
7. Design and verify the operation of 4-bit Universal Shift Register for different Modes of operation.
8. Design up counter and down counters
9. Design MOD–8 synchronous counter /asynchronous counters.

Note: Any seven experiment are to be simulated using Hardware Description Language.

PART B

1. Generate various Signals and Sequences: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc function.
2. Operations on Signals and Sequences: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Write a program to find the trigonometric & exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings- Plot the discrete spectrum of the signal.
4. Write a program to find Fourier transform of a given signal. Plot its amplitude and phase spectrum.
5. Write a program to convolve two discrete time sequences. Plot all the sequences.
6. Write a program to find autocorrelation and cross correlation of given sequences.
7. Write a program to verify Linearity and Time Invariance properties of a given Continuous System.
8. Write a program to generate discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.
9. Write a program to generate Complex Gaussian noise and find its mean, variance, Probability Density Function (PDF) and Power Spectral Density (PSD).

Note: Any seven experiments are to be simulated using MATLAB or equivalent software.

References

1. Lab Manual for Digital Logic Design Lab, Department of Electronics and Communication Engineering, NSRIT.

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SOC **23DSS01 Python Programming** **0 1 2 2.0**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs					
		PO1	PO2	PO3	PO5	PSO1	PSO2
23DSS01.1	Illustrate the use of basic concepts and control structures of python programming	3	3	2	1	2	1
23DSS01.2	Apply python programming concepts like functions, strings to solve a variety of computational problems	3	3	2	1	2	1
23DSS01.3	Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries	3	3	2	1	2	1
23DSS01.4	understand the principles of object-oriented programming (OOP) in Python, including classes, Objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs	3	3	2	1	2	1
23DSS01.5	Become proficient in using commonly used Python libraries such as JSON, NumPy, pandas	3	3	2	1	2	1

Unit-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements.

Sample Programs:

1. Write a program to find the largest element among three Numbers.
2. Write a program to swap two numbers without using a temporary variable.
3. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
4. Write a program to add and multiply complex numbers
5. Write a program to print multiplication table of a given number.
6. Write a Program to display all prime numbers within an interval

Unit-II:

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Programs:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to count the number of vowels in a string (No control flow allowed).
12. Write a program to create, display, append, insert and reverse the order of the items in the array.
13. Write a program to add, transpose and multiply two matrices.
14. Write a program to perform the given operations on a list:
    i. Addition ii. insertion iii. slicing
15. Write a program to perform any 5 built-in functions by taking any list.

Unit-III:

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Programs:

16. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
17. Write a program to check if a given key exists in a dictionary or not.
18. Write a program to add a new key-value pair to an existing dictionary.
19. Write a program to sum all the items in a given dictionary.

Unit-IV:

Files: Types of Files, Creating File, Reading and Writing Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism, Catching Exceptions Using try and except Statement.

Sample Programs:

20. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
21. Python program to print each line of a file in reverse order.
22. Python program to compute the number of characters, words and lines in a file.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and Perimeter. Implement subclasses for different shapes like circle, triangle, and square.

Unit-V:

GUI Library: tkinter
Mathematical Libraries: JSON, NumPy, Pandas, Matplotlib
Sample Programs:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

References

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

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BS **23ACX01 Environmental Science** **2 0 0 0**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		DoK
		PO1	PO12	
23ACX01.1	Gain in-depth knowledge on importance of environment,natural resources utilization and exploitation	3	1	L1, L2, L3
23ACX01.2	Classify the various types of an eco systems and Identify their interconnections	3	1	L1, L2, L3
23ACX01.3	Illustrate the impacts of ever increasing environmental pollution and understand the issues on global environment.	3	1	L1, L2, L3
23ACX01.4	Understand various acts formulated by Govt.of India and apply the knowledge gained in conserving energy and environmental protection	3	1	L1, L2, L3
23ACX01.5	Explain the importance of Environment and human health.	3	1	L1, L2, L3

Unit I:	**Multidisciplinary Nature of Environmental Studies & Natural Resources**	**4 hours**
Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness. **Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources		**COs: CO1**
Unit II:	**Ecosystems& Biodiversity and its Conservation :**	**4 hours**
Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem. b. Grassland ecosystem c. Desert ecosystem. d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **Biodiversity and its Conservation :** Introduction ,Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		**COs: CO2**
Unit III:	**Environmental Pollution& Solid Waste Management :**	**4 hours**

Environmental Pollution: Definition, Cause, effects and control measures of : a. Air Pollution. b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards **Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.	**COs: CO3**
Unit IV: Social Issues and the Environment:	**4 hours**
From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.	**COs: CO4**
Unit V: Human Population and the Environment:	**4 hours**
Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies. **Field Work**: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..	**COs: CO5**

Textbooks

1. Textbook of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.AzeemUnnisa, “Environmental Studies” Academic Publishing Company
4. K.RaghavanNambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

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HS 23HSX03 Managerial Economics and Financial Analysis 2 0 0 2

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		DoK
		PO11	PO12	
23HSX04.1	Understand the theoretical concepts of managerial economics to make decisions for business problems	2	1	L1, L2
23HSX04.2	Gain adequate theoretical knowledge on production function and cost concepts to perform successful business operations	2	1	L2, L3
23HSX04.3	Understand the types of market structure and pricing strategies	2	1	L1, L2
23HSX04.4	Apply investment decisions and maximize returns to make successful long term investment decisions.	2	1	L2, L3
23HSX04.5	Analyze accounting concepts and interprete financial strength of business	2	1	L2, L3

1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge

Unit I : Introduction to Managerial Economics and Demand Analysis **6 Hours**

Definition of Managerial Economics –Scope of Managerial Economics and its Relationship with other Subjects – Concept of Demand, Types of Demand, Determinants of Demand- Law of Demand and its Limitations- Elasticity of Demand, Types of Elasticity of Demand - Demand Forecasting.

Unit II: Production and Cost Analysis **6 Hours**

Theory of Production: Meaning and Factors of Production, Production Function with One Variable Input (Law of Variable Proportion), With Two Variable Inputs (Law of Returns to Scale) Theory of Cost: Different Cost Concepts and Different Relations between Cost and Output in Short Run and Long Run, Break-Even Point.

Unit III: Business Organization and Markets **6Hours**

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies -. Types of Markets Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–-Price-Outp Determination - Pricing Methods and Strategies

Unit IV: Introduction to Capital Planning **6 Hours**

Cocept of Capital – Types of Capital - Capital Budgeting -: Meaning of Capital-Capitalization-Meaning of Capital Budgeting--Traditional Methods – Payback period method, accounting rate of return, Modern Methods- net present value , internal rate of return, profitability index.

Unit V : Financial Accounting and Ratio Analysis **6 Hours**

Financial Accounting- Concepts and Conventions – Double Entry System – Preparation of Journal, Ledger and Trial Balance – Preparation of Final Accounts: Trading, Profit and Loss Account and Balance Sheet. Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, Capital structure Ratios , Profitability ratios.

Text Books

1. AppaRao N., Vijay Kumar P., “Managerial Economics and Financial Analysis”, Cengage Publications, New Delhi, 2011
2. Siddiqui S. A. and Siddiqui A. S., “Managerial Economics and Financial Analysis”, New Age International Publishers, 2012
3. Kuberudu B. and Ramana T. V., “Managerial Economics and Financial Analysis”, Himalaya Publishing House, 2014
4. Aryasri A. R., “Managerial Economics and Financial Analysis”, Tata Mcgraw Hill, 2011

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1. Maheswari V., "Managerial Economics", Sultan Chand,2014
2. Suma Damodaran, "Managerial Economics", Oxford, 2011
3. Vanitha Agarwal, "Managerial Economics", Pearson Publications, 2011
4. Sanjay Dhameja, "Financial Accounting for Managers", Pearson Publications, 2011
5. Maheswari V., "Financial Accounting", Vikas Publications, 2012
6. Dominick Salvatore, "Managerial Economics: Principles and World Wide Application", 7th Edition, OxfordUniversity Press, 2012

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2. https://www.smartzworld.com/notes/managerial-economics-and-financial-analysis-pdf-notes-mefa
3. https://www.scribd.com/document/259129127/Mefa-course-plan
4. https://www.coursera.org/browse/business/entrepreneurship

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	25
L2	35	30
L3	15	45
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Managerial Economics?
2. What is meant by Elasticity of demand? How do you measure it?
3. Define different product curves
4. Define Accounting
5. Define Partnership

L2: Understand

1. Explain the role of a Managerial Economist in a Business firm
2. Explain the concept of cross elasticity of demand. Illustrate your answer with suitable examples
3. Explain the formation of a Joint Stock Company
4. Distinguish between a partnership and a joint stock company
5. Explain accounting principles
6. Journalese the following transactions
   - 2013 Jan 1st — ABC Firm commenced business with Rs.40000
   - Jan 2nd — Deposited into bank Rs.30000
   - Jan 3rd — Bought goods worth Rs.48000 from Kamala
   - Jan 4th — Sold goods worth Rs.60000
7. Calculate Net Profit Ration from the following data

Sales returns Rs.100000	Administration expenses Rs.10000
Gross Profit Rs.40000	Selling expenses Rs.10000
Income from investment Rs.5000	Loss on account of fire Rs.3000

L3: Apply

1. From the following particulars find out

Selling price	Rs.200 per unit
Variable cost	Rs.100 per unit
Total fixed cost	Rs.96000

   i) Break even units and values
   ii) Sales to earn a profit Rs.20000

2. The following are the Ratios related to XYZ Limited company.
   Inventory holding period 2 months
   Gross profit ration 25 %
   Gross profit for the current year announced Rs.200000
   Closing stock is excess of Rs 40000 over opening stock. Findout
   A) Sales
   B) Cost of goods sold
   C) Closing stock
   D) Opening stock

3. A Project cost is Rs.144000. The average annual cash inflows are likely to be Rs.45000 for a period of 5 Years calculate IRR for the project
4. The cost of project is Rs.50000 The annual cash inflows for the next 4 years are Rs.25000 what is the PBP for the project
5. A firm is considering two different investment options A & B details of both the options are given below (Rs, in Lakhs)

	Investment cost	**Inflow 1**	**Inflow 2**	**Inflow 3**
Option A	(25)	10	10	12
Option B	(40)	15	20	24

6. ARR method (ARR on original investment)
   Inintial investment Rs.1200000

Year	Cash inflows (Rs)	
	Project A	Project B
1	600000	500000
2	500000	300000
3	200000	200000
4	-	300000

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Board of Studies

PC **Linear Control Systems** **3 0 0 3**

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		DoK
		PO3	PSO1	
23ES402.1	Understand the concepts of various mathematical representations of control systems, Time response of first order and second order systems, stability, frequency response and fundamentals of modern control systems	-	3	L1 – L3
23EE402.2	Apply Block diagram reduction, Signal flow graph for solving various numerical problems.	-	3	L1 – L3
23EE402.3	Analyze time response characteristics, Apply Routh criterion, Root locus for stability analysis of various control systems.	2	1	L1 – L4
23EE402.4	Analyze frequency response characteristics, Apply Bode, Polar, Nyquist concepts for solving various numerical problems. Design various compensators and controllers for different control systems by using design procedures	3	1	L1 – L4
23EE402.5	Apply state space modelling to Create suitable control systems for various real time applications	3	3	L1 – L4
All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning				

Unit I: Control Systems Concepts Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Controller components, DC Servomotor and AC Servomotor- their transfer functions, Synchros	**12 hours** **Cos:CO1**
Self-Learning Topic: Effect of feedback on disturbance and Noise	
Unit II: Time Response Analysis Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, Study of effects and Design of P, PI, PD and PID Controllers on second order system.	**12 hours** **COs:CO2**
Self - Learning Topic: Ramp response of 2nd order system	
Unit III:Stability Analysis In Time Domain	**12 hours**
The concept of stability – Routh's stability criterion – Stability and conditional stability - limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci *Self - Learning Topic: Effect of addition of poles and zeroes on root locus*	**COs:CO3**
Unit IV: Frequency Response Analysis Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram - Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain Margin-Stability Analysis.	**12 hours** **COs:CO4**

Compensation techniques – Study of Effects and Design of Lag, Lead, Lag-Lead Compensator design in frequency Domain on a second order system.	
Self - Learning Topic: M & N circles, Nicholas Charts	
Unit V: STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS Concepts of state, state variables and state model - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability	**12 hours** **COs: CO5**
Self - Learning Topic: Eigen Vectors and Diagonalization	

Board of Studies		EEE	
Approved in : BoS No. VII		VII	
Approved in ACM: ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Industrial applications of control systems - Temperature control in buildings, Speed of conveyor belts in process plant		PO3
2	Motor Controls in Electric Vehicles		PO3

Text Books

1. Kotsuhiko Ogata, “Modern Control Engineering”, Prentice Hall of India, 5th edition, 2015.
2. Benjamin C.Kuo , “Automatic control systems”, Prentice Hall of India, 9th Edition,2014.

Reference Books

1. M.Gopal, “Control Systems principles and design”, Tata Mc Graw Hill education Pvt Ltd., 4th Edition, 2020
2. Norman S. Nise,”Control Systems Engineering” by, Wiley Publications, 7th edition, 2021
3. by Manik Dhanesh N, “Control Systems”, Cengage publications, 3rd Edition, 2020

Web References

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2. https://nptel.ac.in/courses/108106098.
3. https://onlinecourses.nptel.ac.in/noc23_ee16/preview
4. https://www.vssut.ac.in/lecture_notes/lecture1423904331.pdf

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	30	40
L3	50	30
L4	-	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Write the expression for Mason’s gain formula?

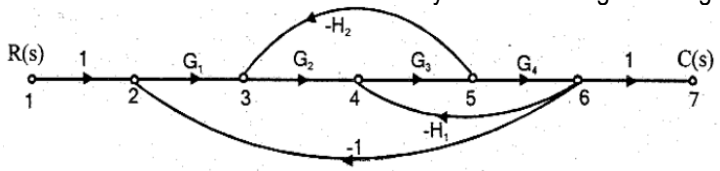
2. What are the standard test signals used in control systems
3. Discuss the limitations of root locus plot?
4. What is a Phase Lead compensator and why is it used?

L2: Understand

1. Describe the construction of synchro transmitter with neat diagram.
2. Explain in detail about any two practical examples on open loop and closed loop control systems? And list out its merits and demerits?
3. Explain in detail about the steady state errors and error constants?
4. How RH Stability Criterion Can Be Used to Study the Relative Stability?

L3: Apply

1. Find the overall transfer function of the system whose signal flow graph is shown in figure



2. Examine stability of the following system given by $S^4 + 3S^3 + 3S^2 + 2S + 1$ using Routh-Hurwitz stability criterion
3. Draw the Nyquist plot for the system whose open loop transfer function is $G(S)H(S) = \frac{(1+4s)}{S^2(1+S)(1+2S)}$.
   Determine the stability of a closed loop system. If the closed loop system is not stable then find the number of closed loop poles lying on the right half of S-plane.

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Board of Studies (EEE)

PC **23EC403 Electromagnetic Waves and Transmission Lines** **3 0 0 3**

Version 01.00

Pre-requisite: Applied Physics

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23EC403.1	Understand the coordinate system and its application in the field of electromagnetics and demonstrate the concept of Electric fields using various laws.	3	3	2	3	L1, L2, L3
23EC403.2	Application of Maxwell equation to describe the propagation of electromagnetic waves.	3	3	2	3	L1, L2, L3
23EC403.3	Understand the characteristics of uniform plane wave in various media.	3	3	2	3	L1-L4
23EC403.4	Build the expressions for input impedance of transmission lines	3	3	2	3	L1-L4
23EC403.5	Find and Analyze transmission line parameters for impedance matching purpose.	3	3	2	1	L1-L4

Unit I:	**Electrostatics**	**9 hours**
Review of Co-ordinate Systems, **Electrostatics:** Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.		**COs: CO1**
Unit II:	**Magnetostatics and Maxwell's Equations**	**9 hours**
Magnetostatics: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems. **Maxwell's Equations (Time Varying Fields):** Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in all possible forms and related Word Statements, Conditions at a Boundary Surface, Illustrative Problems.		**COs: CO2**
Unit III:	**EM Wave Characteristics**	**9 hours**
EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem, Illustrative Problems.		**COs: CO3**
Unit IV:	**Transmission Lines - I**	**9 hours**
Transmission Lines - I : Types, Parameters, T & π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems.		**COs: CO4**
Unit V:	**Transmission Lines – II**	**Hours**
Input Impedance Relations, Reflection Coefficient, VSWR, Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Low loss radio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.		**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No.		VII	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Elements of Electromagnetics, Matthew N.O. Sadiku, 4th Edition, Oxford University Press, 2008.
2. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, 2nd Edition, PHI, 2000.
3. Transmission Lines and Networks, Umesh Sinha, 8th Edition, Satya Prakashan Tech. India Publications, New Delhi, 2003.

Reference Books

1. Electromagnetic Field Theory and Transmission Lines, G. S. N. Raju, 2nd Edition, Pearson Education, 2013.
2. Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, 7th Edition, Tata McGraw Hill, 2006.
3. Electromagnetics, John D. Krauss, 3rd Edition, McGraw Hill, 1988.
4. Networks, Lines, and Fields, John D. Ryder,2nd Edition, PHI publications, 2012.

Web Resources

1. https://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring-2008/index.htm
2. https://nptel.ac.in/courses/108/106/108106157/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	30	30
L3	20	20
L4	30	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List out any three types of transmission
2. Define the term characteristic impedance
3. What is Smith Chart?
4. State and explain Coulomb's law
5. Write Maxwell's equations in different final forms
6. Define Brewster angle and Critical angles
7. State Poynting theorem
8. What is Brewster angle?
9. Recall Relaxation Time
10. Where Gauss's law is applicable?

L2: Understand

1. Explain the principle of impedance matching with quarter wave transformer
2. Explain the transmission line parameters and also obtain the transmission line equations
3. A manufacturer produces a ferrite material with $\mu = 750\mu_o$, $\varepsilon = 5\varepsilon_o$, and ζ=10-6 S/m at 10MHz. i) Would you classifythe material as lossless, lossy, or conducting. ii) Calculate β and λ

4. Explain about Low loss radio frequency lines and UHF transmission lines in detail
5. Show that when a uniform plane wave propagating in particular direction, it does not contain any field components in that direction
6. Show that in a good conductor, the skin depth δ is approximately given by $\delta = 2\pi/\lambda$
7. Find the relations between E and H in a uniform plane wave.
8. Summarize the four Maxwell's equations with statements in Integral form
9. Relate Electric Potential and Electric Field Intensity
10. Show that E/H is equal to intrinsic Impedance

L3: Apply

1. Develop relation between Electric potential and Electric field intensity
2. Make use of Gauss's law, Derive the expressions for Electric field intensity and Electric flux density due to an infinitesheet of conductor of charge density ρs C/cm
3. The VSWR measured of UHF transmission line, working at a frequency of 300 MHz is found to be 2. If the distancebetween load and voltage minimum is 0.8 meter. Calculate the value of load impedance
4. Discuss the Maxwell's equations for electrostatic fields
5. Write about i) Equation of continuity for time varying fields. ii) Relaxation time
6. Derive an expression for the Electric field intensity due to a finite length line charge along the z-axis at an arbitrary point Q(x, y, z)
7. Find magnetic field strength, H, on the Z-axis at a point P (0, 0, h), due to a current carrying circular loop, $X^2 + y^2 = A^2$ in Z=0 plane
8. Show that when a uniform plane wave propagating in particular direction, it does not contain any field components in that direction
9. Build the relation between Zoc and Zsc
10. By Applying Equations of Transmission, derive the Input impedance of Transmission Line

L4: Analyze

1. Analyze magnetic field strength H on the Z-axis at a point P (0, 0, h) due to a current carrying circular loop $X^2 + Y^2 = A^2$ in Z=0 plane
2. Categorize the various charge Distributions
3. Analyse λ/8, λ/4 and λ/2 lines
4. Examine how the Zsc and Zoc lines are acting as Capacitor and Inductor with Varying Lengths
5. Discover the Relation between Zsc and Zoc
6. List the Maxwell's equation in integral and differential form
7. Conclude that the direction of EM wave is perpendicular to both E and H directions

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Chairman Board of Studies

PC **23EC404 Analog Circuits Design** **3 0 0 3**

Version 01.00

Pre-requisite: Electronic Devices and Circuits

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23EC404.1	Examine the frequency response of multistage amplifier circuits using BJT & FETs at low and high frequencies.	3	3	2	3	L1, L2, L3
23EC404.2	Classify, analyze and design different types of feedback amplifier and transistor oscillators for different frequencies	3	3	3	3	L1, L2, L3
23EC404.3	Design and explain operation of different power amplifiers circuits	3	3	3	3	L2, L3, L4
23EC404.4	Design and explain operation of different tuned amplifiers circuits	3	3	3	3	L2, L3, L4
23EC404.5	Design pulse analog circuits for the given specifications and application.	3	3	3	3	L1, L2, L3

Unit I:	**Multistage Amplifiers**	**9 hours**
Classification of amplifiers, distortion in amplifiers, frequency response of an amplifier, step response of an amplifier, methods of coupling, band pass of cascaded stages, analysis of cascaded transistor amplifier, two stage RC coupled amplifier, Darlington pair amplifier, Boot-strap emitter follower, Cascode amplifier, differential amplifier.		**COs: CO1**
Unit II:	**Feedback Amplifiers and Oscillator**	**9 hours**
Feedback Amplifiers: Classification of basic amplifiers, Feedback concept, types of feedback, feedback topologies, characteristics of negative feedback amplifiers, generalized analysis of feedback amplifiers, performance comparison of feedback amplifiers, method of analysis of feedback amplifiers. **Oscillators:** Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wein bridge oscillators using BJT and FET, generalized analysis of LC oscillators, Hartley and Colpitt's oscillators using BJT and FET, crystal oscillator, frequency stability of oscillators.		**COs: CO2**
Unit III:	**Power Amplifiers**	**9 hours**
Classification of amplifiers, Class A power Amplifiers, harmonic distortions, Class B amplifier, Push-pull amplifier, Complementary symmetry push pull amplifier, Class AB amplifier, Class-C amplifier, thermal stability and heat sink, distortion in power amplifiers.		**COs: CO3**
Unit IV:	**Tuned Amplifiers**	**9 hours**
Introduction, Q-Factor, small signal tuned amplifiers, effect of cascading single tuned and doubled tuned amplifiers on band width, stagger tuned amplifiers, comparison of tuned amplifiers, large signal tuned amplifiers, stability of tuned amplifiers.		**COs: CO4**
Unit V:	**Pulse Electronic Circuits**	**9 hours**
Wave shaping circuits, diode clippers, diode comparator, diode clampers, astable, mono stable and bi-stable multivibrators using BJT, Schmitt trigger using BJT, Tunnel diode, UJT, Blocking oscillator, time base circuits.		**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No.		VII	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	Pos
1			
2			

Textbooks

1. Electronic Devices and Circuits - J.Millman, C.C. Halkias & S.Jit, TMH, 4thEdition, 2015.
2. Pulse and Digital Circuits- A.Anand Kumar, PHI Learning Private Limited, 2012.

Reference Books

1. Integrated Electronics- Jacob Millman, C. Halkies&C.D.Parikh, TMH, 2nd Edition,2010.
2. Electronic Devices and Circuits- S.Salivahanan& N.Suressh Kumar,TMH,3rd Edition, 2012.
3. Electronic Devices and Circuits – A.K.Maini & V.Agarawal, Wiley India Pvt.Ltd., First Edition, 2009.

Web References

1. http://ecetutorials.com/analog-electronics/high-frequency-hybrid-pi-model-or-giacoletto-modelof-bjt/
2. http://www.iitg.ac.in/apvajpeyi/ph218.html
3. http://cktse.eie.polyu.edu.hk/eie3100/8-FeedbackOscillator.pdf
4. http://www.electronics-tutorials.ws/amplifier/amp_1.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	20	20
L3	30	30
L4	30	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is cascade amplifier?
2. What is the need of blocking capacitor?
3. Write any three applications of cascode amplifiers
4. List the four types of power amplifiers
5. Define crossover distortion
6. Define tuned amplifier

L2: Understand

1. Explain various hybrid-pi capacitances and conductance of a BJT

2. Discuss the effect of a coupling and bypass capacitors on CE amplifier
3. Explain three types of coupling methods used in multistage amplifiers
4. With the help of a neat circuit diagram, describe the working of a cascade amplifier
5. Describe the effects of negative feedback on the various characteristics of the amplifier
6. Write the six differences between RC oscillators and LC oscillators
7. Draw and explain the circuit diagram of class A power amplifier
8. Describe the operation of single tuned amplifier
9. Describe the operation of double tuned amplifier
10. With neat circuit diagram explain stagger tuned amplifier

L3: Apply

1. With suitable expressions explain CE short circuit current gain
2. Obtain the expressions for f_T and f_β
3. Draw the circuit diagram and equivalent circuit of an emitter follower amplifier and derive the expression for A_v, A_i and input impedance
4. Find the expression for CMRR of a BJT based differential amplifier
5. Obtain the expression for output resistance of a voltage sampled circuit
6. Explain the principle of negative feedback in amplifiers. Show quantitatively the effect of negative feedback on
   (i) Gain (ii) Stability (iii) Noise (iv) Distortion
7. Establish the condition for frequency of oscillation in an RC phase shift oscillator
8. Show that the conversion efficiency of a transformer coupled power amplifier is 50%.
9. Prove the conversion efficiency of a class B power amplifier is 78.5%
10. With suitable expressions discuss about Thermal stability of power amplifier

L4: Analyze

1. Derive the expressions for the following hybrid Π conductance i) g_m ii) $g_{b'e}$ iii) $g_{b'c}$ iv) g_{ce}
2. Derive the voltage gain equation for common source amplifier at high frequencies
3. A CE amplifier is drawn by a voltage source of internal resistance of 500 Ω and load impedance of 800 Ω. The h-parameters h_{ie} = 2kΩ, h_{re} = $2X10^{-4}$, h_{fe} = 50, h_{oe} = 25μA/V and compute A_I, R_I, A_V and R_O using exact analysis
4. An amplifier has a gain of 50 with negative feedback. For a specified output voltage, if the input required is 0.1V without feedback and 0.8V with feedback, Compute β and open loop gain
5. Derive an expression for frequency of oscillations of a Wien bridge oscillator using BJT
6. Derive the expression for frequency of oscillation and condition for sustained oscillations of Colpitts oscillator
7. Derive the expression for frequency of oscillation and condition for sustained oscillations of Hartley oscillator

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PC 23EC405 Analog & Digital Communications

3 0 0 3
Version 01.00

Pre-requisite: Signals and Systems.

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23EC405.1	Explain various Analog modulation and demodulation schemes and their spectral characteristics	3	3	2	2	L1, L2, L3
23EC405.2	Apply the basic knowledge of signals and systems and understand the concept of Frequency modulation.	3	3	2	2	L1, L2, L3
23EC405.3	Utilize fundamental electronic circuit knowledge to analyse the impact of noise on communication systems and the operation of AM and FM systems.	3	3	2	3	L1, L2, L3
23EC405.4	Demonstrate understanding of various pulse modulation and demodulation techniques	3	3	2	3	L1, L2, L3
23EC405.5	Evaluate the performance of digital modulation techniques.	3	3	2	2	L1, L2, L3

Unit I:	**Amplitude Modulation**	**9 hours**
Amplitude Modulation- Basic blocks of Communication System, Need for modulation, Amplitude (Linear) Modulation – AM, DSB-SC, SSB-SC and VSB-SC. Methods of generation and detection, Comparison of different AM techniques, Application of different AM techniques.		**COs: CO1**
Unit II:	**Angle Modulation**	**9 hours**
Angle (Non-Linear) Modulation - Frequency and Phase modulation. Frequency Modulation: Single tone frequency modulation, Narrow band FM, Wide band FM, Transmission bandwidth of FM signals. Generation: Direct Method, Indirect Method. Detection: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM, Applications.		**COs: CO2**
Unit III:	**Noise Analysis & Transmitters & Receivers**	**9 hours**
Noise Analysis - Internal and External Noise, Noise Calculation, Noise Figure, Noise temperature, Noise analysis in AM receivers, Noise analysis in FM receivers, Threshold effect, Pre-emphasis and De-emphasis. **Transmitters & Receivers:** Classification of Transmitters, AM Transmitters, FM Transmitters. Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.		**COs: CO3**
Unit IV:	**Pulse Modulation Techniques**	**9 hours**
Pulse Analog Modulation techniques – Pulse Amplitude Modulation, Pulse width Modulation, Pulse Position Modulation, Methods of generation and detection. Time division multiplexing, Frequency Division Multiplexing, Noise performance. **Pulse Digital Modulation techniques**- Elements of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Companding in PCM systems. Differential PCM systems (DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems.		**COs: CO4**
Unit V:	**Digital Modulation Techniques and Baseband transmission**	**9 hours**
Digital Modulation Techniques: BASK, BFSK, BPSK, QPSK, generation and detection. **Baseband transmission**: Base band signal receiver, probability of error and its mathematical analysis, the optimum receiver, matched filter, coherent and non-coherent reception.		**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No.		VII	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Communication Systems - Simon Haykin, John Wiley& Sons, 2ndEdition.
2. B. P. Lathi, Zhi Ding "Modern Digital and Analog Communication Systems", Oxfordpress, 2011.
3. Digital Communication- Simon Haykin, John Wiley, 2005.

Reference Books

1. Digital Communications – John Proakis, TMH, 1983
2. Digital and Analog Communication Systems - Sam Shanmugam,JohnWiley& Sons, 1999.
3. Digital Communications: Fundamentals and Applications -Bernard Sklar, F. J. Harris, Pearson Publications, 2020.
4. Principles of Communication Systems- Taub and Schilling,Tata McGraw Hill, 2007.

Web References

1. https://nptel.ac.in/courses/117/102/117102059/
2. https://nptel.ac.in/courses/117/101/117101051/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Need for modulation?
2. Define pre-emphasis and de-emphasis
3. What is uniform quantization?
4. What are the advantages of M-ary Signalling Schemes?
5. Define source entropy

L2: Understand

1. Draw the Envelope detector and illustrate the process of detection of AM wave?
2. Derive the expression for the frequency modulated signal. Explain what is meant by narrowband FM and wideband FM using the expression.
3. Explain the methods for demodulation of PAM signals.
4. Explain the process of generating FSK signals.
5. Explain the following.
   i) Shannon's Source Coding Theorem ii) Channel Capacity

L3: Apply

1. An amplitude modulated signal represented in time domain as 4Cos (1800πt) +10Cos (2000πt) + 4Cos (2200πt). Sketch the spectrum and calculate the band width & total power
2. A cable has a power loss of 3 dB is connected to the input of an amplifier, which has a noise temperature of 100K. Calculate the overall noise temperature referred to the cable input
3. A DM system can handle message signals of bandwidth up to 5 kHz and has a sampling rate of 50 kHz. A sinusoidal signal of 1.5 volts peak amplitude and frequency 2 kHz is applied to the system. Determine the step-size Δ required to avoid slope overload.
4. Find the Probability of error of Optimum Filter
5. A memory less source emits messages m1 and m2 with probabilities 0.8 and 0.2, respectively. Find the Huffman binary code for this source and determine the code efficiency.

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Chairman Board of Studies

PC **23EC406 Analog Circuits Design Lab** **0 0 3 1.5**

Version 01.00

Pre-requisite: Electronic Devices and Circuits

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs			
		PO4	PO5	PO9	PSO2
23EC406.1	Using CRO (or) DSO to measure the frequency, and amplitude of any signal generated from Oscillator	3	3	2	2
23EC406.2	Understand the DC analysis and Transient analysis of amplifier.	3	3	2	2
23EC406.3	Understand the working of Power amplifiers	3	3	2	2
23EC406.4	Compare the frequency response of Various Tuned voltageamplifier	3	3	2	2
23EC406.5	Design and analyse different electronic circuits on Multisim tool	3	3	2	2

List of Experiments

1. Design and analysis of Two-Stage RC-Coupled Amplifier
2. Design and Analysis of Darlington Pair Amplifier.
3. Design and Analysis of Cascode Amplifier.
4. Design and analysis of Differential Amplifier.
5. Design and Analysis of Voltage-Series/Voltage-Shunt Feedback Amplifier.
6. Design and Analysis of Current-Series/Current-Shunt Feedback Amplifier.
7. Design and Analysis of RC Phase Shift Oscillator
8. Design and Analysis of LC Heartley/Colpitts Oscillator
9. Design and Analysis of Class A power amplifier
10. Design and Analysis of Class AB amplifier
11. Design and analysis of Single Tuned amplifier.
12. Diode Clippers and Diode clampers
13. Astable and Monostable Multivibrators using BJT
14. Schmitt Trigger using BJT

Note: At least twelve experiments shall be performed using BJT/FET/ MOSFET devices and the relevant circuits shall be designed and perform the analysis using both hardware and equivalent EDA software tools.

Board of Studies		ECE	
Approved in : BoS No.		VII	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	Pos
1			
2			

References

1. Lab Manual for Analog circuits Design Lab, Department of Electronics and Communication Engineering, NSRIT

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Chairman Board of Studies

PC **23EC407 Analog and Digital Communications Lab** **0 0 3 1.5**

Version 01.00

Pre-requisite: Electronic Devices and Circuits

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs			
		PO4	PO5	PO9	PSO2
23EC407.1	Know about the usage of equipment /components / software tools used to conduct experiments in analog and digital modulation techniques.	3	3	2	2
23EC407.2	Design analog modulation circuits as amplitude and frequency modulation	3	3	2	2
23EC407.3	Perform the time and frequency domain analysis of the signals in a digital communication system	3	3	2	2
23EC407.4	Design various pulse modulation techniques as PAM, PPM, PWM	3	3	2	2
23EC407.5	Analyze the Performance of digital design in the communication system	3	3	2	2

List of Experiments

Design the circuits and verify the following experiments taking minimum of six from each section shown below.

Section-A

1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. FM Modulation and Demodulation
4. Radio receiver measurements
5. PAM Modulation and Demodulation
6. PWM Modulation and Demodulation
7. PPM Modulation and Demodulation

Section-B

1. Sampling Theorem.
2. Time Division Multiplexing
3. Frequency Division Multiplexing
4. Delta Modulation and Demodulation
5. PCM Modulation and Demodulation
6. BPSK Modulation and Demodulation
7. BFSK Modulation and Demodulation
8. QPSK Modulation and Demodulation
9. DPSK Modulation and Demodulation

Board of Studies		ECE	
Approved in : BoS No.		VII	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	Pos
1			
2			

References

1. Lab Manual for Analog and Digital Communications Lab, Department of Electronics and Communication Engineering, NSRIT

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HS **23HSMC01 Soft Skills**

2 1 0 3
Version 01.00

Pre-requisite: None. Soft Skills (Desirable)

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs			DoK
		PO8	PO9	PO10	
23HSMC01.1	List out various elements of soft skills				L1, L2
23HSMC01.2	Describe methods for building professional image				L1, L2
23HSMC01.3	Apply critical thinking skills in problem solving				L3
23HSMC01.4	Analyse the needs of an individual and team for well-being				L4
23HSMC01.5	SA the situation and take necessary decisions				L5
23HSMC01.6	Create a productive workplace atmosphere using social and work-life skills ensuring personal and emotional well-being				L6

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

MODULE I:	**Soft Skills & Communication Skills**	**6+3 hours**
Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques. **Activities:** Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity. Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace. Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.		**COs: CO1**
MODULE 2:	**Critical Thinking**	**6+3hours**
Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection **Activities:** Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis		**COs: CO2**
MODULE 3:	**Problem Solving & Decision Making**	**6+3hours**
Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles **Activities:** Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision- Case Study & Group Discussion.		**COs: CO3**
MODULE 4:	**Emotional Intelligence & Stress Management**	**4+2 hours**

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips **Activities:** Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates	**COs: CO4**
MODULE 5: Corporate Etiquette	**6+3+3 hours**
Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips -Overcoming challenges **Activities** Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games	**COs: CO5. CO6**

Board of Studies		BASIC HUMANITIES AND SCIENCES	
Approved in : BoS No.		IV	
Approved in : ACM No. VI		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Seminar with Socialists	CO1	PO10

Prescribed Books:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018

Reference Books

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher: Vayu Education of India, 2014

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZeI_j2PUy0pwjVUgj7KlJ

3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7. https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

ASSESSMENT:

This is a mandatory course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation

- Assessment by faculty mentor: 10 m
- Self-assessment: 10 marks
- Assessment by peers: 10 marks
- Socially relevant project/Group Activities/Assignments: 20 marks
- Semester End Examination: 50 marks
- The overall pass percentage is 40%. In case the student fails , he/she must repeat the course

HS 23ESX08 Design Thinking & Innovations 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	DoK		
		PO1	PO2	DoK
23ESX08.1	Explain the fundamentals of Design Thinking and innovation .	3	2	L1 – L4
23ESX08.2	Emphatize and Analyze the model action plan in implementing the process in driving innovations	3	2	L1 – L4
23ESX08.3	Evaluate the value of creativity & Analyse to work in a multidisciplinary environment	3	2	L1 - L4
23ESX08.4	Describe the principles of innovation and idea generation in product design	3	2	L1 – L4
23ESX08.5	Formulate specific problem statements of real time issues	3	3	L1 – L4
All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning				

Unit I:	**Introduction to Design Thinking**	**9 Hours**
Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry *Self learning topic*		**COs: CO1**
Unit II:	**Design Thinking Process**	**9 Hours**
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development **Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development. *Self Learning Topic:*		**COs: CO2**
Unit III:	**Innovation**	**9 Hours**
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity. **Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation. *Self Learning Topic*		**COs: CO3**
Unit IV:	**Product Design**	**9 Hours**
Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies **Activity:** Importance of modelling, how to set specifications, Explaining their own product design. *Self Learning Topic:*		**COs: CO4**
Unit V:	**Design Thinking in Business Processes**	**9 Hours**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes. **Activity:** How to market our own product, About maintenance, Reliability and plan for startup *Self Learning*	**COs: CO5**

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in : BoS No.		IV	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Design Thinking-Overview	CO1-CO5	PO2, PO3
2	Success Stories of Companies benefited from Design Innovations	CO5	PO2, PO3

Textbooks:

1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell,Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

Online Learning Resources:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What do you mean by Design Thinking?
2. What are the tools of design Thinknig?
3. What are the new materials in the industry?

L2: Understand

1. Explain the elements of Design
2. Differentiate between innovation and creativity
3. Why new materials are important for industry?

L3: Apply

1. How design thinking helped financial sector to gain the customer trust?
2. Explain the method of implementing Design thinking process driving inventions
3. What are some contemporary examples of design thinking in action.

L4: Analyze

1. How can organizations capture and evaluate the value of creativity in their design innovations?
2. Evaluate the impact and value of creativityin the context of design innovations?

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Board of Studies

HO **23ECH01 Low Power VLSI Design** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
23ECH01.1	Identify the sources of power dissipation in digital IC systems	-	L1, L2
23ECH01.2	Demonstrate the impact of power on system performance andreliability.		L1, L2, L3, L4
23ECH01.3	Extend the Low Power Design to Different Applications		L1, L2
23ECH01.4	Design and analysis of Low-Voltage Low-Power Circuits		L1, L2, L3
23ECH01.5	Realize the leakage sources and reduction techniques		L1, L2, L3, L4

Unit I:	**Fundamentals of Low Power VLSI Design**	**9 hours**
Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation. *Short-Channel Effects*		**COs: CO1**
Unit II:	**Low-Power Design Approaches**	**9 hours**
Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. *Combining Parallelism with Pipelining*		**COs: CO2**
Unit III:	**Power estimation and analysis**	**9 hours**
SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power and gate level capacitance estimation. *Gate level logic simulation*		**COs: CO3**
Unit IV:	**Low-Voltage Low-Power Adders**	**9 hours**
Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques. *Carry Skip Adder*		**COs: CO4**
Unit V:	**Low-Voltage Low-Power Multipliers**	**9 hours**
Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.		**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No. IV			
Approved in : ACM No. VI			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Kiat-Seng Yeo and Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems", 2nd Edition, TechnischeHochschule Mittelhessen publications, 2017
2. Chandrakasan A. and Brodersen R., "CMOS Low Power Digital Design", Kluwer Academic Publications, 1995

Reference Books

1. Kaushik Roy and Sharat C. Prasad, "Low Power CMOS VLSI Circuit Design", 2nd Edition, John Wiley & Sons, 2000
2. Gary K. Yeap, "Practical Low Power Digital VLSI Design", 3rd Edition, Kluwer Academic Press, 2002

Web Resources

1. http://www.eeherald.com/section/design-guide/Low-Power-VLSI-Design.html 2. https://nptel.ac.in/courses/106/105/106105034/
3. https://www.intechopen.com/chapters/59358

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	30
L2	40	30
L3	10	20
L4	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the various issues involved in low power VLSI Design?
2. What is short channel effect?
3. What is SPICE?
4. Define DIBL
5. What is the need for low power circuit design?

L2: Understand

1. Explain about Sub-threshold leakage in a MOS transistor
2. Explain about gate level logic simulation
3. Describe about Braun multiplier with help of neat Schematics
4. Describe the basic concepts of supply voltage scaling
5. Clarify the VTCOMS and MTCMOS in low power VLSI design

L3: Apply

1. Draw the basic architecture of Ripple Carry Adder and explain its operation
2. Draw and Explain the MOSFET model for estimating
3. Draw and explain different configurations of full adder schematic
4. Draw the basic architecture of Carry Save Adder and explain its working
5. Draw the basic architecture of Typical SRAM and explain its operation
6. Construct Baugh-Wooley Multiplier and explain its operation

L4: Analyze

1. Compare Carry Select and Ripple Carry Adders in terms of delay and area
2. Compare EPROM and Flash memory w.r.t functionality and cost of the design
3. Discuss about future trends and Development of DRAM
4. Discuss the features of a six transistor CMOS memory cell
5. Explain8 bit architecture of CSA with an example

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Board of Studies (ECE)

HO **23ECH02 DSP Processors and Architectures** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
23ECH01.1	Demonstrate the basic concepts of Digital Signal Processing	-	L1, L2
23ECH01.2	Differentiate the architectural features of General-purpose processorsand DSP processors		L1, L2
23ECH01.3	Understand the architectures of TMS320C54xx devices and ADSP2100 DSP devices		L1, L2
23ECH01.4	Write the simple assembly language programs by using instruction setof TMS320C54xx		L1, L2, L3
23ECH01.5	Interface the various devices to DSP Processors		L1, L2, L3

Unit I:	Introduction to Digital Signal Processing	**9 hours**
Introduction, a Digital signal-processing system, discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation. **Computational Accuracy in DSP Implementations** Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter. *Sampling Process*		**COs: CO1**
Unit II:	**Architectures for Programmable DSP Devices**	**9 hours**
Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External interfacing. *Speed Issues*		**COs: CO2**
Unit III:	Programmable Digital Signal Processors	**9 hours**
Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX Instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54XX Processors. *Commercial Digital signal-processing Devices*		**COs: CO3**
Unit IV:	Analog Devices Family of DSP Devices	**9 hours**
Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100. Introduction to Black fin Processor - The Black fin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals. *ADSP-2181 high performance Processor*		**COs: CO4**
Unit V:	**Interfacing Memory and I/O Peripherals to Programmable DSP Devices**	**9 hours**
Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O. *Direct memory access (DMA)*		**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No.			
Approved in : ACM No.			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Avtar Singh and S. Srinivasan, "Digital Signal Processing", Thomson Publications, 2004
2. Padmanabhan K, Vijayarajeswaran R. and Ananthi S., "A Practical Approach to Digital Signal Processing", New Age International, 2009
3. Woon-Seng Gan and Sen M.Kuo, "Embedded Signal Processing with the Micro Signal Architecture", Wiley-IEEE Press, 2007

Reference Books

1. Venkataramani B and Bhaskar M., "Digital Signal Processors, Architecture, Prog and Applications", Tata Mc Graw Hill, 2002
2. Amy Mar, "Digital Signal Processing App Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices", DSP Division, Prentice Hall of India
3. Lapsley et al, "DSP Processor Fundamentals, Architectures & Features", S. Chand &Co, 2000

Web Resources or Links

1. https://cds.cern.ch/record/1100536/files/p167.pdf
2. https://people.eecs.berkeley.edu/~pattrsn/252S98/Lec08-dsp.pdf

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	30
L2	40	40
L3	30	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define Decimation and Interpolation
2. What are the sources of error in DSP Implementations?
3. What are the Features for External interfacing?
4. Write any four Interrupts of TMS320C54XX Processors
5. What are the I/O Peripherals to Programmable DSP Devices?

L2: Understand

1. What are the different number formats that are used to represent signals and coefficients in DSP systems? Explain any two of them
2. Describe the following on-chip peripherals of TMS320C54xx processors.
    a) Hardware Timer
    b) Host port interface
4. Discuss in brief about the basic peripherals in analog devices family of DSP devices.
5. Explain the Data Addressing modes of TMS320C54XX DSPs

6. Explain the Bus Architecture of Black fin Processor
7. Write short notes on the following
    a) Basic peripherals
    b) DMA

L3: Apply

1. Find DFT of a sequence x(n) = { 0,1,2,4,,6,8,7,3} using DIFFFT algorithm
2. How does DMA help in increasing the processing speed of a DSP processor?

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Board of Studies (ECE)

HO **20ECH03 Information Theory and Coding** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
23ECH03.1	Design an Application with Error-Control coding	-	L1, L2, L3, L4
23ECH03.2	Classify and demonstrate Compression and Decompression Techniques		L1, L2
23ECH03.3	Perform source coding and channel coding		L1, L2
23ECH03.4	Design Encoding and Decoding of Digital DataStream		L1, L2, L3
23ECH03.5	Demonstrate the Entropy, source coding channel and its capacity		L1, L2, L3, L4

Unit I:	**Information Theory and Source Coding**	**9 hours**
Uncertainty, information, entropy and its properties, entropy of binary memory less source and its extension to discrete memoryless source, source coding theorem, data compression, prefix coding, Lempel-Ziv coding, Source with memory and its entropy. *Huffman coding*		**COs: CO1**
Unit II:	**Discrete Channels**	**9 hours**
Binary Symmetric Channel, mutual information & its properties, Channel capacity, channel coding theorem and its application to BSC, Shannon's theorem on channel capacity, capacity of a channel of infinite bandwidth, bandwidth - S/N trade off, Fading channel, channels with memory. *Practical communication systems in light of Shannon's theorem*		**COs: CO2**
Unit III:	**Groups, Fields and Linear Block Codes**	**9 hours**
Galois field and its construction in GF(2m) and its basic properties, vector spaces and matrices in GF(2), Linear block codes, systematic codes and its encoding circuit, syndrome and error detection, minimum distance, error detecting and correcting capabilities of block code, probability of undetected error for linear block code in BSC, Hamming code and their applications. *Decoding circuit*		**COs: CO3**
Unit IV:	**Cyclic Codes and BCH Codes**	**9 hours**
Basic properties of Cyclic codes, Generator and parity check matrix of cyclic codes, encoding and decoding circuits, syndrome computation and error detection, encoding and decoding of BCH codes, error location and correction. *Cyclic Hamming codes*		**COs: CO4**
Unit V:	**Convolutional Codes**	**9 hours**
Introduction to convolution code, its construction and Viterbi algorithm for maximum likelihood decoding, Automatic repeat request strategies and their throughput efficiency considerations. *Convolution codes with examples*		**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No.			
Approved in : ACM No.			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Sklar, "Digital Communication", 2nd Edition, Pearson Education Asia, 2001
2. Shu Lin and Costello, "Error Control Coding: Fundamentals and Applications", 2nd Edition, Pearson, 2004

Reference Books

1. Haykin Simon,"Digital Communication", Wiley Publications,2013
2. ChithodeJ. S., "Information theory and coding", 1st Edition, Technical publishers, 2014

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1. https://www.cl.cam.ac.uk/teaching/0809/InfoTheory/InfoTheoryLectures.pdf 2. https://nptel.ac.in/courses/117/101/117101053/
3. http://www.nitjsr.ac.in/course_assignment/EC23EC4211ITC_PPT.pdf

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	20	20
L3	30	30
L4	20	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is prefix coding?
2. Define channel capacity of the discrete memoryless channel
3. Define mutual information
4. What is the efficiency of the source encoder?
5. What is mean by code redundancy?

L2: Understand

1. Explain channel capacity theorem
2. Write the properties of information theory coding
3. What do you understand from adaptive coding? Explain in details
4. Explain the Properties of entropy
5. State and explain the sampling theorem

L3: Apply

1. Construct Shannon's theorem on channel capacity
2. With suitable expressions explain a source coding theorem
3. Construct the Lempel – Ziv encoding algorithm over Huffman coding
4. Discuss about linear block codes in BSC

L4: Analyze

1. Compare encoding and decoding BCH codes
2. Compare Huffman coding Forward and backward with neat example
3. Discuss about Convolution codes with examples
4. Discuss about Hamming codes with neat examples
5. Draw the diagram of encoder and syndrome calculator generated by polynomial g(x)

6. Verify whether g(x) = 1+x+x2+x3+x4 is a valid generator polynomial for generating a cyclic code for message [111]

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HO **23CEH04 Hardware Design using Verilog** **3 0 0 3**

Version 01.00

Pre-requisite: Electronic Devices and Circuits , Digital logic Design

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO3	PO5	PSO1	
23CEH04.1	Understand the Verilog fundamentals and tools used in modelling of digital design.	2	3	2	2	1
23CEH04.2	Analyze and design basic digital circuits with combinatorial and sequential logic circuits using Verilog HDL.	2	3	2	2	1
23CEH04.3	Model complex digital systems at several levels of abstractions.	2	3	2	1	1
23CEH04.4	Design real time applications such as vending machine and washing machines etc.	2	3	2	1	1
23CEH04.5	Understand the various applications for Digital interface.	3	2	3	1	1

Unit I:	**Introduction**	**9 hours**
Digital Circuit Design Flow, Hardware Description Languages, Verilog Fundamentals, Module Representation, Timing and Delays in Modelling, Hierarchical Module Representation		**COs: CO1**
Unit II:	**Verilog Data Types and Operators**	**9 hours**
Data Types in Verilog, Net and Variable Data Types, Defining Constants and Parameters, Defining Vectors, Operators in Verilog		**COs: CO2**
Unit III:	**Combinational Circuits**	**9 hours**
Combinational Circuit Analysis, Combinational Circuit Implementation, Combinational Circuit Design, Adders in Verilog, Comparators in Verilog, Decoders in Verilog, Encoders in Verilog, Multiplexers in Verilog, Applications on Combinational Circuit		**COs: CO3**
Unit IV:	**Sequential Circuits**	**9 hours**
Sequential Circuit Analysis, Sequential Circuit Implementation, Sequential Circuit Design, Latches in Verilog, Flip-Flops in Verilog, Shift Registers in Verilog, Counters in Verilog, Applications on Sequential Circuits.		**COs: CO4**
Unit V:	**Digital Interfacing**	**9 Hours**
Universal Asynchronous Receiver/Transmitter (UART) in Verilog, Serial Peripheral Interface (SPI) in Verilog, Inter-Integrated Circuit (I2C) in Verilog, *Universal Serial Bus (USB) Receiving Module in Verilog* Video Graphics Array (VGA) in Verilog, Applications on Digital Interfacing		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	Pos
1			
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Text Books

1. CemUnsalan and BoraTar, "Digital System Design with FPGA Implementation Using Verilog and VHDL" McGraw-Hill Education,2017
2. PadmanabhanR. andBala Tripura Sundari B., "Design through Verilog HDL", WSE, IEEE Press,2004.

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1. MichaelD. Ciletti, "Advanced Digital Design with Verilog HDL", Prentices Hall International,2005.
2. Stephen Brown andZvonkoVranesic, "Fundamentals of Logic Design with Verilog", Tata McGraw Hill,2005.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs94/preview
2. https://www.classcentral.com/course/swayam-hardware-modeling-using-verilog-14103

HO 23CEH05 Advanced Digital Signal Processing

3 0 0 3
Version 01.00

Pre-requisite: Digital Signal processing

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23CEH05.1	Understand the Verilog fundamentals and tools used in modelling of digital design.	2	3	2	2	1
23CEH05.2	Analyze and design basic digital circuits with combinatorial and sequential logic circuits using Verilog HDL.	2	3	2	2	1
23CEH05.3	Model complex digital systems at several levels of abstractions.	2	3	2	1	1
23CEH05.4	Design real time applications such as vending machine and washing machines etc.	2	3	2	1	1
23CEH05.5	Understand the various applications for Digital interface.	3	2	3	1	1

Unit I:	**Review of DFT, FFT, IIR Filters and FIR Filters**	**9 hours**
Multi Rate Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion.		**COs: CO1**
Unit II:	**Applications of Multi Rate Signal Processing**	**9 hours**
Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low PassFilters, Implementation of Digital Filter Banks,Trans-multiplexers, Over Sampling A/D and D/A Conversion		**COs: CO2**
Unit III:	**Non-Parametric Methods of Power Spectral Estimation**	**9 hours**
Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods		**COs: CO3**
Unit IV:	**Implementation of Digital Filters**	**9 hours**
Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Advantages of lattice structures.		**COs: CO4**
Unit V:	**Parametric Methods of Power Spectrum Estimation**	**9 Hours**
Autocorrelation & Its Properties,Relationbetween auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA &ARMA models for power spectrum estimation, Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	Pos
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Text Books

1. Proakis, J.G. andManolakisPunmia, D.G.,"Digital Signal Processing: Principles, Algorithms &Applications",Prentice-Hall International, 4th Edition,2008
2. Alan, V. Oppenheim & Ronald, W. Schaffer, "Discrete-Time signal processing ", Prentice-Hall International. 2nd Edition,1999
3. Emmanuel, C. Ifeacher, Barrie, W. Jervis,"DSP – A Practical Approach", 2nd Edition, PearsonEducation,2000.

Reference Books

1. Kay, S. M ., "Modern spectral Estimation: Theory & Application ", Prentice Hall International, 1988.
2. Kaluri, V. Rangarao andRanjan, K. Mallik,"Digital Signal Processing: A Practitioner's Approach", ISBN: 978-0-470-01769-2, 210 pages, November JohnWeley 2006
3. Vaidyanathan, P.P., "Multi Rate Systems and Filter Banks", Pearson Education.

Web References

1. https://nptel.ac.in/courses/117101001
2. https://onlinecourses.nptel.ac.in/noc21_ee20/preview

HO 23CEH06 Advanced Digital Communications

3 0 0 3
Version 01.00

Pre-requisite: Digital Communication

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23CEH06.1	Understand the mathematical model for channels and can represent digitally modulated signals.	2	3	2	2	1
23CEH06.2	Design slabs with different boundary conditions and RC Staircases	2	3	2	2	1
23CEH06.3	Estimate signal parameters.	2	3	2	1	1
23CEH06.4	Understand under Band-Limited Channels	2	3	2	1	1
23CEH06.5	Understand the concept of parallel Transmission.	3	2	3	1	1

Unit I:	**Introduction**	**9 hours**
Introduction Elements of Digital Communication System: Communication channels and their characteristics, mathematical models for channels, representation of Band pass signals and Systems,Gram-Schmidt orthogonalization procedure, representation of digitally modulated signals, signalling schemes with memory - CPFSK - CPM		**COs: CO1**
Unit II:	**Optimum Receiver for Additive White Gaussian Noise Channel**	**9 hours**
Channel Coherent and noncoherent demodulation: Matched filter,Correlator demodulator, square-law, and envelope detection, Detector: Optimum rule for ML and MAP detection Performance: Bit-error-rate, symbol error rate for coherent and noncoherent schemes.		**COs: CO2**
Unit III:	**Carrier and Symbol Synchronization**	**9 hours**
Signal Parameter Estimation: Carrier phase estimation, symbol timing estimation, joint estimation of carrier phase, performance characteristics of ML estimators		**COs: CO3**
Unit IV:	**Band-Limited Channels**	**9 hours**
Band-Limited Channels Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation, Channel with distortion. Equalization: MLSE, linear equalization, decision feedback equalization, adaptive linear equalizer - adaptive decision feedback equalization.		**COs: CO4**
Unit V:	**Concept of parallel transmission**	**9 Hours**
Concept of parallel transmission, Multichannel and multicarrier CDMA Systems, fading, multi-path channel, OFDM		**COs: CO5**

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Text Books

1. John, G.Proakis, “Digital Communication” , McGraw Hill
2. Stephen, G. Wilson, “Digital Modulation and Coding”, Pearson Education (Asia) Pvt. Ltd, 2003.
3. Andrew, J. Viterbi, "CDMA: Principles of spread spectrum communications",Prentice Hall International, USA, 1995.

Reference Books

1. Proakis, J. G. and M. Salehi, “Fundamentals of Communication Systems”, Pearson Education, 2005.
2. SimonHaykins, “Communication Systems”, 5th Edition, John wiley, 2008.
3. Simon, M. K., Hinedi, S. M. and Lindsey, W. C.,”Digital Communication Techniques: Signaling and detection”, Prentice Hall India, N. Delhi, 1995.
4. Tomasi, W. “Advanced Electronic Communication Systems”, 4th Edition., Pearson Education, 1998.

Web References

1. https://nptel.ac.in/courses/117105144
2. https://onlinecourses.swayam2.ac.in/nou20_cs14/

HO **20ECH07 Design of Digital Integrated Circuits** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23ECH07.1	Describe any algorithm to efficient architecture mapping
23ECH07.2	Construct various adder architecture
23ECH07.3	Construct various multiplier architecture
23ECH07.4	Describe CORDIC architecture with any applications
23ECH07.5	Illustrate the timing issues in VLSI

Unit I:	**Algorithm to Efficient Architecture Mapping**	**9 hours**
One bitincrementer, four bit incrementer, n-bit incrementer, ones' complement, two's complement, sum of N –natural numbers, prioritization, greatest common divisor (GCD)		**COs: CO1**
Unit II:	**Adder Architecture**	**9 hours**
Single bit addition, Carry – Ripple adder, Carry – Skip adder, Carry-Look ahead adder, Carry –Select adder, Carry – Increment adder, Tree adder		**COs: CO2**
Unit III:	**Multiplier Architecture**	**9 hours**
Tree multiplication, Array multiplication, signed multi-operand addition, squaring, shift and add multiplier, synchronous shift and add multiplier, Booth algorithm		**COs: CO3**
Unit IV:	**Cordic Architecture**	**9 hours**
CORDIC method, rotation and vectoring mode, convergence, precision and range, scaling factor and compensation, implementations: word-serial and pipelined, New techniques – Micro rotation to Angel Recoding (MAR), Binary to BipolarRecoding (BBR)		**COs: CO4**
Unit V:	**Issues in Timing Closure**	**9 hours**
Static and Dynamic timing analysis, System Considerations - edge triggered, clock skew, handling asynchronous inputs,sequential machine, clock cycle time, Violation – maximum propagation delay, race through, Re-timings		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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1. BehroozParhami, "Computer Arithmetic Algorithms and Hardware Designs", 2nd Edition, Oxford University Press, 2010
2. MErcegovac, D. and T. Lang, "Digital Arithmetic", Elsevier Science (USA), 2003

Reference Books

1. Ulrich, W. Kulisch, "Advanced Arithmetic for the Digital Computer", Springer-Verlag Wien, 2002
2. Rabaey, M., Anantha Chandrakasan and BorivojeNikolic, "Digital Integrated Circuits - A Design Perspective", 2nd Edition, Prentice Hall International, 2016

Web Resource

1. https://www.youtube.com/watch?v=iQHmtEtEggY
2. https://onlinecourses.nptel.ac.in/noc22_ee58/preview
3. https://onlinecourses.nptel.ac.in/noc20_ee37/preview

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HO **20ECH08 Pattern Recognition** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23ECH08.1	Understand and recollect the basics of Baye's Theorem, Auto Correlation and Cross Correlation Techniques
23ECH08.2	Illustrate the Bayes Decision Theory and Parameter Estimation Methods
23ECH08.3	Demonstrate the Criterion and Clustering Techniques
23ECH08.4	Demonstrate the Sequential Pattern Recognition Techniques like HMMs, Parzen-Window Method
23ECH08.5	Understand the principles involved in Dimensionality Reduction using Non-metric methods for pattern classification

Unit I:	**Basics of Probability, Random Processes and Linear Algebra**	**9 hours**
Probability: independence of events, Baye's theorem; Random Processes: Stationary and non stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; Linear Algebra: Inner product, outer product, inverses, Eigen values, Eigen vectors		**COs: CO1**
Unit II:	**Baye's Decision Theory**	**9 hours**
Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, discriminant functions, discrete features. Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case; Maximum a Posteriori estimation; Bayesian estimation: Gaussian case.		**COs: CO2**
Unit III:	**Unsupervised learning and clustering**	**9 hours**
Criterion functions for clustering; Algorithms for clustering: K-Means, Hierarchical and other methods; Cluster validation, Expectation-Maximization method for parameter estimation; Maximum entropy estimation		**COs: CO3**
Unit IV:	Sequential Pattern Recognition	**9 hours**
Hidden Markov Models (HMMs); Discrete HMMs; Continuous HMMs, Nonparametric techniques for density estimation: Parzen-window method.		**COs: CO4**
Unit V:	Dimensionality Reduction	**9 hours**
Fisher discriminant analysis; Principal component analysis;Linear discriminant functions: Gradient descent procedures; Perceptron, Support vector machinesm, Non-metric methods for pattern classification: Non-numeric data or nominal data; Decision trees: CART.		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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1. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley, 2001.
2. S.Theodoridis and K.Koutroumbas,"Pattern Recognition",4th Edition, Academic Press, 2009.
3. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

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1. Earl Gose, Richard Johnsonbaugh and Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India, 2002.

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1. https://onlinecourses.nptel.ac.in/noc19_ee56/preview
2. https://www.ll.mit.edu/outreach/adaptive-antennas-and-phased-arrays-online-course

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HO **20ECH09 Advanced 3G and 4G Mobile Communications** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23ECH09.1	Understand the concept of cellular systems, cell structures, cell sectoring.
23ECH09.2	Design of Antenna system, Types of interferences.
23ECH09.3	Understand the channel assignments, formula for mobile propagation over water and flat open area.
23ECH09.4	Classify and analyse types of hand-off strategies, vehicle locating methods, and dropped call rates.
23ECH09.5	Understand GSM Architecture, Multiple Access Schemes

Unit I:	**The Cellular Mobile Radio Systems**	**9 hours**
Introduction, uniqueness of mobile radio environment, cellular system operation, components of Cellular system, Hexagonal shaped cells, Analog and Digital Cellular systems .Evolution of Cellular systems, frequency reuse and it's ratio, Number of channels in a cellular system, Trunking and Blocking, Grade of Service, macro, micro, pico and femto cell structures, Cell splitting, Cell sectoring.		**COs: CO1**
Unit II:	Interference	**9 hours**
Types of interferences, Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni-directional Antennasystem, design of Antenna system, antenna parameters and their effects, diversity receiver, non-co-channel interference- different types.		**COs: CO2**
Unit III:	**Frequency Management and Assignments of Channels**	**9 hours**
Numbering and grouping, setup access and paging channels, channel assignments to cell sites and mobile units, channel sharing and borrowing, overlaid cells. Cell coverage for signal and traffic: Signal reflections in flat and hilly terrain,effect of human made structures, mobile propagation over water and flat open area, near and long-distance propagation, antennaheight gain, form of a point-to-point model		**COs: CO3**
Unit IV:	Handoff Strategies	**9 hours**
Concept of Handoff, types of handoffs, handoff initiation, delaying handoff, forced handoff, mobile assigned handoff, intersystem handoff, soft and hard handoffs, vehicle locating methods, dropped call rates and their evaluation		**COs: CO4**
Unit V:	Digital Cellular Networks	**9 hours**
GSM architecture, GSM channels, multiple access schemes; TDMA, CDMA, OFDMA.3G and 4G Wireless Standards GSM,GPRS, WCDMA, LTE, Wi-MAX, Introduction to 5G standards..		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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Text Books

1. Lee W.C.Y.,"Mobile Cellular Telecommunications", Tata McGraw Hill, 2nd Edition, 2006
2. Gordon L. Stuber.," Principles of Mobile Communications", Springer International, 2nd Edition, 2007.
3. Savo G. Glisic," Advanced Wireless Communications-4G", John Wiley & Sons Publication, 2nd Edition

Reference Books

1. Theodore, S. Rapport.," Wireless Communications", Pearson education, 2nd Edition,2002.
2. David Tse and Pramod Viswanath," Fundamentals of Wireless Communication", Cambridge University Press

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1. https://nptel.ac.in/courses/105/102/105102012/
2. https://onlinecourses.swayam2.ac.in/nou20_cs14/
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HO **23ECH10 Simulation and Testing Methods for VLSI Design** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23ECH10.1	Identify the significance of testable design and specify Fabrication defects, Errors and Faults
23ECH10.2	Analyze various Simulation Methods in Modeling circuits
23ECH10.3	Understand the importance of Design verification
23ECH10.4	Implement the test methods for static and dynamic CMOS circuits
23ECH10.5	Analyze the BIST techniques to improve testability

Unit I:	**Introduction to Testing**	**9 hours**
Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends affecting Testing, Types of Testing, Fault Modeling: Defects, Errors and Faults, Functional Versus Structural Testing, Levels of Fault Models, Single Stuck-at Fault.		**COs: CO1**
Unit II:	**Logic and Fault Simulation**	**9 hours**
Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation,Algorithms for Fault Simulation, ATPG		**COs: CO2**
Unit III:	**Testability Measures**	**9 hours**
SCOAP Controllability and Observability, High Level Testability Measures, Digital DFT and Scan Design: Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.		**COs: CO3**
Unit IV:	**CMOS Testing**	**9 hours**
CMOS testing**:** Testing of static and dynamic circuits. Fault diagnosis: Fault models for diagnosis, Cause- effect diagnosis, Effect- cause diagnosis.		**COs: CO4**
Unit V:	**Built-In Self-Test**	**9 hours**
The Economic Case for BIST, Random Logic BIST: Definitions, BIST Process, Pattern Generation, Response Compaction, Built- In Logic Block Observers, Test-Per-Clock, Test-Per Scan BIST Systems, Circular Self Test Path System, Memory BIST, DelayFault BIST.		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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Text Books

1. WenW. W., "VLSI Test Principles and Architectures Design for Testability", Morgan Kaufmann Publishers, 2006.
2. AbramoviciM., BreuerM. and FriedmanA.,"Digital Systems Testing and Testable Design", IEEE Press, 1990
3. William K. Lam "Hardware Design Verification: Simulation and Formal Method based Approaches", Prentice Hall, 2008

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1. Stroud and Kluwer,"A Designer's Guide to Built-in Self-Test", Academic Publishers, 2002
2. BushnellM. and AgrawalV. and Kluwer, "Essentials of Electronic Testing for Digital, Memory &MixedSignal VLSI Circuits", Academic Publishers, 2000
3. AgrawalV. and SethS.C.,"Test Generation for VLSI Chips", Computer Society Press.1989.

4. LalaP. K., “Digital Circuit Testing and Testability”, Academic Press.

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1. https://www.semanticscholar.org/paper/Advanced-simulation-and-test-methodologies-for-VLSI-Russell-Sayers/c97ef40cf7a38b27bc3ec0496f9d0943dc29fdd4
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HO **20ECH11 Digital Signal Processing and Image Processing Using MATLAB** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23ECH11.1	Understand the mathematical functions , operations and programming
23ECH11.2	Derive the frequency domain representation of signals and systems
23ECH11.3	Design and realization of IIR and FIR filters from the given specifications
23ECH11.4	Demonstrate the basic operations and processing techniques of digital Image processing
23ECH11.5	Understand the algorithms and Develop some applications of digital image processing

Unit I:	**Introduction to MATLAB**	**9 hours**
Variables, Operations and Functions, Matrix operations, Matrix functions, Logical operators on Boolean variables, Graphicallydisplaying results, Program writing.		**COs: CO1**
Unit II:	**Operations on Signals and Systems**	**9 hours**
Concept of signal, Concept of System, Sampling Theorem, Plotting a signal as a function of time, Spectral representation, Discrete –Time Fourier Transform, Discrete Fourier Transform		**COs: CO2**
Unit III:	**Linear Filters**	**9 hours**
Transforming and Linear Filtering, Connection between gain and poles /zeros, Filter Design methods: Continuous to Discrete time Filter, FIR filter design using the window method, IIR filter design.		**COs: CO3**
Unit IV:	**Image Processing**	**9 hours**
Introduction: Image display, Arithmetical and logical operations, Geometric transformations of an image, Linear Filtering, Otheroperations on images, Median filtering, Morphological filtering of binary images.		**COs: CO4**
Unit V:	**Applications of Digital Signal Processing and Digital Image Processing**	**9 hours**
Speech Processing: A speech signal Model, Principal Component Analysis(PCA),Matched Filters in radar telemetry, Kalman filtering.		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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Text Books

1. Gerard Blanchet Maurice Charbit,"Digital Signal and Image Processing using MATLAB", Wiley, 2006.
2. Sanjit K. Mitra," Digital Signal Processing , A Computer Based Approach " Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Reference Books

1. Steven, L. Eddins, Rafael C. GONZALES, Richard, E. Woods ,"Digital Image Processing Using MATLAB , Tata McGraw Hill Education (India)2010

2. Chris Solomon, Toby Breckon,P.C., "Fundamentals of Digital Image Processing - A Practical Approach with Examples in Matlab"Wiley, 2011
3. Robert, J. Schilling and Sadra,L.Haris," Fundamentals of Digital Signal Processing using MATLAB" Thomson, 2007

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2. https://nptel.ac.in/courses/108106168/
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HO **23ECH12 5G Mobile & Wireless Technology** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23ECH12.1	Understand the basics of wireless technology
23ECH12.2	Demonstrate the fundamentals of cellular system
23ECH12.3	Classify and Understand the various Digital standards for wireless communication
23ECH12.4	Understand the requirements and advantages of CDMA
23ECH12.5	Demonstrate the 5G Technlogy

Unit I:	**Introduction to Wireless Technology**	**9 hours**
Radio wave propagation, Block diagram of wireless communication system, Wireless network generations, mobile wireless system, cordless telephone system, cellular telephone system, and wireless local loop (WLL) and Local Multipoint Distribution System (LMDS), Mobile Standards.		**COs: CO1**
Unit II:	**Elementary Cellular Systems**	**9 hours**
Basic of Cellular fundamentals, cell structure, cluster, minimum reuse distance, basics of cellular systems, mobile station, basestation, traffic channel and control channel, frequency reuse, concept of Handoffs, Types of Handoffs (Hard, soft, queued, delayed and Mobile assisted Handoffs) and channel interference.		**COs: CO2**
Unit III:	**Digital Cellular Standards**	**9 hours**
Global system for mobile communication (GSM), Architecture, features, channel types and security and call routing. IS-95/CDMA One, Comparison with GSM features. Signaling system, network services part (NSP), Message transfer part (MTP), Signaling correction control part (SCCP) and its performance. Need of 3G & 4G technology.		**COs: CO3**
Unit IV:	**Advanced Cellular Standards**	**9 hours**
IMT-2000 global standards, its vision, spectrum requirements, services and compatibility. Architecture, features of UMTS standard. Features and advantages of CDMA-2000 over 3G. Features and architecture of 802.15.1, Basics of RFID, frequency band andclassification of RFID tags, WMAN, MANET.		**COs: CO4**
Unit V:	**Introduction to 5G**	**9 hours**
Review of 4G, 4G LTE, VoLTE, 4.5G. Introduction to advantages of 5G, its challenges and applications, Basics of 5G channels access methods, radio access network requirements for 5G, 5G &IoT. - 5G for Massive Machine Type Communication and Massive IoT- V2X Communication.		**COs: CO5**

Board of Studies			
Approved in : BoS No. IV			
Approved in : ACM No. VI			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Text Books

1. Lin Yi-Bang, Clamtaclmrich, “Wireless and mobile network architecture” John Wiley & sons, 2001.
2. William, Y.,“Mobile cellular telecommunications system” McGraw Hill Education, New Delhi, 2017.
3. SaadZ. Asif, “5G Mobile Communications Concepts and Technologies”,1st Edition, CRC Press, 2019.

4. Jonathan Rodriguez, "Fundamentals 5G Mobile Networks", 1st Edition John Wiley& Sons, 2015.

Reference Books

1. Rappaport, S., Theodore, "Wireless communications principles and practice" Pearson publication, New Delhi, 2005.
2. Singal, T.L., " Wireless communications" McGraw Hill Education Private Limited, 2010.
3. Erik Dahlman, Stefan Parkvall, Johan Skold, "5G NR: The Next Generation Wireless Access Technology",1st Edition, Academic Press, 2018.
4. AfifOsseiran, Jose F., Monserrat and Patrick Marsch, "5G Mobile and Wireless Technology", Cambridge press, 2016.

Web References

1. https://nptel.ac.in/courses/108105134
2. https://www.researchgate.net/publication/337224719_Mobile_and_Wireless_Technology_MWT

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Board of Studies
(ECE)

MI 23CEO01 Environmental Pollution and Control **3 0 0 3**

Version 01.00

Pre-requisite: Environmental science and sustainability

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs			DoK
		PO3	PO4	PO7	
23CEO04.1	Understand the basic ideology on human and environment relationship	1	2	3	L1, L2
23CEO04.2	Understand the concept of pollution control and monitoring	2	3	3	L1, L2
23CEO04.3	Apply the waste management rules and methods for controlling pollution	1	2	3	L1, L2
23CEO04.4	Use the applications of EIA in developmental projects	2	3	3	L1, L2
23CEO04.5	Know the regulations to control environmental degradation	3	3	3	L1, L2
23CEO04.6	Know the policies to control environmental degradation	3	3	3	L1, L2

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I:	**Human communities and Environment**	**09 hours**
Human population growth - Impacts on Environment, human health and welfare, resettlement and rehabilitation of project affected persons, Types of life supporting systems, Disaster management - Floods, earthquakes, cyclones and landslides. Environmental movements - Chipko, silent valley, Bishnoi's of Rajasthan, Role of Indian and other religious and cultures in environment conservation, communication and public awareness *Risk mitigation, Ecology and ecosystem*		**COs: CO1**
Unit II:	**Pollution monitoring and control**	**09 hours**
Quality standards of air, water and soil, Types of air pollutants, methods for monitoring and control of air, water and soil pollution, effects of pollution on plants, animals and human being, Effects and control of noise pollution, noise levels. *CPCB, MoEF , Pollution control*		**COs: CO2**
Unit III:	**Solid waste Management**	**09 hours**
Definition, types, sources, Solid waste generation, collection, segregation, storage, transport and disposal Effects of poor solid waste management, protective measures and municipal solid waste management rules 2016 *E-waste, Plastic waste, biological waste*		**COs: CO3**
Unit IV:	**EIA**	**09 hours**
Definition, scope, Procedure, Public involvement, EIA Methodologies - Ad hoc, Matrices, Networking, Overlays, Cost benefit analysis, Environmental management planning, Applications of EIA in developmental projects and Environment *EIS, EMP*		**COs: CO4**
Unit V:	**Environmental laws and policy**	**09 hours**
Article 48 A, Article 51A, Forest act 1865, The air act 1981, The water act 1974, EPA 1986, The motor vehicle act 1988, The biological diversity act 2002, noise pollution rules 2000, Role of MoEF and CPCB, Stockholm conference 1972, Rio de Janeiro, Montreal protocol 1987, Kyoto protocol 1997 *Pollution monitoring and control*		**COs: CO5**

Board of Studies			
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Applications of EIA in the project development	CO #4	PO #3, PO #4, PO #7
2	Know the policies to control environmental degradation	CO #6	PO #3, PO #4, PO #7

Textbooks

1. H S Bhatia, Environmental pollution control, 1st Edition, JDM Publishers & Distributors, 2022.
2. Gilbert M Masters, Introduction to Environmental Engineering and Science, 3rd Edition, Pearson Education India, 2015.
3. CS Rao, Environmental pollution Control Engineering, 3rd Edition, New age international publishers, 2018.

Reference Books

1. Santosh Kumar Garg, Sewage disposal and air pollution Engineering, Volume 2, 41st Edition, Khanna publications, 1979.
2. Debapriya De & Debasish De, Fundamentals of Environment and Ecology, 2nd Edition, S. Chand publications, 2023.

Web References

1. https://byjus.com/biology/solid-waste-management/#:~:text=Municipal%20solid%20waste%20can%20further,%2C%20bulb%2C%20batteries%2C%20etc.
2. https://gmch.gov.in/sites/default/files/documents/Solid%20Waste%20Management.pdf
3. https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/education/Teachers_Manual/Teacher_manual_master_EIA.pdf
4. **https://iced.cag.gov.in/?page_id=256**

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define Disaster management
2. List the types of air pollutants
3. Recall the concept of pollution monitoring and control

L2: Understand

1. Explain the consequences and control measures for earthquakes and cyclones
2. Discuss the concept of EIA and explain the criteria for selecting EIA methods
3. write a brief note on
    a. EPA 1986
    b. Role of MoEF and CPCB

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PC 23CS405 Operating Systems 3 0 0 3.0

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs PO1	PO3	DoK
23CS405.1	Describe the structure, components and functionalities of operating system	3	1	L1, L2
23CS405.2	Describe the process management activities of operating system	3	1	L1, L2
23CS405.3	Illustrate the use of process synchronization tools	3	1	L1, L2
23CS405.4	Describe the various memory management and allocation techniques	3	1	L1, L2
23CS405.5	Demonstrate different secondary storage management strategies and file system	3	1	L1, L2

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Operating System Concepts **9 Hours**

What Operating System do? Operating System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments, Operating Systems Services, System Call, Types of System Call, Operating System Generation, System Boot

COs : CO1

Self - Learning Topics: The Shell, Mobile Operating System, Choice of Interface

Unit II: Process Management **9 Hours**

Process Concept: The Process, Process State, Process Control Block, Threads,
Process Scheduling: Scheduling Queues, Schedulers, Context Switch, Operations on Processes, Inter Process Communication.
Multithread Programming: Overview, Benefits, Multithreading Models.
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

COs: CO2

Self - Learning Topics: Process Termination, Multiprocess Architecture

Unit III: Synchronization **9 Hours**

Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

COs: CO3

Self - Learning Topics: Transactional Memory, Two Phase Locking

Unit IV: Memory Management **9 Hours**

Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.
Virtual Memory Management: Background, Demand Paging, Page Replacement, Thrashing.
Mass-Storage Structure: Overview of Mass-Storage Structure, Hard Disk Drives, Volatile Memory, HDD Scheduling-FCFS Scheduling, SCAN Scheduling, Selection of a Disk-Scheduling Algorithm.

COs: CO4

Self - Learning Topics: Buddy System, Prepaging

Unit V: File System Interface **9 Hours**

File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File Sharing, Protection.

Implementing File Systems: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management. **COs: CO5**

Self - Learning Topics: Consistency Checking, Malware, Denial of service

Board of Studies		Computer Science and Engineering	
Approved in: BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs / PSOs**
1	Process Scheduling	CO1 – CO5	PO1, PO3
2	Memory Management	CO1 – CO5	PO1, PO3

Text Books

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne,"Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018
2. William Stallings,"Operating Systems - Internals and Design Principles", 9th Edition, Pearson, 2018

Reference Books

1. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Pearson, 2015
2. Charles Crowley, "Operating Systems: A Design-Oriented Approach", 1st Edition, Tata McGrawHill Education, 2001
3. Dhananjay M. Dhamdhere, "Operating Systems: A Concept-Based Approach", 3rd Edition, McGrawHill Higher Education, 2017

Web References

1. http://nptel.ac.in/downloads/106108101/
2. https://www.coursera.org/learn/iot/lecture/MrgxS/lecture-3-1-operating-systems
3. https://www.geeksforgeeks.org/operating-system-introduction-operating-system-set-1/
4. https://www.unf.edu/public/cop4610/ree/Notes/PPT/PPT8E/CH12-OS8e.pdf
5. https://in.udacity.com/auth?next=/course/introduction-to-operating-systems--ud923

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	40
L2	50	60
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define Operating System
2. What are operating system services?
3. List any four types of system calls
4. What is a process? List any four fields of process control block
5. What are the necessary conditions for a deadlock?
6. Differentiate between binary and counting semaphore.
7. What are the various attributes that are associated with an opened file?

L2: Understand

1. Discuss the essential properties of operating systems - Batch, Interactive, Timesharing Real time and Distributive
2. Explain how multiprogramming increases the utilization of CPU
3. Why system calls are needed in operating system?
4. Distinguish between logical address and physical address
5. What is the difference between a process and thread?
6. How does the system detect thrashing? What can the system do to eliminate this problem?
7. Consider the following four processes represented as (Process, Arrival Time, Burst Time) with the length of CPU burst in milliseconds
   { (P1, 0, 10), (P2, 1, 7), (P3, 2, 13), (P4, 3, 11) }. Using preemptive SJF scheduling: (i) Draw Gantt chart (ii) Calculate average waiting time
8. Why semaphores are important? Suggest the solution for bounded buffer problem with semaphores
9. Explain the steps involved in handling a page fault with a neat sketch

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Chairman
Board of Studies (CSE)

OE 23AIO01 Introduction to Python 3 0 0 3

Pre- Requisite Concepts of Basic Mathmetics

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs		DoK
		PO1	PO2	
23AIO01.1	Explain the basic language features of Python programming	3	2	L1, L2, L3
23AIO01.2	Articulate and use various control structures and data structures in Python	3	2	L1, L2, L3
23AIO01.3	Able to use the concepts of functions and modules to solve simple computing problems	3	2	L1, L2, L3
23AIO01.4	Explain the object oriented programming principles	3	2	L1, L2, L3
23AIO01.5	Illustrate the use of Mathematical Libraries in Python	3	2	L1, L2, L3
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning				

Unit I:	**Introduction**	**9 hours**
Basic Concepts: Introduction to Python, Programming Paradigms:Procedural Programming Model, Object-Oriented Programming Model, Event-driven programming model – Python Basics - Comments, Identifiers, Keywords, Types, operators, Precedence, associativity, Type conversions, Console input, output - Strings: properties, built-in functions,comparisons *Integer and float ranges*		**COs: CO1**
Unit II:	**Control Statements and Data Structures**	**9 hours**
Decision control instructions – conditional expressions, Decision statements, repetition control instruction: while, for, break and continue, **Data Structures:** List, Tuples, Sets, Dictionaries, List Comprehensions *Stack operations*		**COs: CO2**
Unit III:	**Functions, Modules & Packages**	**9 hours**
Functions: types of arguments,Recursion **Modules**:The Main Module, Creating Modules, Importing Module, Built in Modules - Random, Math, Date, Regex **Packages**: Introduction to PIP, Installing Packages using PIP. *Functional programming*		**COs: CO3**
Unit IV:	**Object Oriented Programming**	**9 hours**
Object Oriented Programming: OOP principles, Classes & Object, Class variables & Instance variables, Inheritance, Runtime Polymorphism , Abstract Classes,Overloading Operators, Exceptions: try,catch,finally,User defined exceptions *Iterators and generators*		**COs: CO4**
Unit V:	**Mathematical Libraries**	**9 hours**

GUI Library:tkinter **Mathematical Libraries**: NumPy, Pandas, Matplotlib *Case study: Text Analysis*	**COs: CO5**

Board of Studies		CSE (AI & ML)	
Approved in : BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Importance of learning Python	CO1 – CO6	PO1, PO2
2	Why Python is popular programming language	CO1 – CO6	PO1, PO2

Text Books

1. Yashavant Kanetkar.,Aditya Kanetkar., "Let Us Python", 3rd Edition, bpb., 2021
2. Kenneth A. Lambert., "Fundamentals of Python First Programs", 1st Edition, Cengage Learning, Inc., 2017
3. Vamsi Kurama., "Python Programming: A Modern Approach", 1st Edition, Pearson Education, 2018
4. Mark Lutz., "Learning Python", 1st Edition, Orielly, 2019

Reference Books

1. Gowrishankar S., Veena A., "Introduction to Python Programming", CRC Press, 2019
2. Daniel Liang Y., "Introduction to Programming Using Python", 1st Edition, Pearson, 2012
3. Allen Downey., "Think Python", 2nd Edition, Green Tea Press, 2017
4. Chun W., "Core Python Programming", 2nd Edition, Pearson, 2006

Web References

1. https://www.tutorialspoint.com/python3/python_tutorial.pdf
2. https://www.w3schools.com/python
3. https://www.programiz.com/python-programming
4. https://www.javatpoint.com/python-tutorial

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	40
L2	30	40
L3	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List out Python Features and Applications
2. Define Variable? Write rules for naming variables?
3. What are the difference between list and tuples in Python?
4. List out any 5 functions in Datetime module
5. Define Class & Object

L2: Understand

1. Explain the type conversion functions with example?
2. Explain the following datastructures?
   i. list ii. tuple iii. strings
3. How to create a constructor in Python? Give an example
4. Demonstrate implementation of single inheritance in Python, with a program?
5. Explain the operator overloading with example

L3: Apply

1. Write a program that should print out the user's name the specified number of times
2. Write a program that generates a list of 20 random numbers between 1 and 100. Print the total and average of the elements in the list.
3. Write a function called sum_digits that is given an integer num and returns the sum of the digits of numbers.
4. Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.
5. Write programs to demonstrate the usage of class & object.

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Board of Studies (CSE(AI & ML))

MI 23DSO01 Introduction to Database Management Systems 3 0 0 3.0

Pre- Requisite Linear Algebra & Calculus

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with Pos	DoK
23DSO01.1	Describe the basic concepts of DBMS And different data models	-	L1,L2
23DSO01.2	Apply Constrains on relations		L2,L2,L3
23DSO01.3	Apply SQL commands on relations		L1,L3
23DSO01.4	Understand PL/SQL operations		L1,L2,L3
23DSO01.5	Understand the principles of database normalization and Transaction management system.		L1,L2
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos			
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create DoK: Depth of Knowledge			

Unit I: Introduction to Databases **9 Hours**

Overview of Data Base Systems, Database System Applications, File System VS Database System, Data Abstraction, Levels of Abstraction, Data Independence Instances and Schemas, Different Data Models, Database Languages, Data Base Users and Administrator, Database System Structure, N-tier Architecture, Database design and ER diagrams, Design Entities, Attributes and Entity sets, Relationships and Relationship Sets, Advanced Features of ER Model

Self - Learning Topics: History of DBMS **COs: CO1**

Unit II: Relational Model, Relational Algebra and Relational calculus **9 Hours**

Relational Model: Introduction to the Relational Model, Integrity Constraint and key constraints over relations, Logical data base Design, Views, Destroying / Altering Tables and Views - Relational Algebra: Selection and Projection, Set Operations, Aggregate Operations, Renaming, Joins, Division, Additional Relational Algebraic operations - Relational calculus: Tuple Relational Calculus, Domain Relational Calculus

Self - Learning Topics: Expressive Power of Algebra and Calculus **COs: CO2**

Unit III: Structured Query Language **9 Hours**

SQL: Concept of different Database Languages over SQL - DDL, DML, DCL., Set operations, SQL Commands, Nested queries, Aggregate Functions, Null Value, Referential Integrity Constraints, views.

Self - Learning Topics: Compare all Database Languages **COs: CO3**

Unit IV: Schema Refinement and Normalization **9 Hours**

Understand PL/SQL block, components of PL/SQL block, Control statements and conditional statements in PL/SQL Embedded SQL, Triggers, Cursors, Stored procedures packages

Self - Learning Topics: Compare all Normal Forms **COs: CO4**

Unit V: Normalization **9 Hours**

Understand the principles for Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure Set of Functional Dependencies, Closure Set of Attributes. - Normalization: 1NF, 2NF, 3NF, BCNF, Lossless Join and Dependency Preserving decomposition,4NF and 5N. Transaction Concept, ACID Properties, States of Transaction, Implementation of Atomicity & Durability, Schedules

Self - Learning Topics: concurrency without Locking **COs: CO5**

Board of Studies		Computer Science and Engineering (Data Science)	
Approved in: BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Data Integrity and security	CO1 – CO5	PO2, PO3, PO5
2	Recent trends in Data bases	CO2 – CO5	PO2, PO3, PO5

Text Books

1. Abraham Silber Schatz, Henry F Korth, S Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill International Edition, 2013.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.
3. Raghurama Krishnan, Johannes Gehrke, "Data base Management Systems", 3rd Edition, TATA McGraw Hill, 2008

Reference Books

1. Elmasri Navrate, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.
2. Peter Rob & Carlos Coronel, "Data base Systems design, Implementation, and Management", 10th Edition, Pearson Education, 2013

Web References

1. https://www.javatpoint.com/dbms-tutorial
2. https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/?ref=lbp

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	30
L2	30	40
L3	40	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List types of database users
2. List out all types of data models present
3. Give syntaxes to Create and Alter a table
4. What is Redundancy?
5. List out the properties of transactions

L2: Understand

1. Compare the database system with conventional file system
2. Demonstrate the use of DISTINCT keyword in SQL select statement
3. Explain the following SQL constructs with examples:

(1) Order by (2) group by and having (3) as select (4) schema

4. Explain the difference among Entity, Entity Type & Entity Set
5. Illustrate ACID properties

L3: Apply

1. Choose a relation R with 5 attributes ABCDE and the following FDs: A ->B, BC->E, and ED ->A. Is R in 3NF? Justify?
2. Apply Normalization technique for the following relation up to 3NF:Bank (acno, cust_name, ac_type, bal, int_rate, cust_city, branchId, branch_nm, br_city)
3. Construct a transaction state diagram and describe each state that a transaction goes through during its execution?

4. Demonstrate serializability concept

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Board of Studies (CSE-DS)

M **23ECO01 Semiconductor Devices and Circuits** **3 0 0 3**

Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
20ECO01.1	Classify different types of semiconductors with energy band diagrams	-	L1, L2
20ECO01.2	Explain the operation and characteristics of PN junction diode and special diodes		L1, L2
20ECO01.3	Classify and Analyze different types of rectifiers		L1, L2, L3
20ECO01.4	Demonstrate the flow of current in different configurations of the transistor & the concept of DC biasing and transistor stabilization		L1, L2, L3
20ECO01.5	Analyze and Design the small signal low frequency amplifiers		L1, L2, L3

Unit I: Semiconductor Physics	**9 hours**
Atomic structure, Neil Bohr's atomic theory, definition of conductors, insulators and semiconductors, energy level diagrams. Semiconductors: Classification and types, intrinsic and extrinsic, P-type and N-type semiconductors, majority and minority carriers, recombination, effect of temperature. *Fermi Level, Charge Densities in Semiconductors*	**COs: CO1**
Unit II: Semiconductor Diodes and Special Diodes	**9 hours**
Formation of depletion region, barrier potential, reverse breakdowns, PN junction as diode, symbol, biasing modes, V-I characteristics, diode current equation, effect of temperature on diode current, ideal diode. Special Diodes: Zener diode, Photo Diode, LED - Working, characteristics and applications. *Diode Switching times, Varactor diode, Tunnel Diode*	**COs: CO2**
Unit III: Rectifiers and Filters	**9 hours**
Half wave Rectifier, Full wave rectifier, Bridge Rectifier - Operation, Input and output wave forms. Filters: Inductor filter, Capacitor filter, π filter, Comparison of various filter circuits in terms of ripple factors. *LC filter, Multi section π filter*	**COs: CO3**
Unit IV: Transistors and Biasing Techniques	**9 hours**
Junction transistor, Transistor current components, Transistor configurations, Transistor as an amplifier, characteristics of transistor in CB and CE configurations. Need for biasing, operating point, Load line analysis, fixed bias and self bias, Stabilization against variations in VBE, Ic, and β, Stability factor, Thermistor and Sensistor bias compensation techniques, Thermal runaway. *Ebers-Moll model of a transistor, Punch through/reach through, Thermal stability*	**COs: CO4**
Unit V: Small Signal Low Frequency Transistor Amplifier Models	**9 hours**
BJT: Two port network, Transistor hybrid model, Determination of h-parameters, Generalized analysis of transistor amplifier model using h-parameters, Exact and approximate analysis of CB and CE amplifiers, Comparison of transistor amplifiers. *Effects of emitter bypass capacitor (Ce) on low frequency response*	**COs: CO5**

Board of Studies		**ECE**	
Approved in : BoS No.		VII	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Lal Kishore K., "Electronic Devices and Circuits", 4th Edition, Bright Sky Publications, 2016
2. Millman J. and Christos C. Halkias, "Electronic Devices and Circuits", 4th Edition, Tata Mc-Graw Hill, 2010
3. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2009
4. Boylestad R. L. and Louis Nashelsky, "Electronic Devices and Circuits", 10th Edition, Pearson Publications,2009

Reference Books

1. Salivahanan S., Suresh Kumar and Vallavaraj N. A., "Electronic Devices and Circuits", 2nd Edition, Tata Mc-Graw Hill, 2012
2. Donald A. Neamen, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill, 2010
3. Millman J. and Halkias C., "Integrated Electronics", 2nd Edition, Tata Mc-Graw Hill, 2009
4. Singh B. P. and Rekha, "Electronic Devices and Integrated Circuits", 3rd Edition, Pearson publications, 2009
5. Mittal G. K., "Electronic Devices and Circuits", 3rd Edition, Khannan Publishers, 2008

Web Resources

1. www.elprocus.com/p-n-junction-diode-theory-and-working/
2. http://fourier.eng.hmc.edu/e84/lectures/ch4/node3.html
3. http://nptel.ac.in/courses/117103063/11

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	35
L2	40	35
L3	20	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define Semiconductor
2. What is ideal diode?
3. List any three applications of Zener diode
4. What is rectifier?
5. Define ripple factor
6. What is BJT?
7. What is thermal runaway?
8. Define stability

L2: Understand

1. Describe the formation of P type semiconductor
2. Draw and explain V-I characteristics of PN junction diode

3. Describe the construction and operation of Photo diode
4. With neat circuit diagram describe the operation of bridge rectifier
5. Explain, why Zener diode is used in reverse bias with the help of characteristics
6. Draw and explain the input and output Characteristics of Common base configuration
7. With neat sketches explain the V-I characteristics of NPN transistor in common emitter configuration
8. Write a short note on Thermal Runaway
9. Explain thermistor compensation technique

L3: Apply

1. Show that the efficiency of half wave rectifier is 40.6%
2. Show that the efficiency of full wave rectifier is 81.2%
3. Obtain an expression of stability factor for fixed bias
4. With suitable expressions explain self bias of BJT
5. Obtain the expressions for voltage gain and current gain of small signal low frequency common emitter amplifier.

MI **23EEO01 Basics of DC Machines** **3 0 0 3**

Version 01.00

Pre-requisite: Basic Electrical and Electronics Engineering

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	DoK
23EEO01.1	Classify various types of DC machines	2	1	L1 – L2
23EEO01.2	Explain operation of DC machines	2	1	L1 – L2
23EEO01.3	Summarize the characteristics of DC motor	2	1	L1 – L2
23EEO01.4	Summarize the characteristics of DC generator	2	1	L1 – L2
23EEO01.5	Understand various testing methodologies of DC Machine	2	1	L1 – L2

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to DC Machines **9 hours**

Overview of electrical machines and their classification, Basic principles of electromagnetism and magnetic circuits, Constructional features of DC machines: parts and their functions, Working principle of a DC machine and basic operation

COs: CO1

generation of electromotive force (EMF)

Unit II: DC Machine Fundamentals **9 hours**

Understanding the working of DC generators and DC motors, Types of DC generators: series, shunt, and compound generators, Types of DC motors: series, shunt, and compound motors and Operating characteristics

COs: CO2

differences between generators and motors

Unit III: DC Generator Operation and Characteristics **9 hours**

Armature reaction and its effects in DC generators, Voltage regulation in DC generators: methods and significance, Open circuit and short circuit characteristics of DC generators,

COs: CO3

Analysis of load conditions and their impact on generator performance

Unit IV: DC Motor Operation and Characteristics **9 hours**

Torque production and speed control in DC motors, Armature reaction in DC motors: compensating windings and methods to reduce effects, Starting methods for DC motors: series, shunt, and compound starters, Speed control techniques: armature control, field control, and

COs: CO4

Combined speed control methods

Unit V: DC Machine Testing and Maintenance **9 hours**

Testing procedures for DC machines: no-load test, load test, and efficiency calculation, Faults and troubleshooting in DC machines: common issues and remedies, Preventive maintenance practices for ensuring optimal performance: advancements and future prospects

COs: CO5

Emerging trends in DC machine technology

Approved in : BoS No. VII		EEE	
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Troubleshooting methods in DC Machines	23EEO01.1	

Text Books

1. Bhimbra P.S. "Electrical Machines", 4th Edition, Khanna Publishers, 2015
2. Theraja B.L., Theraja A.K., "A Textbook Of Electrical Technology: AC And DC Machines", volume 2, S Chand, 1999
3. A.E.Fitzgerald, Charles kingsley, Stephen D.Umans "Electric Machinery", 6th Edition, Tata McGraw- Hill 2013

Reference Books

1. Kothari D. P., Nagarth I .J., "Electrical Machines", 4th edition, Mc Graw Hill Publications, 2010
2. Rajput R.K. "Electrical Machines", 5th edition, Lakshmi publications, 2016
3. Mulukutla S.Sarma & Mukesh k.Pathak "Electric Machines", 4th Edition, CENGAGE Learning, 2012
4. Guptha J.B., "Theory & Performance of Electrical Machines", 6th Edition, S.K.Kataria & Sons, 2008

Web References

1. https://nptel.ac.in/courses/108/105/108105017/
2. https://www.youtube.com/watch?v=AECBgmkWvo0&list=PLbMVogVj5Njqbg9363J1uq5Fnq4m1Ygxl

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1 List all the classification of machines
2 What are the various faults that occur in a DC machine

L2: Understand

1. Explain the operation of a DC machine
2. Explain various starting methods of DC machine

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Board of Studies (EEE)

MI **23MEO01 Nanotechnology** **3 0 0 3**

Version 01.00

Pre-requisite: Engineering Chemistry, Material Science

At the end of the course, students will be able to

Code	Course Outcomes	DoK
23MEO01.1	Familiarize about the science of nanomaterials	L1
23MEO01.2	Demonstrate the preparation of nanomaterials	L1, L2
23MEO01.3	Understand the challenges on safe nanotechnology	L1, L2
23MEO01.4	Develop knowledge in characteristic nanomaterial	L1, L2, L3
23MEO01.5	Acquire an understanding the Nanoscience and Applications	L1, L2, L3
23MEO01.6	Application of Nanotechnology in the field of medicine	L1, L2, L3

Unit I:	**Introduction to Nanoscale Science and Technology**	**12 hours**
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. *Introduction to properties and motivation for study (qualitative only)*		**COs: CO1**
Unit II:	**General Methods of Preparation**	**12 hours**
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation. *Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.*		**COs: CO2**
Unit III:	**Nano materials**	**12 hours**
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nano-alumina, CaO, AgTiO2, Ferrites, Nano clays-functionalization and applications-Quantum wires. *Quantum dots-preparation, properties and applications*		**COs: CO3**
Unit IV:	**Characterization Techniques**	**12 hours**
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA. *SIMS-Nano-indentation*		**COs: CO4, CO5**
Unit V:	**Applications**	**12 hours**
Nano InfoTech: Information storage- nano-computer, molecular switch, super chip, nanocrystal, Nano-biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano-sensors, nano crystalline silver for bacterial inhibition. *Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery*		**COs: CO6**

Board of Studies			
Approved in: BoS No. VII			
Approved in: ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Synthesis and applications of Carbon nanotubes	CO3	PO1, PO6, PO7
2	Characterization of nanomaterials	CO4, CO5	PO1, PO6, PO7

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, Eds., "Nanomaterials: Synthesis, Properties And Applications", Institute Of Physics Publishing, Bristol And Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Characterization Of Surfaces & Interfaces", 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000
3. B.S.Murthy and P.Shankar, " Nanoscience and NanoTechnology" , 1st Edition, Springer Publications,2013
4. Louis Hornyak and H F Tibbals, " Introduction to Nanoscience and NanoTechnology" , 1st Edition,Tailor Francis CRC Press,2008

REFERENCE BOOKS:

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

Web references:

1. http://www.nano.gov
2. http://mrsec.wisc.edu/edetc/IPSE/links.html
3. http://nptel.ac.in/courses/112105182/9
4. IOPSCIENCE—Nanotechnology

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	20	30
L2	40	30
L3	40	40
Total(%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Nano technology?
2. How does Nano Technology Works?
3. What are Nano Materials?
4. Who is Developing Nano technology?

L 2: Understand

1. What are some of the most interesting Nanoparticles found in nature (not manufactured in the lab)?
2. Given the Nano-Size of the particles. Are there any effective respirator filters to guard against inhalation?
3. What do you feel the repercussions are for extended life through utilization of nanotechnology?

L 3: Applying

1. How are safety tests carried out in nano tech?
2. Seems that (nano)tech is moving fast. Is there a risk that results of safety testing will be out-of-date as soon as printed? How to keep up pace?
3. Discuss about targeted drug delivery using nanoparticles.

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Board of Studies (ME)

MI 23CEO02 Air Pollution

3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20CEM01.1	Identify different types of pollution and their sources
20CEM01.2	Identify the meteorological components
20CEM01.3	Outline the impact on local and global effects of air pollution on human, materials, properties and vegetation
20CEM01.4	Explain various types of air pollution control equipment and their working principles
20CEM01.5	Understand sampling methods and monitoring of air pollution

Unit I:	**Introduction**	**09 hours**
Definition of air pollution, Sources and causes of air pollution, Types and classification of air pollution - Natural contaminants, Particulate, Gases and Vapours, Primary and secondary air pollutants		**COs: CO1**
Unit II:	**Meteorology**	**09 hours**
General atmospheric circulation, Atmospheric stability, Effect of meteorology on Plume dispersion, Inversion, Wind profiles and stack plume patterns		**COs: CO2**
Unit III:	**Effects of Air Pollution**	**09 hours**
Effects of air pollution on human beings, plants and animals and properties. Global effects-Greenhouse effect, Ozone depletion, heat island, dust storms, Automobile pollution sources and control, Photochemical smog		**COs: CO3**
Unit IV:	**Air Pollution Control**	**09 hours**
Particulate matter and gaseous pollutants - Settling chambers, Cyclone separators, Scrubbers, Filters & Electrostatic precipitator		**COs: CO4, CO5**
Unit V:	**Air Quality Sampling and Monitoring**	**09 hours**
Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants		**COs: CO6**

Board of Studies			
Approved in : BoS No. IV			
Approved in : ACM No. VI			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Text Books

1. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, "Environmental Engineering", Mc Graw Hill, International Edition, 2017
2. Rao M. N., Rao H. V. N., "Air Pollution", 1st Edition, Mc Graw Hill, 2004

Reference Books

1. Martin, Crawford, "Air Pollution Control Theory", Tata McGraw Hill, New Delhi, 1986
2. Bulkeley, H., "Cities and Climate Change", Routledge, London, 2013
3. Rao C. S., "Environmental Pollution Control Engineering," Wiley Eastern Limited, New Delhi, 1992
4. Gurjar, B. R., Molina, L., Ojha, C. S. P., "Air Pollution: Health and Environmental Impacts", CRC Press, 2010

Web References

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com
5. https://dgserver.dgsnd.gov

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Board of Studies (CE)

PC 23CS305 Software Engineering 3 0 0 3.0

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs PO1	PO2	PO3	PO5	DoK
23CS305.1	Understand the knowledge in practice of software engineering skills	3	2	2	2	L1, L2
23CS305.2	Implement software engineering methodologies, practices to fit the nature of software	3	2	2	2	L1 – L3
23CS305.3	Implement design and devlop correct and robust software products	3	2	2	2	L1 – L3
23CS305.4	Implement right stratagies in software testing	3	2	2	2	L1 – L3
23CS305.5	Implement software quality and risk mitigation	3	2	2	2	L1, L2

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Software Engineering **9 Hours**

What is Software Engineering? Nature of Software, Core Principles of Software Engineering, Software Myths, Software Engineering Processes Framework – The Capability Maturity Model Integration (CMMI) Process Patterns, Software Development Life Cycle (SDLC).

Process Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models – Iterative Model, Increment Model, The Unified Process, Agile Process, Extreme Programming, The Role of Tools in Agile Model.

COs: CO1

Self - Learning Topic: Evloutionary Process Model

Unit II: Software Requirement Engineering **9 Hours**

Functional and Non functional Requirements, User Requirements, System Requirements, Requirement Specification (SRS) Documentation, Feasibility Study – Requirement Elicitation, Analysis, Requirement Validation, Information Modeling, Data Flow Diagram.

COs: CO2

Self - Learning Topic: Data Models

Unit III: Software Design, The Unified Process Model, Coding **9 Hours**

Basic Concepts of Software Design, Software Design Principles, Architectural Design, Architectural Mapping using Dataflow, Micro Services Architecture, Function Oriented Design, Object Oriented Design, Conceptual Model of UML Class Diagram, Use Case Diagram, Structural Coding Techniques, Coding Styles, Standards and Guidelines.

COs: CO3

Self - Learning Topic: Modern Programming Language Features

Unit IV: Software Quality Assurance and Testing **9 Hours**

Software Quality Assurance (SQA): SQA tasks, goals & metrics, Software Reliability Metrics.

Software Testing: Verification vs Validation, Test Strategies for Conventional Software and Test Strategies for Object Oriented Software, Software Testing Types.

COs: CO4

Self - Learning Topics: Debugging, Strategies for Webapps

Unit V: Risk Management and Software Maintenance **9 Hours**

Risk management-Reactive and Proactive strategies , Software Risks, Risk identification, Risk Projection, Risk Mitigation.

Need for Software Maintenance, Categories of maintenance-Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering and Forward Engineering. **COs: CO5**

Self - Learning Topics: Software Risk Mitigation and Plans

Board of Studies		Computer Science and Engineering	
Approved in : BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs / PSOs**
1	SDLC, Agile process	CO1 – CO5	PO1, PO2, PO3, PO5
2	COCOMO, LCNC	CO1 – CO5	PO1, PO2, PO3, PO5

Text Books

1. Rajiv chopra, “Modern software engineering”, Wiley, 2019
2. Roger S., Pressman, “Software Engineering: A Practitioners Approach”, 8th Edition, McGraw Hill Higher, 2015
3. Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018
4. Ian Someravelli, “Software Engineering”, 9th Edition, 2011

Reference Books

1. Ugrasen Isvor Jacobson, Harold Bud Lawson, “The Essential of Modern Software Engineering”, ACM books, 2019
2. Pankaj Jalote, “Software Engineering”, Wiley India, 2010
3. Waman S Jawadekar, “Software Engineering Principles and Practice”, The Mc Graw-Hill Companies, 2015

Web References

1. https://en.wikipedia.org/wiki/Software_engineering
2. https://www.compact.nl/articles/modern-software-development/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	20
L2	40	40
L3	20	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List the phases in SDLC
2. What is Agile process model?
3. Define software design principles

4. How tools play important role in Agile process model?
5. List Risk Management activities

L2: Understand

1. What is SQA role in software engineering ?
2. Summarize the myths in software development
3. Demonostrate Requirement Elicitation
4. Describe White Box testing ?
5. What is need for software maintenance?
6. Expalin Constructive Cost Model (COCOMO)

L3: Apply

1. Illustrate test staratagic for approach in software testing
2. Apply test stratagies for Object-oriented software
3. Illustrate risk mitigation plan for a software development

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Board of Studies (CSE)

PC 23AI305 Artificial Intelligence 3 0 0 3.0

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs					DoK
		PO1	PO2	PO3	PSO1	PSO2	
23AI305.1	Describe the foundational principles of artificial intelligence	3	2	2	3	2	L1, L2
23AI305.2	Formalise the given problem using different AI methods	3	2	3	3	2	L1, L2
23AI305.3	Explain different concepts of logic	3	2	3	3	2	L1, L2
23AI305.4	Describe the different methods of knowledge representation	3	2	3	3	2	L1, L2
23AI305.5	Explain the principles and applications of expert systems	3	2	3	3	2	L1, L2

All the COs are mapped to PO12 as fewself learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Artificial Intelligence **9 Hours**

Introduction, History, Intelligent Systems, Foundations of AI, Applications – Tic-Tac-Tie Game Playing, Development of AI Languages, Current Trends in AI.

COs : CO1

Self - Learning Topic: Online Agents

Unit II: Problem Solving **9 Hours**

Problem Solving: State-Space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative Deepening A*, Constraint Satisfaction.

Problem Reduction and Game Playing: Introduction, Problem Reduction, Game playing, Alpha Beta Pruning, Two-Player Perfect Information Games .

COs: CO2

Self - Learning Topic: Unknown Environment

Unit III: Logic Concepts **9 Hours**

Introduction, Propositional Calculus, Proportional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Proportional Logic, Resolution Refutation in Proportional Logic.

COs: CO3

Self - Learning Topic: Predicate Logic

Unit IV: Knowledge Representation **9 Hours**

Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames, Advanced Knowledge Representation Techniques: Introduction, Conceptual Dependency Theory, Script Structure, Cyc Theory, Case Grammars.

COs: CO4

Self - Learning Topic: Semantic Web

Unit V: Expert Systems **9 Hours**

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System vs Traditional Systems, Rule-based Expert Systems, Blackboard Systems, Truth Maintenance Systems, Application of Expert Systems.

COs: CO5

Self - Learning Topic: List of Shells and Tools

Board of Studies		Computer Science and Engineering (AI & ML)	
Approved in: BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs/PSOs**
1			
2			

Text Books

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.

Reference Books

1. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence", McGraw Hill, 2008
2. Patrick H. Winston, "Artificial Intelligence", 3rd Edition, Pearson Edition, 2006
3. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013

Web References

1. https://nptel.ac.in

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	40
L2	50	60
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. State the tasks which are associated with AI
2. Give an example of script-arithmetic problem
3. Define Script
4. Recall Intelligence

L2: Understand

1. Explain Turing Test
2. Explain the characteristics of production system
3. Write A* algorithm in detail and explain its functionality to solve 8-puzzle problem
4. Explain the semantic analysis phase done through case grammars in Natural Language understanding

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Board of Studies (CSE – AI&ML)

MI 23DSO02 Introduction to Data Science 3 0 0 3.0

Pre- Requisite Probability & Statistics

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
23DSO02.1	Understand Fundamentals of Data Science Terminology.	-	L1, L2
23DSO02.2	Demonstrate different computing tools involved in data handling.		L1, L2
23DSO02.3	Understand Knime Tool.		L1, L2
23DSO02.4	Understand Machine Learning Concepts		L1, L2
23DSO02.5	Apply domain expertise to solve real world problems using data science		L1, L2
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos			
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge			

Unit I: Introduction to Data Science **9 Hours**

Analyzing the Pieces of the Data Science Puzzle, Exploring the Data Science Solution Alternatives, Defining Big Data by the Three Vs, Grasping the Difference between Data Science and Data Engineering, Making Sense of Data in Hadoop, Identifying Alternative Big Data Solutions, Converting Raw Data into Actionable Insights with Data Analytics, distinguishing between Business Intelligence and Data Science, Defining Business-Centric Data Science

Self - Learning Topics: Identifying Data Science Users; Data Engineering in Action: A Case Study **COs: CO1**

Unit II: Computing for Data Science - 1 **9 Hours**

Using Python for Data Science, Using Open-Source R for Data Science.

Self - Learning Topics: Sorting Out the Python Data Types; R's Basic Vocabulary **COs: CO2**

Unit III: Computing for Data Science - 2 **9 Hours**

Using SQL in Data Science, Doing Data Science with Excel and Knime

Self - Learning Topics: Basic SQL Commands; Knime Basics **COs: CO3**

Unit IV Machine Learning, Probability and Statistical Modelling **9 Hours**

Defining Machine Learning and Its Processes, Considering Learning Styles, Seeing What You Can Do, Exploring Probability and Inferential Statistic, Quantifying Correlation, Reducing Data Dimensionality with Linear Algebra, Modeling Decisions with Multi-Criteria Decision Making, Introducing Regression Methods

Self - Learning Topics: Linear Regression **COs: CO4**

Unit V Applying Domain Expertise to Solve Real-World Problems Using Data Science **9 Hours**

Data Science in Journalism, Delving into Environmental Data Science, Data Science for Driving Growth in E-Commerce, Using Data Science to Describe and Predict Criminal Activity

Self - Learning Topics: Applying statistical modeling to natural resources in the raw; Deploying web analytics to drive growth **COs: CO5**

Board of Studies		Computer Science and Engineering (Data Science)	
Approved in: BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Exploratory Data Analysis	CO1 – CO5	PO2, PO3, PO5
2	Statistical Analysis	CO2 – CO5	PO2, PO3, PO5

Text Books

1. Lillian Pierson and Jake Porway,"Data Science For Dummies", 2nd Edition,For Dummies, 2017

Reference Books

1. Joel Grus, "Data Science from Scratch", 2nd Edition, O'Reilly Media, 2015
2. Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, 2020

Web Resources

1. https://www.simplilearn.com/tutorials/data-science-tutorial/
2. https://www.w3schools.com/datascience/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is data science? Identify three areas or domains in which data science is being used
2. Give three examples of structured data formats
3. Name three measures of centrality and describe how they differ
4. What is supervised learning? Give two examples of data problems where you would use Supervised learning

L2: Understand

1. How do data analysis and data analytics differ?
2. Relate likelihood of a model given data, and probability of data given a model. Are these two the same? Different? How?

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MI **23ECO02 Digital Electronics** **3 0 0 3**

Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23ECO02.1	Utilize theory of Boolean algebra & the underlying features of various number systems
23ECO02.2	Choose the concepts of Boolean algebra for the minimization of switchingfunctions
23ECO02.3	Design of various combinational logic circuits using basic gates
23ECO02.4	Design various simple programmable logic devices to complexprogrammable logic devices & arrays
23ECO02.5	Develop of various sequential logic circuits

Unit I:	**Introduction to Boolean Algebra and Switching Functions**	**9 hours**
	Conversion from One Radix to Another Radix, r - 1 and r's complement. 4 Bit Codes: BCD, Excess - 3, 2421, 84 – 2 – 1, 9's Compliment Code, Gary Code etc. Realization of logic operations forBasic and Universal gates	**COs: CO1**
Unit II:	**Boolean Minimization**	**9 hours**
	Minimization of Logic Functions using Boolean Theorems, Minimization of Switching Functions using K-Map Up to 6 Variables, Quine - McCluskey Method, Standard SOP And POS forms	**COs: CO2**
Unit III:	**Finite State Machines and Bipolar Logic Families**	**9 hours**
	Design of synchronous FSMs, Asynchronous FSMs. Bipolar Logic Families (ECL), MOS logic families (NMOS and CMOS) and their electrical behaviour	**COs: CO3**
Unit IV:	**Memory Elements**	**9 hours**
	Basic structures and realization of Boolean functions using PROM, PAL, PLA, PLD, CPLD, FPGA, Buffers. Logic Implementation using Programmable Devices (ROM, PLA, FPGA)	**COs: CO4**
Unit V:	**Elementary combinational and sequential digital circuits**	**9 hours**
	Adders, Subtractors, Multiplexer, Demultiplexer, Encoder, Decoder, Comparators, Latches, Flip-flops, Shift registers, Counters	**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No. IV		VII	
Approved in : ACM No. VI		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Text Books

1. Taub, H. and Schilling, D., "Digital Integrated Electronics", McGraw Hill, 1977
2. Hodges, D.A. and Jackson, H.G., "Analysis and Design of Digital Integrated Circuits", International StudentEdition, McGraw Hill, 1983
3. Hill, F.J. and Peterson, G.L., "Switching Theory and Logic Design", John Wiley, 1981
4. Anand Kumar, A., "Switching Theory and Logic Design", 3rd Edition, Prentice Hall International Learning, 2016

Reference Books

1. Kohavi, Z., "Switching and Finite Automata Theory", McGraw Hill,1970
2. Jain, R.P., "Modern Digital Electronics", 3rdEdition, Tata McGraw Hill, 2003
3. Charles Roth, H. and Larry Kinney,L.Jr., "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2014

Web Resource

1. https://onlinecourses.nptel.ac.in/noc19_ee51/preview
2. https://nptel.ac.in/courses/117/105/117105080/
3. https://gate.iitkgp.ac.in/gate_syllabus.html
4. https://www.ee.iitb.ac.in/web/academics/courses/EE221

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Board of Studies (ECE)

MI **23EEO02 Basics of AC Machines** **3 0 0 3**

Version 01.00

Pre-requisite: Basic Electrical and Electronics Engineering

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	DoK
23EEO02.1	Classify various types of AC machines	2	1	L1 – L2
23EEO02.2	Explain operation of AC machines	2	1	L1 – L2
23EEO02.3	Summarize the characteristics of synchronous machine	2	1	L1 – L2
23EEO02.4	Summarize the characteristics of induction machine	2	1	L1 – L2
23EEO02.5	Understand various testing methodologies of DC Machine	2	1	L1 – L2

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to AC Machines **9 hours**

Overview of alternating current (AC) systems and their importance, Basic principles of electromagnetism and magnetic circuits in AC machines, Types of AC machines: synchronous machines and induction machines, Constructional features of AC machines: parts and their functions

COs: CO1

Applications of AC machines

Unit II: AC Machine Fundamentals **9 hours**

Working principle of synchronous machines: generation of rotating magnetic fields, Classification of synchronous machines: synchronous generators and synchronous motors, Operating characteristics and differences between synchronous generators and motors

COs: CO2

Advantages and applications of synchronous machines in power systems

Unit III: Synchronous Machine Operation and Characteristics **9 hours**

Synchronous generator operation: voltage regulation, synchronous impedance, and synchronous reactance, Synchronous motor operation: starting methods, excitation control, and synchronous speed, Analysis of load conditions and their impact on synchronous machine performance,

COs: CO3

Power factor correction using synchronous machines: capacitive and inductive compensation

Unit IV: Induction Machine Operation and Characteristics **9 hours**

Working principle of induction machines: production of rotating magnetic fields, Types of induction machines: single-phase and three-phase induction motors, Induction motor operation: slip, torque-speed characteristics, and starting methods,

COs: CO4

Analysis of load conditions and their impact on induction machine performance

Unit V: AC Machine Testing and Maintenance **9 hours**

Testing procedures for AC machines: no-load test, load test, and efficiency calculation, Faults and troubleshooting in AC machines: common issues and remedies, Preventive maintenance practices for ensuring optimal performance

COs: CO5

Emerging trends in AC machine technology

Board of Studies		EEE	
Approved in : BoS No. VII			
Approved in : ACM No. . IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Impact of Load variation on Machine	23EEO02.2	

Text Books

1. Bhimbra P.S. "Electrical Machines", 4th Edition, Khanna Publishers, 2015
2. Theraja B.L., Theraja A.K., "A Textbook Of Electrical Technology: AC And DC Machines", volume 2, S Chand, 1999
3. A.E.Fitzgerald, Charles kingsley, Stephen D.Umans "Electric Machinery", 6th Edition, Tata McGraw- Hill 2013

Reference Books

1. Kothari D. P., Nagarth I .J., "Electrical Machines", 4th edition, Mc Graw Hill Publications, 2010
2. Rajput R.K. "Electrical Machines", 5th edition, Lakshmi publications, 2016
3. Mulukutla S.Sarma & Mukesh k.Pathak "Electric Machines", 4th Edition, CENGAGE Learning, 2012
4. Guptha J.B., "Theory & Performance of Electrical Machines", 6th Edition, S.K.Kataria & Sons, 2008

Web References

1. https://nptel.ac.in/courses/108/105/108105017/
2. https://www.youtube.com/watch?v=AECBgmkWvo0&list=PLbMVogVj5Njqbg9363J1uq5Fnq4m1Ygxl

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1 List all the classification of machines
2 What are the various faults that occur in a DC machine

L2: Understand

1. Explain the operation of a DC machine
2. Explain various starting methods of DC machine

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Board of Studies (EEE)

MI **23MEO02 Biomaterials** **3 0 0 3**

Version 01.00

Pre-requisite: Engineering materials, Nanotechnology

At the end of the course, students will be able to

Code	Course Outcomes	DoK
23MEO02.1	Understand the basic principles in material science and their contribution towards Biomedical engineering	L1, L2
23MEO02.2	Analyze different types of materials and apply in designing a device.	L1, L2
23MEO02.3	Select the materials for designing an implant in tissue replacement.	L1, L2, L3
23MEO02.4	Identify significant gap required to overcome challenges and further developments	L1, L2, L3
23MEO02.5	Demonstrate the various testing Techniques	L1, L2, L3
23MEO02.6	Critically review papers from the scientific journals and identify areas of research opportunities.	L1, L2, L3

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I:	**INTRODUCTION**	**12 hours**
Definition of biomaterials, mechanical properties, surface chemistry of materials, surface modification, Tissue Reaction, Bio Compatibility. Cu-Ni and Fe-Fe3 *Wound Kinetics*		**COs: CO1**
Unit II:	**MATERIALS IN MEDICAL DEVICES**	**12 hours**
Metals, Ceramics, Polymers and Biomimetic Materials, Composites. Material preparation, chemical composition, Properties, uses in medicine and failure mechanisms. *Uses in biosciences*		**COs: CO2**
Unit III:	**STERILIZATION OF BIOMATERIALS**	**12 hours**
Sterilization techniques: Process and mechanism of action of steam sterilization, radiation sterilization, electron beam sterilization, ethylene oxide, chlorine dioxide. *Plasma gas sterilization*		**COs: CO3**
Unit IV:	**TESTING OF MATERIALS**	**12 hours**
Testing with Tissue Culture – in vitro and in vivo assessment of biocompatibility, Testing with Soft Tissues and testing at non Thrombogenic surface – biood compatibility, ISO 10993- standard for assessment of biocompatibility *Thrombogenicit*		**COs: CO4, CO5**
Unit V:	**HARD AND SOFT REPLACEMENT**	**12 hours**
Cardiac Implants, Orthopedic Implants, Neuro Muscular Implants, Transcutaneous Implants, Intraocular lenses. *Case study of Hard and Soft Replacement*.		**COs: CO6**

Board of Studies		
Approved in : BoS No. VII		
Approved in : ACM No. IX		
Expert talk (To be delivered by SMEs from industries)	COs	POs
1 Importance of Biomaterials in medical field	CO2	PO6, PO7
2 Applications of Biomaterials	CO6	PO6, PO7

Textbooks

1. Ramnarayan Chattopadhyay, advanced thermally assisted surface engineering processes, kluwer academic

publishers, 2004
2. Sudarshan T S, Surface modification technologies – an engineer's guide; Marcel Dekkar, Newyork, 1989

Reference Books

1. J.H.U.Brown (Ed), Advances in Bio Medical Engineering, Academic Press 1975.
2. Andrew F.Von Racum, Hand Book of Bio Medical Evaluation, Mc-Millan Publishers, 1980.
3. Jacob Cline, Hand Book of Bio Medical Engineering, Academic Press in Sandiego, 1988.
4. Jonathan Black, Biological Performance of Materials- Fundamentals of bio compatibility, 4th Edition, CRC Press 2005.
5. Larry L. Hench and Julian R.Jones, Biomaterials, Artificial organs and Tissue Engineering, 20
6. Buddy D.Ratner,Allan S .Hoffman, Frederick J. Schoen, Jack E. Lemons, Biomaterial Science; An Introduction to Materials in Medicine,2nd Edition, Elsevier Academic Press,San Diego, 2004.,

Web References

1.www.nptel.iitm.ac.in
2.www.btechguru.com

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is meant by biomaterials ?
2. What is carbon ceramic material ?
3. What are the Composites?
4. What are the biopolymers?
5. Write Short notes on Teflon?

L2: Understand

1. Describe properties of widely used materials in manufacturing of orthopaedic implant devices.
2. What are the Various Types bonding in materials solid material.
3. Give an Account of salient features of polymers used in biomedical applications in details

L3: Apply

1. Derive an expression for Kelvin rheological model.
2. Explain the procedure for measurement of angle of repose of food grains.
3. Explain different thermal properties of biological materials.
4. Explain the application of engineering properties in handling and processing equipment.
5. Explain different total quality control principles.
6. What are the set of international standards on quality management and quality assurance? Explain in detail.
7. Describe the application of HACCP in milk and milk products industry with a flow chart

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Board of Studies (ME)

MI 20CEM02 Climate Change Mitigation and Adaptation 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20CEM02.1	Understand the concept of climate change scenarios
20CEM02.2	Outline the causes for the changes in the climate
20CEM02.3	Identify the impacts of climate change on various sectors
20CEM02.4	Adopt the methodologies in finding the changes in climate
20CEM02.5	Demonstrate the climate change adaptation and mitigation options for securing sustainable development

Unit I:	**Fundamentals of Climate Change**	**09 hours**
Greenhouse gases, radiative forcing potential, carbon dioxide equivalency, natural climate forcing factors, emissions sources and sinks		**COs: CO1**
Unit II:	**Observed Changes and its Causes**	**09 hours**
Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change –-Evidences of Changes in Climate and Environment – on a Global Scale and in India.		**COs: CO2**
Unit III:	**Impacts of Climate Change**	**09 hours**
Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios -Projected Impacts for Different Regions- Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.		**COs: CO3**
Unit IV:	**Clean Technology and Energy**	**09 hours**
Clean Development Mechanism -Carbon Trading- examples of future Clean Technology -Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Biofuels -Solar Energy – Wind – Hydroelectric Power.		**COs: CO4, CO5**
Unit V:	**Adaptation and Mitigation Responses**	**09 hours**
Policy, Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC, Concept framework of urban adaptation to climate change**,** Mitigation Efforts in India and Adaptation funding.		**COs: CO6**

Board of Studies		
Approved in : BoS No. IV		
Approved in : ACM No. VI		
Expert talk (To be delivered by SMEs from industries)	COs	POs
1		
2		

Text Books

1. Jan C. Van Dam, “Impacts of Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003
2. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007

Reference Books

1. Pielke, R., “Lifting the taboo on adaptation”, Nature 445 (7128), 597-598, 2007
2. Bulkeley, H., “Cities and Climate Change”, Routledge, London, 2013

Web References

1. IPCC Fourth Assessment Report – The AR4 Synthesis Report
2. https://www.coursera.org/learn/climate-change-mitigation
3. https://www.usc.edu.au/study/courses-and-programs/courses/course-library/ens/ens204-climate-change-mitigation-and- adaptation

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Board of Studies (CE)

PC 23CS304 Database Management Systems 3 0 0 3.0

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs			DoK
		PO1	PO2	PO3	
23CS304.1	Illustrate the basic concepts of databases and data models	3	3	2	L1, L2
23CS304.2	Illustrate the principles of relational data model	3	3	3	L1 – L3
23CS304.3	Make use of SQL commands to work with databases	3	3	3	L1 – L3
23CS304.4	Apply the principles of database normalization	3	3	3	L1 – L3
23CS304.5	Describe the transaction management strategies and recovery systems	3	3	3	L1 – L3

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Database **9 Hours**

Overview of Database Systems, Database System Applications, File System vs Database System, Data Abstraction, Levels of Abstraction, Data Independence Instances and Schemas, Different Data Models, Database Languages, Data Base Users and Administrator, Database System Structure, N-tier Architecture, Database Design and ER Diagrams, Design Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Advanced Features of ER Model, Conceptual Design for Large Enterprises. **COs : CO1**

Self - Learning Topic: History of DBMS

Unit II: Relational Model, Relational Algebra and Relational calculus **9 Hours**

Relational Model: Introduction to the Relational Model, Logical Database Design, Concepts of table Related Operations.
Relational Algebra: Selection and Projection, Set Operations, Aggregate Operations, Renaming, Joins, Division, Additional Relational Algebraic Operations.
Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus. **COs: CO2**

Self - Learning Topic: Expressive Power of Algebra and Calculus

Unit III: Structured Query Language **9 Hours**

SQL: Concept of Different Database Languages over SQL - DDL, DML, DCL, SQL Commands, Set Operations, SQL Queries, Nested Queries, Aggregate Functions, Null Value, Referential Integrity Constraints, Altering Tables.
PL/SQL: Introduction to PL/SQL Block, Creation of Views, Triggers, Cursors, Functions, Stored Procedures. **COs: CO3**

Self - Learning Topics: Compare all Database Languages, Importance of Null values

Unit IV: Schema Refinement and Normalization **9 Hours**

Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure Set of Functional Dependencies, Closure Set of Attributes.
Normalization: 1NF, 2NF, 3NF, BCNF, Lossless Join and Dependency Preserving Decomposition, 4NF and 5NF.
Indexing: Basic Concepts, Primary Index, Dense and Sparse Indices, Secondary Indices, Trees, Structured Indexing, Indexed Sequential Access Method (ISAM). **COs: CO4**

Self - Learning Topic: Compare all Normal Forms

Unit V: Transaction Management and Recovery System **9 Hours**

Transaction Management and Concurrency Control: Transaction Concept, ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Schedules, Serializability and Recoverability Testing of Serializability, 2PL, Introduction to Lock Management, Lock Conversions, Specialized Locking.

Techniques – Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Non-Volatile Storage, ARIES Recovery Method. **COs: CO5**

Self - Learning Topic: Concurrency Control without Locking

Board of Studies		Computer Science and Engineering	
Approved in: BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs / PSOs**
1	Big data handling	CO1 – CO5	PO1, PO2, PO3
2	Current real-time applications of Database management tools	CO2 – CO5	PO1, PO2, PO3

Text Books

1. Raghurama Krishnan, Johannes Gehrke, "Database Management Systems", 3rd Edition, TATA McGraw Hill, 2008
2. Abraham Silber Schatz, Henry F Korth, S Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill International Edition, 2013
3. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006

Reference Books

1. Elmasri, Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016
2. Peter Rob & Carlos Coronel, "Database Systems Design, Implementation, and Management", 10th Edition, Pearson Education, 2013

Web References

1. http://www.nptelvideos.in/2012/11/database-managementsystem.html
2. https://www.javatpoint.com/dbms-tutorial

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	30	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List all the types of database users
2. List out all the different types of data models present
3. Give syntaxes to create and alter a table
4. What is Redundancy?
5. List out the properties of transactions

L2: Understand

1. Compare the database system with conventional file system
2. Demonstrate the use of DISTINCT key word in SQL select statement
3. Explain the following SQL constructs with examples:
   a. Order by
   b. group by
   c. as select
   d. schema
4. Explain the difference among Entity, EntityType & EntitySet
5. Illustrate different types of joins in SQL

L3: Apply

1. Apply Normalization technique for the following relation upto 3NF:
   Bank(acno, cust_name, ac_type, bal, int_rate, cust_city, branchId, branch_nm, br_city)
2. Construct a transaction state diagram and describe each state that a transaction goes through during its execution
3. Utilize the following database schema to write queries in SQL
   Sailor(sid, sname, age, rating), Boats (bid, bname, bcolor), Reserves(Sid, bid, day)
   a. Find the sailors who have reserved a red boat
   b. Find the names of the sailors who have reserved at least two boats
   c. Find the colors of the boats reserved by 'Mohan'?
4. By considering relevant example, show insertion and deletion operations on a B-Tree

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Board of Studies (CSE)

OE 23AIO03 Machine Learning for Engineers 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
23AIO03.1	Describe different types of learning's	-	L1, L2
23AIO03.2	Explain different supervised learning algorithms		L1, L2
23AIO03.3	Explain different unsupervised learning algorithms		L1, L2
23AIO03.4	Describe various types of machine learning models		L1, L2
23AIO03.5	Choose appropriate machine learning model and algorithm for given task		L1, L2
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge			

Unit I: Introduction to learning **9 hours**

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – LinearSeparability – Linear Regression

Examples of regression

Unit II: Linear Models **9 hours**

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice –Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines

Applications of perceptron

Unit III: Trees and Probabilistic Models **9 hours**

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbour Methods – Unsupervised Learning – K means Algorithms – Vector Quantization

Self-Organizing Feature Map

Unit IV: Dimensionality Reduction and Evolutionary Models **9 hours**

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Geneticalgorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms

Markov decision process

Unit V: Graphical Models **9 hours**

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models

Tracking Methods

Text Books

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, "Machine Learning", 1st Edition, McGraw Hill Education, 2013

Reference Books

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1st Edition, Cambridge University Press, 2012.
2. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2014

3. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)", 3rd Edition, MIT Press, 2014

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels L1:

Remember

1. Define Machine Learning.
2. List the types of Machine Learning.
3. State Bayes Theorem.
4. What is Regularization?

L2: Understand

1. Demonstrate Linear Regression.
2. Explain Back Propagation Algorithm.
3. Illustrate Decision Tree Induction process
4. Explain Genetic Operations with examples

MI 23DSO03 Introduction to Big Data 3 0 0 3.0

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
23DSO03.1	Identify the Knowledge of Big Data	-	L1, L2
23DSO03.2	Demonstrate Hadoop Framework for handling Big Data		L1, L2
23DSO03.3	Illustrate the Architectural Concepts of HDFS in Hadoop Ecosystem		L1, L2
23DSO03.4	Illustrate MapReduce Framework		L1, L2
23DSO03.5	Explain Spark & RDD		L1, L2
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos			
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge			

Unit I: Introduction to Big Data 9 Hours

What is Big Data, Evolution of Big Data, Types of Big Data, Sources of Big Data,5Vs of Big Data, Big Data Analytics, Big Data Applications, Google File System

Self - Learning Topics: Uses of Big Data in Retail Industry **COs: CO1**

Unit II: Introduction to Hadoop 9 Hours

Introducing Hadoop, Hadoop History, Hadoop-definition, Comparing SQL Databases and Hadoop, Hadoop Cluster, Hadoop Modes, Hadoop Features, The building blocks of Hadoop, NameNode, DataNode, Secondary NameNode, Job Tracker, Task Tracker

Self - Learning Topics:Hadoop Cluster **COs: CO2**

Unit III: Hadoop Ecosystem &HDFS 9 Hours

Hadoop and its Ecosystem, Hadoop Ecosystem Components, Hadoop Ecosystems Tools, Hadoop Distributed File System, Concept of Block in HDFS Architecture, Features of HDFS, HDFS Read and Write Mechanism, Rack awareness in HDFS, Introducing HBase, Hive, Pig

Self - Learning Topics: HDFS Read/Write **COs: CO3**

Unit IV: Introduction to MapReduce 9 Hours

Hadoop MapReduce Framework, Architecture, Phases, MapReduce Job Types, Uses of MapReduce, Techniques to Optimize MapReduce Jobs, Limitations of MapReduce.

Self - Learning Topics: MapReduce Phases **COs: CO4**

Unit V: Introduction to Spark and RDD 9 Hours

Introduction to Spark, Data Frames – Data Frames role in Spark, Introduction to RDD, RDD operations, Creating RDDs, RDD Operations, Working with Key/Value Pairs.

Self - Learning Topics: Data Frames **COs: CO5**

Board of Studies		Computer Science and Engineering (Data Science)	
Approved in: BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Challenges in Handling Big Data	CO1 – CO5	PO2, PO3, PO5
2	Big Data Applications	CO2 – CO5	PO2, PO3, PO5

Text Books

1. DT Editorial Services, "Big Data – Hadoop2, MapReduce, Hive, YARN, Pig, R and Data Visualization", Black Book,DreamTech Press, 2019.
2. Sridhar Alla, "Big Data Analytics with Hadoop 3" - Packt Publications, 2018.
3. Holden Karau, Andy Konwinski, Patrick Wendell & MateiZaharia, "Learning Spark" O'reilly Publications, 2015.

Reference Books

1. Chuck Lam, "Hadoop in Action", 1st Edition, MANNING Publications,2016.
2. Balamurugan Balusamy, Nandhini Abirami R, SeifedineKadry, Amir H. Gandomi, "Big Data: Concepts, Technology,and Architecture" 1st Edition, Wiley Publications, 2021.
3. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers &Techniques", 1st Edition, Pearson Publications, 2016.

Web Resources

1. https://hadoop.apache.org/
2. https://spark.apache.org/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define Big Data.
2. List the characteristics of Big Data.
3. Define Hadoop.
4. What are Hadoop components?
5. What are RDD operations?

L2: Understand

1. Explain HDFS Read & Write mechanism.
2. Explain Rack awareness in HDFS.
3. Explain MapReduce workflow in detail.
4. Describe the working with Key/value pairs in RDDs.

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Board of Studies CSE(DS)

MI **23ECO03 Analog Electronic Circuits** **3 0 0 3**

At the end of the course, students will be able to

Code	Course Outcomes
23ECO03.1	Demonstrate the concept of DC biasing and transistor stabilization leading to the design of amplifiers
23ECO03.2	Classify, analyze types of multistage amplifiers
23ECO03.3	Classify, analyze and design different types of feedback amplifiers and Oscillators
23ECO03.4	Analyze the response of different signals for linear and Nonlinear wave shaping circuits
23ECO03.5	Understand the internal operation of Op-Amp and its Applications

Unit I:	**Transistor Biasing**	**9 hours**
	Need for biasing, operating point, BJT biasing methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, IC, and β, Stability factors, (S, S', S'').	**COs: CO1**
Unit II:	**BJT and Multistage Amplifiers**	**9 hours**
	BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductance, Hybrid π capacitances, Multistage Amplifiers: Classification of amplifiers, methods of coupling, cascaded transistor amplifier.	**COs: CO2**
Unit III:	**Feedback Amplifiers and Oscillators**	**9 hours**
	Feedback Amplifiers: Feedback principle and concept, types of feedback, classification of feedback amplifiers. Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wien bridge oscillators with BJT, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT.	**COs: CO3**
Unit IV:	**Linear Wave Shaping**	**9 hours**
	Linear wave shaping: High pass, low pass RC circuits, response for sinusoidal, step, pulse, square, ramp and exponential inputs. RC network as differentiator and integrator; Attenuators, Diode clippers.	**COs: CO4**
Unit V:	**Linear Applications of Op-Amp**	**9 hours**
	Internal Block Diagram of various stages of Op-Amp and Roll of each Stage, Characteristics of Op-Amp, Ideal and Practical Op-Amp specifications, Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier.	**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No.		VII	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Text Books

1. Robert, L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 10th Edition, Prentice Hall ofIndia, 2009.
2. Millman, J.,TaubH., Mothiki Surya Prakash Rao and Millman's, "Pulse Digital and Switching Waveforms", 2nd Edition, Tata McGraw-Hill, 2008.
3. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", Prentices Hall of India, 1987.

Reference Books

1. Donald A. Neaman, "Electronic Circuit Analysis and Design", 3rd Edition, Tata Mc Graw-Hill, 2010
2. Paul Gray, Hurst, Lewis and Meyer, "Analysis and Design of Analog Integrated Circuits", 4th Edition, JohnWilley &Sons, 2005
3. Anand Kumar, A., "Pulse and Digital Circuits", 2nd Edition, Prentice Hall of India, 2005
4. Sanjay Sharma,"Operational Amplifiers & Linear Integrated Circuits", 2ndEdition,S. K. Kataria& Sons, 2010.

Web Resource

1. https://nptel.ac.in/courses/108102112
2. https://www.udemy.com/course/analog-electronics-basic-concepts/

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Board of Studies
(ECE)

MI **23EEO03 Basics of Power Electronics** **3 0 0 3**

Version 01.00

Pre-requisite: Basics of AC machines, Basics of DC machines

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	DoK
23EEO03.1	Classify various types of semi-conductor devices	2	1	L1 – L2
23EEO03.2	Explain operation of semi-conductor devices	2	1	L1 – L2
23EEO03.3	Summarize the characteristics of rectifiers	2	1	L1 – L2
23EEO03.4	Summarize the characteristics of converters	2	1	L1 – L2
23EEO03.5	Extend the application of Power Electronics to EV	2	1	L1 – L2

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Power Electronics **9 hours**

Overview of power electronics and its applications in various industries, Basic concepts of semiconductor devices used in power electronics: diodes, transistors, and thyristors, Power electronic circuits and their classification: rectifiers, inverters, and converters

COs: CO1

Importance of power electronics in energy conversion

Unit II: Semiconductor Devices and their Characteristics **9 hours**

Characteristics and working principles of power semiconductor devices: diodes and thyristors, Bipolar Junction Transistors (BJTs) and Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs), Comparison of different semiconductor devices based on their characteristics and applications

COs: CO2

Gate triggering techniques for thyristors

Unit III: Power Converter Topologies - I **9 hours**

Single-phase and three-phase rectifiers: half-wave, full-wave, and bridge rectifiers, AC to DC converters: voltage and current source converters

COs: CO3

Applications of AC to DC converters

Unit IV: Power Converter Topologies - II **9 hours**

DC to DC converters: buck, boost, buck-boost, and flyback converters, DC to AC converters: inverters, PWM techniques, and voltage control methods

COs: CO4

Applications of DC-to-DC converters

Unit V: Power Electronics in Modern Systems **9 hours**

Smart grids and microgrid systems: power electronic components and control algorithms, Electric vehicle (EV) power electronics: battery management systems, chargers, and motor drives

COs: CO5

wide-bandgap semiconductors

Board of Studies		EEE	
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Fly back converters	23EEO03.2	

Text Books

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore MUndeland, William P Robbins, John Wiley & Sons
2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hallof India, 2nd edition, 1998
3. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.

Reference Books

1. Elements of Power Electronics–Philip T.Krein.oxford.
2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. K.Sinha, New Age International (P) Limited Publishers, 1996.

Web References

1. https://nptel.ac.in/courses/108/102/108102145/
2. https://nptel.ac.in/courses/108/101/108101126/
3. https://www.digimat.in/nptel/courses/video/108101126/L01.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define full wave rectifier
2. List all types of semi-conductors.

L2: Understand

1. Explain the operation half wave rectifier
2. Explain PWM techniques

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Board of Studies (EEE)

MI 23MEO03 Micro Electromechanical Systems

3 0 0 3
Version 01.00

Pre-requisite: Basic electronics engineering, nanotechnology, biomaterials

At the end of the course, students will be able to

Code	Course Outcomes	DoK
23MEO03.1	Acquire the operation of micro devices, micro systems and their applications	L1, L2, L3
23MEO03.2	Ability to design the micro devices, micro systems using the MEMS fabrication process.	L1, L2, L3
23MEO03.3	Acquire basic approaches for various sensor design	L1, L2, L3
23MEO03.4	Acquire basic approaches for various actuator design	L1, L2, L3
23MEO03.5	Gain the technical knowledge required for computer-aided design, fabrication and analysis of nano-structured materials, micro- and nano-scale devices.	L1, L2, L3
23MEO03.6	Characterization of nano-structured materials, micro- and nano-scale devices.	L1, L2, L3

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I:	**Basic Concepts**	**6+3 hours**
Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA. MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping *Piezo actuator, Inchworm technology..*		**COs: CO1**
Unit II:	**Thermal Sensors And Actuators**	**6+3 hours**
Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring *Thermal actuator, data storage cantilever.*		**COs: CO2**
Unit III:	**Micro-Opto-Electro Mechanical Systems**	**6+3 hours**
Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement. MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator. *Large force reluctance actuator, magnetic probe based storage device*		**COs: CO3**
Unit IV:	**Micro Fluidic Systems**	**6+3 hours**
Applications, considerations on micro scale fluid, fluid actuation methods, dielectrophoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, microfluid dispenser, micro needle, molecular gate, micro pumps. RADIO FREQUENCY (RF) MEMS:RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator. *MEMS switches, phase shifter.*		**COs: CO4**
Unit V:	**Chemical And Bio Medical Micro Systems**	**6+3 hours**

Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemoresistors, chemocapacitors, chemotransistors, electronic nose (E-nose), mass sensitive chemosensors, fluorescence detection. *Calorimetric spectroscopy*	**COs: CO5, CO6**

Board of Studies			
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Applications of microfluidic systems	CO4	PO1, PO6, PO7
2	Chemical And Bio Medical Micro Systems	CO5, CO6	PO1, PO6, PO7

Text Books

1. NitaigourPremchandMahalik, “MEMS” TMH Publishing co.
2. Sergey EdwrdLyshevski, “MEMS and NEMS”, CRC Press, Indian Edition.
3. Tai-Ran Hsu, “MEMS and Micro Systems: Design and Manufacture”, TMH Publishers.
4. Thomas M Adams, “Richard A Layton Introductory MEMS”, Springer International Publishers

Reference Books

1. Chang Liu ,”Foundation of MEMS”, Prentice Hall Ltd.

Web References

1. https://nptel.ac.in/courses/117/105/117105082/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	20	30
L2	40	30
L3	40	40
Total(%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is the basic function of light modulator?
2. What are hard magnetic materials?
3. Discuss the scope of the subject MEMS.
4. What are the important applications of MOEMS devices?
5. Give the applications of thermally activated MEMS relays.
6. What is doping?
7. Define micro lens

L2: Understand

1. Explain how pressure is measured by microphone.
2. Write a detailed note on large force reluctance magnetic actuator.
3. Explain various types of actuation methods used in RF switching.
4. Explain how fluorescence detection is done?
5. Explain the construction and working of Bi-directional micro actuator.
6. Explain the considerations to be made by the users and system designers when the geometric scale

decreases in fluid systems

L3: Apply

1. List out the applications and limitations of MEMS magnetic sensor.
2. Comment about various materials used as membrane-transducer.
3. With the help f line diagram explain the functioning of MEMS microphone.

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Board of Studies (ME)

MI 20CEM04 Sustainability and Pollution Prevention Practices 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20CEM03.1	Concept of sustainability and its goals
20CEM03.2	Sources and effects of environmental pollution
20CEM03.3	Identify the prevention measures for environmental protection
20CEM03.4	Approach for analysis and assessment of developmental activities and their impacts on environment
20CEM03.5	Objectives and components of environmental management

Unit I:	**Concept of Sustainability and Development**	**09 hours**
Sustainability and its goals, Growth and development, Development and environment, Causes for industrialization, Changing life styles, Regulatory aspects of industrialization, Overall impact of industrialization and Urbanization on quality of human life, Global environmental issues		**COs: CO1**
Unit II:	**Pollution, Monitoring and Control**	**09 hours**
Definition, types and sources of pollution, Quality standards for air, water, soil; types of pollutants; Methods of monitoring and control of air, water, soil Pollution (Physicochemical and bacteriological sampling and analysis); effects of pollution on plants, animals and Human beings		**COs: CO2**
Unit III:	**Measures for Environmental Protection**	**09 hours**
Formal and informal environmental education, awareness for nature conservation and protection, environmental ethics and morality, conservation of natural habitats, National parks and wild life sanctuaries, role of youth and women, role of NGO's, urban planning and land-use pattern		**COs: CO3**
Unit IV:	**Environmental Impact Assessment**	**09 hours**
Definition, significance and scope of impact assessment, Need & objective, types of environmental impacts, methods of environmental impacts, major steps in impact assessment procedure, generalised approach to impact analysis		**COs: CO4, CO5**
Unit V:	**Environmental Management**	**09 hours**
Objectives and components of environmental management need for training, Environmental Impact Statement and Environment Managemental Plan, Role of remote sensing in environmental management, Sustainable use of natural resources, management of soil, wildlife and its methods, agriculture management, public participation in resource management		**COs: CO6**

Board of Studies		
Approved in : BoS No. IV		
Approved in : ACM No. VI		
Expert talk (To be delivered by SMEs from industries)	COs	POs
1		
2		

Text Books

1. Lars F. Niklasson, "Improving the Sustainable Development Goals: Strategies and the Governance Challenge", 2009
2. Herman Koren, "Best Practices for Environmental Health: Environmental Pollution, Protection, Quality and Sustainability", 21 April, 2017
3. McCully, P, "Rivers no more: the environmental effects of dams (pp. 29-64)", Zed Books, 1996
4. McNeill, John R, "Something New Under the Sun: An Environmental History of the Twentieth Century", 2000

Reference Books

1. Environmental Chemistry - A.K. De, New Age Int. Pub. Co., New Delhi, 1990
2. Lave, L.B and Upton, "Toxic Chemicals, Health and the Environment", The Hopkins Press Ltd., London, 1987
3. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. "Environmental and Pollution Science. Academic Press", 2011

Web References

1. http://mcic.ca
2. https://www.drishtiias.com
3. https://www.jica.go.jp

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Board of Studies (CE)

MI 20CSM03 Database Security 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20CSM03.1	Explain the Cossets DBMS
20CSM03.2	Explain the Constrains in Database
20CSM03.3	Describe different Database Schemas
20CSM03.4	Illustrate Desecrate Data Models and Water Marking Processes
20CSM03.5	Explains Geospatial Data Models and Access Methods

Unit I: Database Introduction 9 Hours

Introduction to Database – Relational Database & Management System, Data Abstraction (Physical Level, Logical Level & View Level) - Multi-level Database, Distributed Database, Database Architecture.

Unit II: Database Securities 9 Hours

Security issues in Database – Integrity constraints, Access Control (Grant & Revoke Privileges) - Statistical Database, Differential Privacy. Distributed Database Security.

Unit III: Schema Models 9 Hours

Security in Data Warehouse & OLAP – Introduction, Fact table, Dimensions, Star Schema, Snowflake Schema, Multi-Dimension Range Query, Data Cubes.

Unit IV: Data Mining Introduction 9 Hours

Data Mining – Introduction - Randomization methods, Data Swapping, Database Watermarking – Basic Watermarking Process - Discrete Data, Multimedia, and Relational Data, Different Data Migration Techniques.

Unit V: Geospatial Database 9 Hours

Geospatial Database Security – Geospatial data models – Geospatial Authorization, Access Control Models: Geo-RBAC, Geo- LBAC

Text Books

1. Michael Gertz., Sushil Jajodia., “Handbook of Database Security: Applications and Trends”, ISBN-10: 0387485325, Springer, 2007
2. Osama S. Faragallah., El-Sayed M. El-Rabaie., Fathi E. Abd El-Samie., Ahmed I. Sallam., Hala S. El-Sayed., “Multilevel Security for Relational Databases”, ISBN 978-1-4822- 0539-8, CRC Press, 2014.

Reference Books

1. Bhavani Thuraisingham., “Database and Applications Security: Integrating Information Security and Data Management”, CRC Press, Taylor & Francis Group, 2005.
2. Elmasri Navrate., “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2016.
3. Peter Rob. , Carlos Coronel., “Database Systems Design, Implementation and Management,” Tenth Edition, Pearson Education, 2013

Web Resources

1. http://www.nptelvideos.in/2012/11/database-managementsystem.html
2. https://www.ibm.com/in-en/cloud/learn/database-security
3. http://data.conferenceworld.in

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Board of Studies (CSE)

MI 20MEM03 Surface Engineering 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20MEM03.1	Decide the surface preparation methods suitable for different substrate materials.
20MEM03.2	Apply knowledge on properties offered by different Coatings based on the application requirement.
20MEM03.3	Interpret the testing &evaluation of metallic coatings.
20MEM03.4	Explain the effect of process parameters on the properties & microstructure of the surface coating processes.
20MEM03.5	Explain the importance & role of surface modifications to achieve several technological properties.

Unit I: Fundamentals of Surface Engineering **9 Hours**

Introduction to surface engineering, Scope of surface engineering for different engineering materials, Surface Preparation methods such as Chemical, Electrochemical, Mechanical: Sand Blasting, Shot peening, Shot blasting, Hydro-blasting, Vapor Phase Degreasing etc., Coatings: Classification, Properties and applications of Various Coatings

Unit II: Chemical Conversion Coating **9 Hours**

Chromating, Phosphating, and Anodizing, Thermochemical processes: Methodology used, mechanisms, important reactions involved, Process parameters and applications.

Unit III: Coating from Vapor Phase **9 Hours**

PVD, and CVD: Various Methods used, mechanisms, important reactions involved, Process parameters and applications.

Unit IV: Metallic coating **9 Hours**

Hot Dipping, Galvanizing, Electrolytic and Electro less plating: Methodology used, mechanisms, important reactions involved, Process parameters and applications. Testing/ evaluation of metallic coatings.

Unit V: Thermal spray coatings **9 Hours**

Processes, Types of spray guns, Comparison of typical thermal spray processes, Surface Preparation, Finishing Treatment, Coating Structures and Properties, Applications.

Text Books

1. J. R. Davis, “Surface Engineering for Corrosion and Wear Resistance”, 1st Edtion, 1997.
2. George J, “Rudzki -Surface Finishing Systems metal and non-metal finishing handbook-guide”, 1st Edition, Metals Park: ASM, 1983.
3. James A. Murphy, “Surface Preparation and Finishes for Metal, McGraw-Hill”, New York 1971.
4. P. G. Sheasby and R. Pinner, “Surface treatment and finishing of Aluminium and its alloy”, 1st Edition, ASM, Metals Park, 1987.

Reference Books

1. Friction Stir Welding and Processing, Rajiv Sharan Mishra, Partha Sarathi De, Nilesh Kumar, International 2006.
2. Friction Stir Welding and Processing, R.S. Mishra and M.W. Mahoney, ASM International, 2007.
3. Advances in Friction-Stir Welding and Processing, M-K Besharati-Givi and P. Asadi, ASM International 2008.

Web References

1. www.nptel.iitm.ac.in
2. www.btechguru.com
3. www.ocw.mit.edu
4. www.corrosion-doctors.org

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Board of Studies (ME)

MI 20EEM03 Electrical Engineering Material Science 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20EEM03.1	Understand the phenomena of metal conductivity
20EEM03.2	Explain the properties of di-electric properties
20EEM03.3	Understand the magnetic properties of materials
20EEM03.4	Explain the types of semi-conductors
20EEM03.5	Understand the modern techniques used for studying the material science

Unit I: Conductivity of Metal **9 Hours**

Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, emission of electrons from metals, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials

Unit II: Dielectric Properties **9 Hours**

Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, significance of the loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system,

Unit III: Magnetic Properties of Materials **9 Hours**

Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials

Unit IV: Semiconductors **9 Hours**

Energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, thermal conductivity of semiconductors, electrical conductivity of doped materials

Unit V: Modern Techniques for Materials Studies **9 Hours**

Optical microscopy – Electron microscopy – Photo electron spectroscopy – Atomic absorption spectroscopy – Introduction to Biomaterials and Nanomaterials

Text Books

1. Joseph Le Roy Hayde Proteus Steinmetz, “Radiation, Light and Illumination: A Series of Engineering Lectures Delivered at Union College”, BiblioLife, 2019
2. Jack L. Lindsey, “Applied Illumination Engineering”, 4th Edition, PHI, 2011
3. John Matthews, “Introduction to the Design and Analysis of Building Electrical Systems”, 2nd Edition, Springer, 2013.

Reference Books

1. M.A. Cayless, “Lamps and Lighting”, 5th Edition, Routledge, 2016.
2. Leopold Bloch, “Science of Illumination: An Outline Of The Principles Of Artificial Lighting”, Kessinger Pub, 2018.

Web References

1. https://nptel.ac.in/courses/108/105/108105060/

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Board of Studies (EEE)

MI 20ECM03 Analog Electronic Circuits 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20ECM03.1	Demonstrate the concept of DC biasing and transistor stabilization leading to the design of amplifiers
20ECM03.2	Classify, analyze types of multistage amplifiers
20ECM03.3	Classify, analyze and design different types of feedback amplifiers and Oscillators
20ECM03.4	Analyze the response of different signals for linear and Nonlinear wave shaping circuits
20ECM03.5	Understand the internal operation of Op-Amp and its Applications

Unit I: Transistor Biasing 9 Hours

Need for biasing, operating point, BJT biasing methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, Ic, and β, Stability factors, (S, S', S'').

Unit II: BJT and Multistage Amplifiers 9 Hours

BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductance, Hybrid π capacitances, Multistage Amplifiers: Classification of amplifiers, methods of coupling, cascaded transistor amplifier.

Unit III: Feedback Amplifiers and Oscillators 9 Hours

Feedback Amplifiers: Feedback principle and concept, types of feedback, classification of feedback amplifiers. Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wien bridge oscillators with BJT, generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT.

Unit IV: Linear Wave Shaping 9 Hours

Linear wave shaping: High pass, low pass RC circuits, response for sinusoidal, step, pulse, square, ramp and exponential inputs. RC network as differentiator and integrator; Attenuators, Diode clippers.

Unit V: Linear Applications of Op-Amp 9 Hours

Internal Block Diagram of various stages of Op-Amp and Roll of each Stage, Characteristics of Op-Amp, Ideal and Practical Op-Amp specifications, Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier.

Text Books

1. Robert, L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 10th Edition, Prentice Hall of India, 2009.
2. Millman, J, TaubH, Mothiki Surya Prakash Rao and Millman's, "Pulse Digital and Switching Waveforms", 2nd Edition, Tata McGraw-Hill, 2008.
3. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", Prentices Hall of India, 1987.

Reference Books

1. Donald A. Neaman, "Electronic Circuit Analysis and Design", 3rd Edition, Tata Mc Graw-Hill, 2010
2. Paul Gray, Hurst, Lewis and Meyer, "Analysis and Design of Analog Integrated Circuits", 4th Edition, John Willey &Sons, 2005
3. Anand Kumar, A., "Pulse and Digital Circuits", 2nd Edition, Prentice Hall of India, 2005
4. Sanjay Sharma, "Operational Amplifiers & Linear Integrated Circuits", 2nd Edition, S. K. Kataria & Sons, 2010.

Web Resource

1. https://nptel.ac.in/courses/108102112
2. https://www.udemy.com/course/analog-electronics-basic-concepts/

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Board of Studies (ECE)

MI 20AIM03 Interpretable Machine Learning 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20AIM03.1	Introduction to interpretability
20AIM03.2	Different interpretable models
20AIM03.3	Explain the software's for interpretable models.
20AIM03.4	Illustrate plotting of prediction changes.
20AIM03.5	Explains individual predictions of any black box classification model.

Unit I: Introduction **9 Hours**

Importance of Interpretability, Taxonomy of Interpretability Methods, Scope and evaluation of Interpretability, Properties of Explanations, Human-friendly Explanations

Unit II: Interpretable Models-I **9 Hours**

Data Sets-Regression, Text Classification. Interpretable Models -Linear Regression, Logistic Regression, Decision Tree, Decision Rules, Decision Rule Fit

Unit III: Interpretable Models-II **9 Hours**

Generalized Linear Models (GLM) - Non-Gaussian Outcomes, Advantages; Generalized Additive Models (GAM) - Nonlinear Effects, Advantages and software; Other interpretable Models: Naive Bayes Classifier, K-Nearest Neighbors

Unit IV: Model Agnostic Methods **9 Hours**

Partial Dependence Plot (PDP), Accumulated Local Effects (ALE) Plot, Feature Interaction, Functional Decomposition, Permutation Feature Importance, Global Surrogate.

Unit V: Local Model Agnostic Methods **9 Hours**

Individual Conditional Expectation (ICE), Local Surrogate (LIME), Counterfactual Explanations, Scoped Rules (Anchors), Shapley Values.

Text Books

1. "Interpretable Machine Learning, A Guide for Making Black Box Models Explainable", By Christoph Molnar · 2020
2. "Interpretable Machine Learning with Python, Learn to Build Interpretable High-performance Models with Hands-on Real-world", By Serg Masís · 2021

Reference Books

1. "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning", By Andrea Vedaldi, Grégoire Montavon, Klaus-Robert Müller, Lars Kai Hansen, Wojciech Samek,2019.
2. "Interpreting Machine Learning Models, Learn Model Interpretability and Explainability Methods", By Anirban Nandi, Aditya Kumar Pal · 2021

Web References

1. https://christophm.github.io/interpretable-ml-book/index.html
2. https://ai.googleblog.com/2021/12/interpretable-deep-learning-for-time.html
3. https://arxiv.org/abs/2103.10689

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Board of Studies CSE(AI/ML)

MI 20DSM03 Data Governance 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20DSM03.1	Understanding of the role computation can play in solving problems and optimization techniques
20DSM03.2	Understanding the usage of computational techniques.
20DSM03.3	Understanding Stochastic programming and statistical thinking
20DSM03.4	Identify the problem using Monte Carlo simulations
20DSM03.5	Plotting with the pylab package

Unit I: Introduction, Data Literacy and Concepts **9 Hours**

Data is an asset, Data governance and governance, Data management, The governance "V", Solutions Other terms, Some final core concepts

Unit II: Overview: A Day in the life of a Data Governance Program and its Capabilities **9 Hours**

What does it look like? - The scope of data governance and data management, Business model, Content, Development methods -Federation, Elements of data governance programs, Principles, Policies, Metrics, The critical success factors for data governance

Unit III: The Data Governance Business Case **9 Hours**

The business case, Objectives of the business case for data governance, Components of the business case - The big picture (vision), Program risks, Business alignment, Costs of data quality issues, Costs of missed opportunities, Data debt, Obstacles, impacts, and changes, Presentation of the case. The process to build the business case - Fully understand business direction, identify possible opportunities, identify usage opportunities, define business benefits, confirm business benefits, quantify costs, Prepare the business case documentation, Approach considerations

Unit IV: Overview of Data Governance Development and Deployment **9 Hours**

Types of approaches, The data governance delivery framework, Process overview, Engagement, Strategy, Architecture and design, Implementation, Operation, and changes

Unit V: Engagement **9 Hours**

Initiation- Obtain program approval, Develop DG rollout team structure. Definition- Define DG for your organization, identify business units (subject to DG), Identify business capabilities that need data governance (and don't have it). Scope- Define scope and constraints with the initial plan for DG, Approve scope and constraints. Assessment- Information maturity, Change capacity, Data environment

Text Books

1. John Ladley, "Data Governance", Academic Press, Second Edition, 2012.

Reference Books

1. Evren Eryuek, Uri Gilad, "Data Governance: The Definitive Guide", O'Reilly Media, Inc., 2021.

Web Resources

1. https://nptel.ac.in/courses/110/106/110106072/
2. https://nptel.ac.in/courses/110/104/110104094/

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Board of Studies CSE(DS)

MI **20SHM06 Journalism** **3 0 0 3**

At the end of the course, students will be able to

Code	Course Outcomes
20SHM01.1	Understand the concepts of mass communication in general and journalism in particular
20SHM01.2	Impact fundamentals of journalism, evolutionary process, basics concepts, practices and recent trends
20SHM01.3	Get exposed to different faces of journalism
20SHM01.4	Get trained to develop inquisitive and analytical skills to be successful in media
20SHM01.5	Prepare the report for the representation

Unit I: Introduction **9 Hours**

Journalism: Meaning, Definition Nature, Scope, Functions; Truth,Objectivity, verification. independent monitor, forum for criticism and comment, watch dog role of press and democracy principles of journalism will stop types of journalism: print, broadcast and online

Unit II: Process Control and Capability Analysis **9 Hours**

Mass Media And Development - Early Journalism in the world, India and Karnataka global context Colin rise of advocacy journalism, professionalism, modern journalism and mobile journal journalism. Community journalism, rural journalism, yellow journalism, penny press, tabloid press, and citizen journalism

Unit III: Process-monitoring and Control Techniques **9 Hours**

Journalism as a profession, responsibilities and criticism, do you know any his interest understanding the public taste, press as a tool in social service relationship between press and other mass media

Unit IV: Acceptance Sampling **9 Hours**

Normative theories of press enter relevance to the present day; wire services- Indian and international news agencies

Unit V: Reliability and Life Testing **9 Hours**

Photojournalism- caption writing, photo feature, visual composition- case studies Danish Siddiq, Jimmy Nelson, Margaret Brooke-white, Philip JonesGriffits, Rathika Ramaswami Raghu Rai exercise assignments analysis of daily newspaper in the classroom practice of writing new stories on various topics writing reports on civic problems incorporating information from civil organization based on interviews prepare questions for a specific interview rewriting news stories from newspapers for magazine filing report of more press conferences filing report for an actual press conference practice of writing to wall journal twice a week

Text Books

1. Keval J. Kumar (2001), Mass Communication in India, Jaico Publication, New Delhi
2. Seema Hasan (2010), Mass Communication – Principles and Concepts, CBS Publishers and distributors, New Delhi
3. V S Gupta & Vir Bala Aggarwal (2001), Handbook of Journalism and Mass Communication, Concept Publishing Company, New Delhi

Web References

3. http://wikipedia.org//wiki//media_of_india#cite
4. http://wikipedia.org//wiki//mass%2520_media__of_india#cite
5. http://wikipedia.org//wiki//mass_media_of_india#cite-buzzle

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Board of Studies

MI 20SHM07 Statistical Quality Control 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20SHM08.1	Identify application of various Statistical quality tools
20SHM08.2	Use control chart techniques for quality improvement
20SHM08.3	planning, establishing, and operating SQC procedures
20SHM08.4	Design a procedure testing incoming batches
20SHM08.5	Carry out reliability testsand perform statistical analysis

Unit I: Introduction **9 Hours**

Quality Improvement in the Modern Business Environment, Modeling Process Quality, Methods and Philosophy of Statistical Process Control

Unit II: Process Control and Capability Analysis **9 Hours**

Control Charts for Variables, Control Charts for Attributes, Process and Measurement System Capability Analysis

Unit III: Process-monitoring and Control Techniques **9 Hours**

Cumulative Sum and Exponentially Weighted Moving Average Control Charts, Univariate Statistical Process Monitoring and Control Techniques

Unit IV: Acceptance Sampling **9 Hours**

Concepts of acceptance sampling, Lot-by-lot acceptance sampling for attributes, Other acceptance sampling techniques

Unit V: Reliability and Life Testing **9 Hours**

Common models and distributions, Estimation of mean life with complete samples, Reliability Estimation, Types of reliability tests

Text Books

1. Montogomery D. C, Introduction to Statistical Quality Control (5th Edition) Wiley eastrenLtd, 2005
2. Gupta.V,Kapoor,V.K Fundamentals of Applied Statistics Sultan Chand Publications, New Delhi

Reference Books

1. Chang D. and Macmillan S. (1992). Statistical Quality Design and Control. Contemporary Concepts and Methods
2. Mahajan M. Statistical Quality Control, Danpatrai & Co Delhi
3. Gupta R.C Statistical quality Control and Quality management,10th Edition, Kanna Publishers, New Delhi

Web References

6. https://www.digimat.in/nptel/courses/video/112107259/L01.html
7. https://freevideolectures.com/course/4539/nptel-operations-management/49
8. https://freevideolectures.com/course/4384/nptel-engineering-metrology/48

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Board of Studies

MI 20MBM05 Entrepreneurship and Business Venture Planning 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20MBM05.1	Know the role of entrepreneurship development in economy
20MBM05.2	Understand the entrepreneurship and creativity
20MBM05.3	Understand the concept of project planning
20MBM05.4	Understand the sources of financing to ventures
20MBM05.5	Know the methods of entrepreneurship training

Unit I: Introduction 9 Hours

Concept of Entrepreneurship, Role of entrepreneurship in economic Development; factors impacting emergence of entrepreneurship, types of entrepreneurs. Characteristic of successful entrepreneurs; Women Entrepreneurs, Social entrepreneurship, Entrepreneurial challenges

Unit II: Entrepreneurship Development 9 Hours

Types of start-ups, Entrepreneurial class Theories, Entrepreneurial training; EDP Programme, Characteristics of entrepreneurial leadership, Components of Entrepreneurial Leadership, Source of innovative ideas, Entrepreneurship and creativity.

Unit III: Project Planning 9 Hours

Concept of Project and classification of Project, Identification, Project Formulation, Project Report, Project Design, Project Appraisal, Profitability Appraisal, Social cost benefit analysis, financial analysis, Developing a Marketing plan-customer analysis, sales analysis, steps in marketing research, Marketing Mix; business plan preparation, elements of a business plan; Business plan failures

Unit IV: Project Financing & Venture Capital 9 Hours

Financing Stages; Sources of Finance; Venture Capital; Criteria for evaluating new-venture proposals; Evaluating the Venture Capital-process; Sources of financing for Indian entrepreneurs.

Unit V: Entrepreneurship Training 9 Hours

Designing appropriate training programmers to inculcate entrepreneurial spirit, significance of entrepreneurial training, training for new and existing entrepreneurs, role of entrepreneurship development institutes, MSMES in providing entrepreneurial training.

Note: Discuss case studies from every unit

Text Books

1. Kumar, Arya and Entrepreneurship: Creating and Leading an Entrepreneurial Organization, Pearson, India.
2. Hishrich, Peters, Entrepreneurship: Starting, Developing and Managing New Enterprise, Irwin.

Reference Books

1. Allen K. R., Launching New Ventures: An Entrepreneurial Approach, Cengage Learning.
2. Rama Chandran K., Entrepreneurship Development, Tata McGraw-Hill, India.
3. Roy, Rajeev, Entrepreneurship, Oxford University Press
4. Vasant, Desai, Small – Scale Industries and Entrepreneurship, Himalya Publication, India

Web References

1. https://nptel.ac.in/courses/105/102/105102012/
2. https://onlinecourses.swayam2.ac.in/nou20_cs14/

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Board of Studies (MBA)

MI 20MBM06 Performance Management and Talent Management 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
20MBM06.1	Know about performance management process
20MBM06.2	Understand the performance management system
20MBM06.3	Understand the issues and challenges in implementation of performance management system
20MBM06.4	Understand the talent management approaches
20MBM06.5	Understand the talent management practices and process of companies

Unit I: Introduction 9 Hours

Performance management process, Objectives of performance management system; Historical development in India, Performance management and performance appraisal, Linkage of performance management system with other HR practices

Unit II: Performance Management System 9 Hours

Performance planning, Ongoing support and coaching, Performance measurement and evaluation, Performance management and appraisal; Methods of performance appraisal, Appraisal Communication; Counselling, Identifying potential for development, Linking pay with performance

Unit III: Issues in Performance Management 9 Hours

Implementing performance management system - Strategies and challenges, Role of HR professionals in performance management, Performance management as an aid to learning and employee empowerment, Performance management documentation, Performance management audit, Ethical and legal issues in performance management

Unit IV: Talent Management 9 Hours

Concept and approaches, Frame work of talent management, Talent identification, integration and retention

Unit V: Talent Management Practices and Process 9 Hours

Building the talent pipeline, Managing employee engagement, Key factors and different aspects of talent management, using talent management processes to drive culture of excellence

Note: Discuss case studies from every unit

Text Books

1. Bhattacharyya, D. K., “Performance Management Systems and Strategies”, Pearson Education
2. Robert B, “Performance Management”, McGraw-Hill Education, India
3. ASTD, “Talent Management: Strategies for success from six leading companies”, Cengage Learning

Reference Books

1. Armstrong M, & Baron A, “Performance Management and Development”, Jaico Publishing House, Mumbai
2. Rao T. V, “Hurconomics for Talent Management: Making the HRD missionary business – driven”, Pearson Education

Web References

1. https://nptel.ac.in/courses/105/102/105102012/
2. https://onlinecourses.swayam2.ac.in/nou20_cs14/

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Board of Studies (MBA)

PC 23CS502 Computer Networks 3 0 0 3.0

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs / PSOs PO1	PO2	PO3	DoK
23CS502.1	Understand basics of computer networks and transmission media	3	3	3	L1, L2
23CS502.2	Understand the functions of data link layer and the protocols	3	3	3	L1, L2
23CS502.3	Explain the functions of network layer and its protocols	3	2	2	L1, L2
23CS502.4	Illustrate the session layer issues and transport layer services	3	3	3	L1, L2
23CS502.5	Understand the functions of application layer and presentation layer and their protocols	3	1	3	L1, L2

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Networks **9 Hours**

Network Topologies, Network Hardware, Network Software, Reference models – The OSI Reference Model, The TCP/IP Reference Model, Physical Layer, Guided Transmission Media, Unguided Transmission Media, Digital Modulation and Multiplexing, Public Switched, Circuit Switched and Telephone Network.

COs: CO1

Self - Learning Topics: Network Devices, The Mobile Telephone System

Unit II: Data Link Layer **9 Hours**

Data Link Layer Design Issues, Error Detection & Correction, Elementary Data Link Protocols, Sliding Window Protocols. The Medium Access Control Sub Layer: Multiple Access Protocols, Wireless LANS.

COs: CO2

Self - Learning Topics: Bluetooth, Data Link Layer Switching

Unit III: Network Layer **9 Hours**

Design Issues, The Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service, The Network Layer in the Internet.

COs: CO3

Self - Learning Topics: Routing for Mobile Hosts, Routing in AdHoc Networks

Unit IV: Transport Layer **9 Hours**

The Transport Service, Elements of Transport Protocols, The Internet Transport Protocols: UDP, TCP, Performance Issues, DTN Architecture.

COs: CO4

Self - Learning Topics: Delay-Tolerant Networking, The Bundle Protocols

Unit V: Application Layer **9 Hours**

The Domain Name System: The DNS Name Space, Resource Records, Name Servers, Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery.

COs: CO5

Self - Learning Topics: World Wide Web, Streaming Audio and Video

Board of Studies		Computer Science and Engineering	
Approved in : BoS No.			
Approved in : ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs / PSOs**
1	Routing	CO1 – CO5	PO1, PO2, PO3
2	DTN	CO1 – CO5	PO1, PO2, PO3

Textbooks

1. Tanenbaum, David J Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2010
2. Behrouz A. Forouzan, Forouz Mosharraf, "Computer Networks: A Top Down Approach", 1st Edition, McGraw Hill, 2012

Reference Books

1. Larry L. Peterson, Bruce. S Davie, "Computer Networks: A Systems Approach", Morgan Kauffman, 5th Edition, 2011
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 5th Edition, Addison-Wesley, 2009
3. William Stallings, "Data and Computer Communications", 8th Edition, Pearson, 2007

Web References

1. https://nptel.ac.in/courses/106105183
2. https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_ pdf_version.htm
3. https://www.javatpoint.com/computer-network-tutorial

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	30
L2	50	70
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define Maximum Data rate of a channel
2. Define Ethernet and Fast Ethernet
3. Define Congestion
4. Define TCP & UDP
5. Write the application layer paradigms
6. What are the design issues of data link layer?
7. What is the significance of DNS?

L2: Understand

1. Explain the structure of UDP Header format
2. Illustrate Routing of Packets within Virtual Circuit Subnet
3. Explain Traffic Aware Routing
4. Compare the throughput of pure aloha and slotted aloha
5. Explain Channel Allocation strategies
6. Explain about the sliding window protocol using Go-Back-NA
7. Explain Simplex Stop & Wait Protocol
8. Compare and contrast synchronous time division multiplexing and statistical time division multiplexing
9. Explain Signal to Noise Ratio

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Board of Studies (CSE)

OE 23AIO04 Fundamentals of Deep Learning 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
23AIO04.1	Describe the fundamental concept of artificial neural networks	-	L1, L2
23AIO04.2	Describe the function of different deep neural networks		L1, L2
23AIO04.3	Explain different deep learning algorithms		L1, L2
23AIO04.4	Describe the functioning of convolution and recurrent neural networks		L1, L2
23AIO04.5	Choose appropriate deep neural network for given application		L1, L2
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge			

Unit 1: Introduction to Deep Learning **9 hours**

Basics: Biological Neuron, Idea of computational units, McCulloch– Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.

Logic gates with perceptron

Unit 2: Feedforward Networks **9 hours**

Feedforward Networks: Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization – Regularization, autoencoders

Applications of multilayer perceptron

Unit 3: Convolution Networks **9 hours**

Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs – Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet

Applications of CNN

Unit 4: Recurrent Neural Networks **9 hours**

Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks –The Long Short-Term Memory

Applications of RNN

Unit 5: Applications of Deep Neural Networks **9 hours**

Applications: Large-Scale Deep Learning - Computer - Speech Recognition - Natural Language Processing

Healthcare applications

Text Books

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, UK, 2017
2. Antonio Gulli and Sujit Pal, "Deep Learning with Keras ", Packt Publishing Ltd, Birmingham, UK, 2017

Reference Books

1. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Web References

1. https://www.coursera.org/specializations/deep-learning

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels L1: Remember

1. List any 4 benefits of artificial neural networks
2. List any 4 features of ANN
3. What are deep neural networks?
4. Define supervised and unsupervised learning
5. Define generalization

L2: Understand

1. Explain the design parameters of deep neural networks
2. Describe the dimensionality reduction techniques
3. Explain backpropagation algorithm
4. Describe any 2 applications of deep networks for image processing
5. Write about any 5 applications of deep networks

MI 23DSO04 Introduction to Data Visualization 3 0 0 3.0

Pre- Requisite IT Workshop

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs			DoK
		PO2	PO3	PO5	
23DSO04.1	Understand the fundamental concepts of data visualization	3	1	3	L1, L2
23DSO04.2	Demonstrate the proficiency in data visualization using ggplot2()	3	2	3	L1 – L3
23DSO04.3	Summarize and visualize the data using different functions in R	3	2	3	L1 – L3
23DSO04.4	Demonstrate Tableau effectively to create compelling data visualizations and narratives	3	2	3	L1, L2
23DSO04.5	Understand storytelling techniques	3	2	3	L1, L2

1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos

L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create DoK: Depth of Knowledge

Unit I: Introduction to Data Visualization **9 Hours**

Introduction, Why to Look at Data? What Makes Bad Figures Bad? Perception and Data Visualization, Channels for Representing Data

COs : CO1

Self - Learning Topics: Think Clearly about Graphs

Unit II: Plotting the Data in R **9 Hours**

Ggplot, Ggplot Working, Tidy and Messy Data, Mappings Link Data to Things you see, Build your Plots Layer by Layer, Mapping Aesthetics vs Setting Them, Grouped Data and the “Group” Aesthetic, Facet to Make Small Multiples

COs: CO2

Self - Learning Topic: Plotting Different Charts in R

Unit III: Graph Tables, Add Labels and Make Notes **9 Hours**

Pipes to Summarize Data, Continuous Variables by Group or Category, Plot Text Directly, Label Outliers, Write and Draw in the Plot Area

COs: CO3

Self - Learning Topic: Understanding Scales and Guides

Unit IV: Tableau Introduction **9 Hours**

Introduction to Tableau, Importance of Context in Storytelling, Choosing the Right Visual, Curating Visuals for your Audience

COs: CO4

Self - Learning Topic: Tableau Filters

Unit V: Storytelling in Tableau **9 Hours**

Preparing Data for Storytelling: Data Interpreter in Action, Handling Nulls in Tableau, Cleaning Messy Survey Data in Excel, Pivoting Data from Wide to Tall, Reshaping Survey Data, Advanced Storytelling Charts and Tables

COs: CO5

Self - Learning Topics: Balance the Data and the Context

Board of Studies		Computer Science and Engineering (Data Science)	
Approved in: BoS No.			
Approved in ACM: ACM No.			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Data preparation and transformation in Tableau	CO1 – CO5	PO2, PO3, PO5
2	Creating effective advanced visualizations in Tableau	CO2 – CO5	PO2, PO3, PO5

Text Books

1. Kieran Healy, "Data Visualization- A Practical Introduction", 1st Edition, Princeton University Press, 2019
2. Lindy Ryan, "Visual Data Storytelling with Tableau, 1st Edition, Pearson Addison Wesley Data & Analytics Series, 2018

Reference Books

1. Kyran Dale, "Data Visualization with Python and Java Script", 1st Edition, O'Reilly Media Inc., 2016
2. Claus O. Wilke, "Fundamentals of Data Visualization", 1st Edition, O'Reilly Media Inc., 2019

Web References

1. https://www.geeksforgeeks.org/data-visualization-in-r/
2. https://intellipaat.com/blog/tutorial/r-programming/data-visualization-in-r/
3. https://www.tableau.com/learn/articles/data-visualization

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	60	60
L3	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Data Visualization?
2. Why Data Visualization is important?
3. What is Perception?
4. What is the use of facet()?
5. What is the use of piping in R?
6. List any two differences between messy and tidy data
7. List any four features of Tableau
8. What are the product portfolios of Tableau
9. What is storytelling and why is it important?
10. Define context in storytelling

L2: Understand

1. Explain the problems of honesty and good judgement
2. Describe mapping aesthetics and setting them
3. Explain facet() to make small multiples
4. Explain the uasage of pipes to summarize the data in R

5. Discuss continuous variables by group or category
6. Explain the importance of context in storytelling
7. Discuss curating the visuals for your audience in Tableau
8. Explain the process to prepare your data for storytelling
9. Discuss different advanced storytelling charts in Tableau
10. Explain storyboarding frame by frame

L3: Apply

1. Write a program in R to write and draw in the plot area
2. Write a program in R to plot text directly and label outliers in a scatterplot
3. Develop a Bar chart and Pie chart in Tableau
4. Develop a Likert chart and lollipop chart in Tableau

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Chairman
Board of Studies (CSE - DS)

MI 23ECO04 COMMUNICATION SYSTEMS

3 0 0 3
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs	DoK
23EC502.1	Explain various Amplitude modulation and demodulation schemes and their spectral characteristics		L1, L2, L3
23EC502.2	Explain various Phase modulation and demodulation schemes and their spectral characteristics		L1, L2, L3
23EC502.3	Demonstrate understanding of various digital modulation and demodulation techniques		L1, L2, L3
23EC502.4	Determine the probability of error for various digital modulation schemes		L1, L2, L3
23EC502.5	Demonstrate the concept different source coding techniques		L1, L2, L3

Unit I:	**Amplitude Modulation**	**9+3 hours**
Introduction to communication system, Need for modulation, Concept of modulation and demodulation of Continuous wave (CW) modulation: amplitude modulation (AM) - double sideband (DSB); Comparison of AM Techniques, Applications of different AM Systems. *Vestigial Sideband (VSB) Modulation*		**COs: CO1**
Unit II:	**Angle Modulation**	**9+3 hours**
Phase modulation (PM) & frequency modulation (FM); narrow and wideband FM; Representation of narrowband noise; receiver model, signal to noise ratio (SNR), noise figure, noise temperature*Zero Crossing Detector, Phase Locked Loop*		**COs: CO2**
Unit III:	**Pulse Digital Modulation**	**9+3 hours**
Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error *Adaptive Delta Modulation*		**COs: CO3**
Unit IV:	**Digital Modulation Techniques**	**9+3 hours**
Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK. **DATA TRANSMISSION:** Base band signal receiver, probability of error, matched filter, *Similarity of BFSK and BPSK, the Optimum Filter*		**COs: CO4**
Unit V:	**Information Theory**	**9+3 hours**
Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties. Information rate. **SOURCE CODING:** Introductions, Advantages, Shannon's theorem, Shanon-Fano coding, Huffman coding, *Mutual Information and its Properties.*		**COs: CO5**

Board of Studies		ECE	
Approved in : BoS No.		VII	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Simon Haykin, "Communication Systems", 5th Edition, John Wiley & Sons, 2009.
2. Taub H. & Schilling D., Gautam Sahe, "Principles of Communication Systems" , 3rd Edition, Tata Mc-Graw Hill, 2007
3. Lathi B. P., Zhi Ding and Hari Mohan Gupta , "Modern Digital and Analog Communication Systems" , 4th Edition Oxford University Press, 2017

Reference Books

1. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley, 2005
2. Proakis J.G., "Digital Communications", 4th Edition, McGraw Hill, 2000
3. Singh and Sapre, "Communication Systems Analog and Digital", Tata McGraw Hill, 2004

Web References

1. https://nptel.ac.in/courses/117/102/117102059/
2. https://nptel.ac.in/courses/117/101/117101051/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Need for modulation?
2. Define pre-emphasis and de-emphasis
3. What is uniform quantization?
4. Define source entropy

L2: Understand

1. Draw the Envelope detector and illustrate the process of detection of AM wave?
2. Derive the expression for the frequency modulated signal. Explain what is meant by narrowband FM and wideband FM using the expression.
3. Explain the methods for demodulation of PAM signals.
4. Explain the process of generating FSK signals.

L3: Apply

1. An amplitude modulated signal represented in time domain as 4Cos (1800πt) +10Cos (2000πt) + 4Cos (2200πt). Sketch the spectrum and calculate the band width & total power
2. A cable has a power loss of 3 dB is connected to the input of an amplifier, which has a noise temperature of 100K. Calculate the overall noise temperature referred to the cable input
3. A DM system can handle message signals of bandwidth up to 5 kHz and has a sampling rate of 50 kHz. A sinusoidal signal of 1.5 volts peak amplitude and frequency 2 kHz is applied to the system. Determine the step-size Δ required to avoid slope overload.

4. Find the Probability of error of Optimum Filter

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Board of Studies, ECE

MI **23EEO04 Introduction to Electric Vehicles** **3 0 0 3**

Version 01.00

Pre-requisite: Basics of Power Electronics

At the end of the course, students will be able to

Code	Course Outcomes	Mapping with POs PO1	PO2	DoK
23EEO04.1	Classification of Electric Vehicles	2	1	L1 – L2
23EEO04.2	Explain operation of Electric Vehicles	2	1	L1 – L2
23EEO04.3	Understand the charging structure of Electric Vehicles	2	1	L1 – L2
23EEO04.4	Summarize the operation of Electric Vehicles	2	1	L1 – L2
23EEO04.5	Understand the challenges of Electric Vehicles	2	1	L1 – L2

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Electric Vehicles **9 hours**

Overview of electric vehicles: history, types, and classifications, Advantages and challenges of electric vehicles compared to internal combustion engine vehicles, Components of an electric vehicle: electric motor, battery pack, power electronics, and charging system

COs: CO1

Environmental and societal impacts of electric vehicles

Unit II: Electric Vehicle Powertrain **9 hours**

Electric motor types used in electric vehicles: AC induction motors, permanent magnet motors, and switched reluctance motors, Power electronics in electric vehicles: inverters, converters, and motor controllers, Battery technologies for electric vehicles: lithium-ion, lead-acid

COs: CO2

solid-state batteries

Unit III: Electric Vehicle Charging Infrastructure **9 hours**

Types of electric vehicle chargers: Level 1, Level 2, and DC fast chargers, charging station deployment and infrastructure development: public charging stations, home chargers, and workplace charging, Charging considerations for range, battery health, and charging time optimization

COs: CO3

Charging standards and protocols

Unit IV: Electric Vehicle Operation and Maintenance **9 hours**

Electric vehicle performance metrics: range, efficiency, acceleration, and regenerative braking, Safety considerations for electric vehicles: high-voltage systems, crash safety, and fire prevention, Maintenance requirements for electric vehicles: battery health monitoring, motor maintenance, and cooling systems

COs: CO4

Software and firmware updates for electric vehicle systems

Unit V: Future Trends and Challenges in Electric Vehicles **9 hours**

Emerging technologies in electric vehicles: solid-state batteries, wireless charging, and vehicle-to-grid (V2G) integration, Environmental sustainability of electric vehicles: life cycle analysis, recycling, and circular economy approaches

COs: CO5

Challenges and opportunities for electric vehicle industry growth

Board of Studies		EEE	
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Safety measures		

Text Books

1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003.
2. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.
3. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003

Reference Books

1. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012.
2. Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017.
3. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer, 2013

Web References

1. https://nptel.ac.in/courses/108/106/108106170/
2. https://www.youtube.com/watch?v=3E1SXG7VkQk&list=PLHRG-unM84XgZd9HKQAmKdE12-1eRSe

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define life cycle analysis
2. List all types of Electric Vehicles

L2: Understand

1. Explain DC fast chargers
2. Explain various battery technologies for Electric Vehicles

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Chairman
Board of Studies (EEE)

PC **23MEO04 Surface Engineering** **3 0 0 3**

Version 01.00

Pre-requisite:

At the end of the course, students will be able to

Code	Course Outcomes	DoK
23MEO04.1	Understand the value of surface engineering	L1, L2
23MEO04.2	Understand the importance of surface & its interactions with its environment	L1, L2
23MEO04.3	Understand the various & Advanced surface modification techniques	L1, L2
23MEO04.4	Evaluate the surface modified materials for various industrial usages.	L1, L2
23MEO04.5	Inspect the surface modified materials for various industrial usages.	L1, L2, L3
23MEO04.6	Understand the various & Advanced surface Coating techniques.	

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I:	**BASICS OF SURFACE PROPERTIES**	**12 hours**
Introduction – Tribology – surface degradation – wear – types of wear – adhesive – abrasive – oxidative – corrosive — roles of friction and lubrication – corrosion – types – passivity – mechanism of growth and break down of passive film – corrosion control. *Erosive and Fretting wear*		**COs: CO1**
Unit II:	**SURFACE CLEANING**	**12 hours**
Introduction – surface pretreatment of metallic and electronic materials – mechanical cleaning polishing – chemical cleaning – acid, alkaline, acetone and carbon tetra chloride cleaning – alumina and diamond polishing – degreasing *Ultrasonic cleaning*		**COs: CO2**
Unit III:	**SURFACE COATING TECHNIQUES**	**12 hours**
Introduction – principle – parameters of electrodeposition –Faraday's laws of electrodeposition electrode position of copper, nickel, chromium and gold for industrial practices – organic coating paints-requirements of good paints-constituents of paints-function -special paints-heat resistant and fire retardant paints-electroless coatings conversion coatings. *Formulation of durable paint enamel coatings*		**COs: CO3**
Unit IV:	**ADVANCED SURFACE MODIFICATION PROCESS**	**12 hours**
Introduction –physical vapor deposition-chemical vapor deposition- ion beam process – ion beam assisted vapour deposition – ion implantation – reactive ion sputtering coating – electron beam process – electron beam assisted vapour deposition – laser assisted surface modification – laser ablation – laser sprayed deposit – direct metal deposition by laser *Laser alloying and Laser melting*		**COs: CO4, CO5**
Unit V:	**STANDARDS FOR SURFACE ENGINEERING MEASUREMENTS**	**12 hours**
Introduction – Terminology – laboratory accreditation – sampling – surface finish evaluation – bare and coated materials – product quality standards for specific coating process – conversion coatings – galvanized coatings – electrodeposited coatings – vapor deposited coatings – depth – thickness – hardness and friction co-efficient *Standards & ASTM Standards for measurement of surface treated materials*		**COs: CO6**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Advanced surface modification processes	CO4, CO5	PO1, PO5, PO6, PO7
2	Standards for surface engineering measurements	CO6	PO1, PO5, PO6, PO7

Textbooks

1. Sidney H. Avener – Introduction to Physical Metallurgy - McGrawHill- 6th Edition- 2015
2. Donald R.Askeland -Essential of Materials science and engineering – Cengage- 7th Edition- 2015
3. Dr.V.D.kodgire- Material Science and Metallurgy, Everest Publishing House- 4th Edition- 2015
4. Callister &Baalasubrahmanyam, Materials Science and engineering- Wiley Publications- 11th Edition- 2015

Reference Books

1. Fischer – Material Science for Engineering students –Elsevier Publishers- 11th Edition-2010
2. Rahghavan.V-Material science and Engineering - PHI Publishers- 5th Edition- 2009
3. Yip-Wah Chung- Introduction to Material Science and Engineering –CRC Press- 8th Edition- 2012
4. Suryanarayana. A V K- Material Science and Metallurgy– B S Publications- 13th Edition- 2013
5. Jindal. U.C-Material Science and Metallurgy– Pearson Publications- 15th Edition-2016

Web References

1. www.edinformatics.com/math_science/how_is_heat_transferred.htm
2. https://www.quora.com/Why-are-dimensionless-numbers-used-in-heat-transfer-and-fl
3. http://nptel.ac.in/courses/103103032/16
4. web.mit.edu/16.unified/www/FALL/thermodynamics/notes/node128.html
5. web.pdx.edu/~yongkang/main/class/Internal%20Flow.pdf

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	30
L3	40	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the properties of surface?
2. Why surface treatment is required?
3. Give the classification of coatings.
4. Differentiate between electroplating and electroless plating.
5. What is the purpose of nitriding? .

L2: Understand

1. Discuss the evolution of surface modification techniques in recent past.
2. Why surface modification is needed?
3. Explain how the chemical properties of surface can be changed?
4. How the surface coatings greatly influence on the properties of the material?
5. Explain the principle of electrodeposition with the help of a diagram.

L3: Apply

1. Explain the growth mechanism of passive film
2. Which surface cleaning method is suitable for metallic materials? Why?
3. How to select a good paint. What are the factors to be considered

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Chairman
Board of Studies (ME)

MI **23SHM01 Psychology** **3 0 0 3**

Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23SHM01.1	Focuses on classical/operant conditioning, reinforcement schedules, and observational learning to help students obtain an understanding of learning and conditioning
23SHM01.2	Understand the properties of Senses
23SHM01.3	Understand the state of Consciouness, Sleep & Dreams,
23SHM01.4	Understand the importance of learning
23SHM01.5	Understanding the components of memory, language, cognition, problem solving, and the many forms of memory will be the focus of this course.

Unit I: Introduction **9 Hours**

Definition of Psychology, Psychology as a science: Methods of psychology, Different schools of Psychology and modern perspectives of psychology - Scope and branches of psychology. **COs: CO1**

Unit II: Sensation And Perception **9 Hours**

General Properties of Senses, subliminal stimuli, Selective Attention, Physiological correlates of Attention, Internal influences on Perception- Learning, Set, Motivation and Emotion; External influences on perception- Figure Ground separation, Movement, organization, illusions, Perceptual constancies, Depth perception, Binocular and Monocular Depth, Perception; Perceptual defense and perceptual vigilance, sensory deprivation, sensory bombardment **COs: CO2**

Unit III: Consciousness **9 Hours**

Fundamental Process, Active and passive roles of consciousness, Sleep and Dreams, Meditation, Hypnosis, Psi Phenomena, Alternate states of consciousness; Natural and Drug induced. **COs: CO3**

Unit IV: Learning **9 Hours**

Definition of learning, Theories of learning, Classical conditioning, Operant conditioning, Cognitive Learning, Social Learning. **COs: CO4**

Unit V: Memory **9 Hours**

Meaning and nature of memory, Theories of memory: Information processing theories-sensory register, short term memory, rehearsal; Levels of processing theories, Long term memory- organizations, TOT, semantic and episodic memory, encoding and storing long term memories, role of organization, role of imagery, role of constructive processes; Retrieval from long term memory; Forgetting- Motivated forgetting, Interference, Decay through disuse, Techniques of improving memory. **COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Text Books

1. Morgan, C.T., King, R.A., Weisz, J.R., &Schopler, J. (2007). Introduction to Psychology, 7th Edition. Singapore: Mcgraw- Hill.
2. Myers, D.G. (2004). Psychology.5th Edition, Worth Publishers: New York.
3. Kalat, J. (2007) Introduction to Psychology, 8th Edition, Wordsworth Pub.Co.

Reference Books

1. Feldman, R.S. (2006) Understanding Psychology, 6th Edition, Tata McGraw Hill, New Delhi.
2. Kosslyn, S.M., & Rosenberg, R.S. (2006) Psychology in Context, 3rd Edition, Pearson Education Ltd.

Web References

1. https://www.all-about-psychology.com/learn-psychology.html
2. https://study-uk.britishcouncil.org/plan-studies/choosing-course/subjects/psychology

3. https://www.youtube.com/watch?v=k-P1BEk6hhE

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MI **23SHM02 English for the Media** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
20SHM02.1	Understand what media literacy is and its importance
20SHM02.2	Introduce the essential requirements of writing for the media
20SHM02.3	Familiarise the learners with the process of writing for the media
20SHM02.4	Make them familiar with the specific use of English in the field of media
20SHM02.5	Generate interest in various aspects of media and thereby equip them with the basic writing skills required for the same

Unit I: Introduction to Media Literacy **9 Hours**

Understand what media literacy is and its importance, analyze and interpret media messages through guided questions, Practice reading strategies to preview a text & skimming and scanning when you read Practice reading for the main idea, Define and accurately use content - related vocabulary in course activities and games, Apply comprehension strategies as you read, watch, and listen to a variety of texts and multimedia sources Demonstrate your understanding of these texts and key course ideas through comprehension check quizzes and a discussion board response **COs: CO1**

Unit II: Writing for the print media **9 Hours**

Newspaper: Writing headlines – Analysing newspaper articles- Practising interview skills – Planning and writing a newspaper article

Magazine: Composing magazine covers –Planning the contents of a magazine – Giving instructions for a photo shoot –Planning and writing a true life story. **COs: CO2**

Unit III: Writing for Radio, Television and Film **9 Hours**

Radio: Understanding the language of radio presenters – Understanding the production process – Planning a newslist – Giving post production feedback.

Television: Understanding the pre-production process –Organising a filming schedule–Filming on location –Editing a TV documentary **COs: CO3**

Film: Writing a screenplay –Pitching successfully –Organising a shoot –Writing a film review

Unit IV: Writing for advertisements **9 Hours**

Advertisement : Creating a print advert –Creating a screen advert –Presenting a finished advert- Analysing market trends – Setting up a marketing communication strategy – Organising the relaunch of a product – Evaluating the success of a relaunch **COs: CO4**

Unit V: Writing for the New Media **9 Hours**

New Media: Briefing a website designer –Analysing problems and providing solutions – Planning and writing a blog – Creating a podcast- Vlogs – Graphic novel [It is suggested for students to follow the different styles of reporting in various **COs: CO5**

media and to familiarize themselves with the emerging trends in the new media]

Core Reading: Ceramella, Nick and Elizabeth Lee. Cambridge English for the Media. CUP, 2008

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Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Text Books

1. Ryan, Michael and James W Tankard.Writing for Print and Digital Media.McGraw-Hill,2005.
2. Allen, Victoria, Karl Davis et al. Cambridge Technicals Level 3 Digital Media. Hodder,2016.
3. Hayward, Susan. Cinema studies: The Key Concepts. Routledge, 1996.

Reference Books

1. Parthasarathy, Rangaswami. Here is the News! Reporting for the Media.Sterling Publications 1998.
2. Axford,Barrie and Richard Huggins. New Media and Politics. Sage,2001.

Web References

1. https://www.google.co.in/books/edition/Designing_New_Media/
2. https://www.google.co.in/books/edition/AS_Media_Studies
3. https://www.google.co.in/books/edition/Social_Media_and_Democracy

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MI **23SHM03 Journalism and Mass Media** **3 0 0 3**

Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23SHM03.1	Understand the concepts of mass communication in general and journalism in particular
23SHM03.2	Impact fundamentals of journalism, evolutionary process, basics concepts, practices and recent trends
23SHM03.3	Get exposed to different faces of journalism
23SHM03.4	Get trained to develop inquisitive and analytical skills to be successful in media
23SHM03.5	Prepare the report for the representation

Unit I: Introduction **9 Hours**

Journalism: Meaning, Definition Nature, Scope, Functions; Truth, Objectivity, verification. independent monitor, forum for criticism and comment, watch dog role of press and democracy principles of journalism will stop types of journalism: print, broadcast and online. **COs: CO1**

Unit II: Process Control and Capability Analysis **9 Hours**

Mass Media And Development - Early Journalism in the world, India and Karnataka global context Colin rise of advocacy journalism, professionalism, modern journalism and mobile journal journalism. Community journalism, rural journalism, yellow journalism, penny press, tabloid press, and citizen journalism **COs: CO2**

Unit III: Process-monitoring and Control Techniques **9 Hours**

Journalism as a profession, responsibilities and criticism, do you know any his interest understanding the public taste, press as a tool in social service relationship between press and other mass media **COs: CO3**

Unit IV: Acceptance Sampling **9 Hours**

Normative theories of press enter relevance to the present day; wire services- Indian and international news agencies **COs: CO4**

Unit V: Reliability and Life Testing **9 Hours**

Photojournalism- caption writing, photo feature, visual composition- case studies Danish Siddiq, Jimmy Nelson, Margaret Brooke- white, Philip JonesGriffits, Rathika Ramaswami Raghu Rai exercise assignments analysis of daily newspaper in the classroom practice of writing new stories on various topics writing reports on civic problems incorporating information from civil organization based on interviews prepare questions for a specific interview rewriting news stories from newspapers for magazine filing report of more press conferences filing report for an actual press conference practice of writing to wall journal twice a week **COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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2			

Text Books

1. Keval J. Kumar (2001), Mass Communication in India, Jaico Publication, New Delhi
2. Seema Hasan (2010), Mass Communication – Principles and Concepts, CBS Publishers and distributors, New Delhi
3. V S Gupta & Vir Bala Aggarwal (2001), Handbook of Journalism and Mass Communication, Concept Publishing Company, New Delhi

Web References

1. http://wikipedia.org//wiki//media_of_india#cite
2. http://wikipedia.org//wiki//mass%2520_media__of_india#cite
3. http://wikipedia.org//wiki//mass_media_of_india#cite-buzzle

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MI **23SHM05 Statistical Methods** **3 0 0 3**

At the end of the course, students will be able to

Code	Course Outcomes
23SHM02.1	Demonstrate statistical techniques in real life problems
23SHM02.2	Gain statistical knowledge on measures of central tendency and variation
23SHM02.3	compute sample space, event, relative frequency, probability, conditional probability, independence
23SHM02.4	familiar with some standard discrete and continuous probability distributions
23SHM02.5	Understand the theory of sampling techniques and their practical applications

Unit I:	**Introduction**	**09 hours**
Definition and classification of statistics, Stages in statistical investigation, Definition of some basic terms, Applications, uses and limitations of statistics, Scales of measurement,methods of data collection and presentation, Diagrammatic and graphical presentation of data		**COs: CO1**
Unit II:	**Treatment of data**	**09 hours**
Frequency distributions,stem-leaf displays,measures of central tendency(mean,median,mode,quantiles),measures of variation(range,quartiledeviation,meandeviation,standard deviation),standard scores,moments(about origin and mean) skewness and kurtosis		**COs: CO2**
Unit III:	**Elementary probability**	**09 hours**
Introduction,definitions of random experiment,samplespace,events,types of events,countingrules,permutation and combinations rue,definition of probability in several approaches,some probability rules,conditional probability and independence,bayes theorem		**COs: CO3**
Unit IV:	**Probability distributions**	**09 hours**
Definition of random variables and probability distributions, Introduction to expectation: mean and variance of a random variable, Common discrete probability distributions: Binomial and Poisson, Common continuous probability distributions: normal, t and chi-square distributions		**COs: CO4**
Unit V:	**Sampling techniques**	**09 hours**
Basic concepts: population, sample, parameter, statistic, sampling frame, sampling units , Reasons for sampling,sampling and non samplingerrors,probability sampling techniques(simple ,stratified,systematic),Non probability sampling methods		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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Text Books

1. Bluman, A.G. (1995). Elementary Statistics: A Step by Step Approach (2nd edition).Wm. C. Brown Communications, Inc.
2. Spiegel, M.R. and Stephens, L.J. (2007).Schaum's Outline of Statistics, Schaum's Outline Series (4th edition).
3. Gupta, C.B. and Gupta, V. (2004).An Introduction to Statistical Methods.Vikas Publishing House, Pvt. Ltd, India

Reference Books

1. Richard.A,Gupta C.B ", Probability and Statistics for Engineers",Miller&Fruend,Pearson's Edition 2010
2. Freund, J.E and Simon, G.A. (1998). Modern Elementary Statistics (9th Edition).
3. Snedecor, G.W and Cochran, W.G. (1980). Statistical Methods (7th edition)
4. David, S.M., McCabe, P. and Craig, B. (2008). Introduction to the Practice of Statistics (6th edition). W.H. Freeman

Web References

1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://archive.nptel.ac.in/courses/111/105/111105077/
3. http://www.nitttrc.edu.in/nptel/courses/video/111105077/L10.html

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MI **23SHM06 Statistical Inference** **3 0 0 3**

At the end of the course, students will be able to

Code	Course Outcomes
23SHM06.1	Understand the concept of sampling distribution for large and small samples
23SHM06.2	calculate the estimator of a parameter using point estimation and bias
23SHM06.3	compare means and variances of two independent or paired samples using interval estimation
23SHM06.4	understand the framework of hypothesis testing for carrying out statistical inference
23SHM06.5	carry out the NP tests with due regard to the assumptions underlying these procedures

Unit I:	**Sampling distribution**	**09 hours**
Population, samples,Parameter and statistics,standard error,sampling distribution of a statistic, sampling distribution of mean (known and unknown variance) for large and small samples, sampling distribution of difference of means,Central limit theorem		**COs: CO1**
Unit II:	**Point Estimation**	**09 hours**
Definition of point estimator , General properties of estimators, Uniformly minimum variance unbiased estimators, Sufficient statistics, Factorization theorem, CR rao inequality, Cramer-Rao lower bound and UMVUE, Methods of finding point estimators by MLestimation,method of moments.		**COs: CO2**
Unit III:	**Interval estimation**	**09 hours**
Notion of interval estimation, Review of sampling distributions ,confidence Intervals, Confidence interval for the mean (population variance is known and unknown) , Confidence interval for the variance (population mean is known and unknown), Confidence interval for the difference between two means		**COs: CO3**
Unit IV:	**Testing of Hypothesis**	**09 hours**
Statistical hypothesis, null and alternative hypothesis, Simple and composite hypotheses,Test of hypothesis, critical region, type I and type II errors and their probabilities ,Simple null hypothesis versus simple alternative, Neyman-Pearson lemma, Examples from the normal population, Tests on the mean, Tests on the variance.		**COs: CO4**
Unit V:	**Non-parametric methods**	**09 hours**
Introduction,assumptions of Npmethods,advantages and disadvantages ,Testinga hypothesis about median, Test for randomness,signtest,Wilcoxon signed rank test		**COs: CO5**

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Expert talk (To be delivered by SMEs from industries)	COs	POs

1			
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Text Books

1. Gupta,V.K, Kapoor " Fundamentals of Mathematical Statististics" sultan Chand Publications,New Delhi
2. Rao, C.R..Linear statistical Inference and its Applications. WileyEastren Publications

Reference Books

1. Richard.A,Gupta C.B ", Probability and Statistics for Engineers",Miller&Fruend,Pearson's Edition 2010
2. Rohatgi, V.K. Statistical Inference. Dover Publications;2003
3. Iyengar,T.K.V,KrishnaGandhi.B,Prasad.M.V.S.S.N "Probability and Statistics" revised Edition,2012
4. Wasserman.L "A concise course in Statistical Inference"Springer Publications2004

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2. https://onlinecourses.nptel.ac.in/noc20_ma19/preview
3. https://onlinecourses.swayam2.ac.in/cec20_ma01/preview

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MI **23SHM07 Statistical Quality Control** **3 0 0 3**

At the end of the course, students will be able to

Code	Course Outcomes
23SHM07.1	Identify application of various Statistical quality tools
23SHM07.2	Use control chart techniques for quality improvement
23SHM07.3	planning, establishing, and operating SQC procedures
23SHM07.4	Design a procedure testing incoming batches
23SHM07.5	Carry out reliability testsand perform statistical analysis

Unit I: Introduction **9Hours**

Quality Improvement in the Modern Business Environment, Modeling Process Quality, Methods and Philosophy of Statistical Process Control

Unit II: Process Control and Capability Analysis **9 Hours**

Control Charts for Variables, Control Charts for Attributes, Process and Measurement System Capability Analysis

Unit III: Process-monitoring and Control Techniques9 Hours

Cumulative Sum and Exponentially Weighted Moving Average Control Charts , Univariate Statistical Process Monitoring and Control Techniques

Unit IV: Acceptance Sampling **9 Hours**

Concepts of acceptance sampling, Lot-by-lot acceptance sampling for attributes, Other acceptance sampling techniques

Unit V: Reliability and Life Testing **9 Hours**

Common models and distributions, Estimation of mean life with complete samples, Reliability Estimation, Types of reliability tests

Text Books

1. Montogomery D. C. (2005) Introduction to Statistical Quality Control (5th Edition) Wiley eastrenLtd.
2. Gupta.V,Kapoor,V.K Fundamentals of Applied Statistics Sultan chand Publications,New Delhi

Reference Books

1. Chang D. and Macmillan S. (1992). Statistical Quality Design and Control. Contemporary Concepts and Methods
2. Mahajan M. Statistical Quality Control,Danpatrai& Co Delhi
3. Gupta R.C Statistical quality Control and Quality management,10th Edition,Kanna Publishers,New Delhi

Web References

1. https://www.digimat.in/nptel/courses/video/112107259/L01.html
2. https://freevideolectures.com/course/4539/nptel-operations-management/49
3. https://freevideolectures.com/course/4384/nptel-engineering-metrology/48

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PC 23SHM08 Introduction to Time Series Analysis 3 0 0 3

At the end of the course, students will be able to

Code	Course Outcomes
23SHM08.1	Understand the theory and methods of time series analysis
23SHM08.2	Perform several Tests for Data randomness and estimate trends using several methods.
23SHM08.3	Estimate the seasonal components by several methods and deseasonalize the data
23SHM08.4	Know the concepts of Stationarity, AR, MA, and ARIMA models by using the Box-Jenkins approach.
23SHM08.5	Forecast the data sets using several methods like exponential smoothing and decomposition methods.

Unit I:	**Introduction**	**09 hours**
Definitions, objectives of Time Series, significance of Time Series, components of Time Series, models of Time Series, editing Time Series data		**COs: CO1**
Unit II:	**Tests of Randomness & Estimation**	**09 hours**
Turning point test, Difference sign test, phase length test, linear trend and estimation by least squares method, moving average method, Exponential smoothing method, Non-linear trend, and its estimation.		**COs: CO2**
Unit III:	**Estimation of Seasonal component**	**09 hours**
Simple average method, link relatives method, ratio to moving average method, ratio to trend method, smoothing models for seasonal data, uses and limitations of seasonal Indexes, deseasonalization of data		**COs: CO3**
Unit IV:	**Introduction to Box-Jenkins Models**	**09 hours**
Introduction, the concept of stationarity, ARIMA models, Autocorrelation function, Partial correlation function, Stages of Box-Jenkins methodology, Seasonal ARIMA, Estimation of parameters, Diagnostic checking.		**COs: CO4**
Unit V:	**Forcasting**	**09 hours**
Need and use of forecasting, some forecasting methods, averaging methods, Exponential smoothing methods, Box Jenkins methods, Decomposition methods, and Accuracy of forecasting methods.		**COs: CO5**

Text Books

1. Chatfield, C. "The Analysis of Time Series: An Introduction",Chapman&Hall,6thEdition 2003.
2. Montgomery, D.C. and Johnson, L.A. and Gardiner, J.S.." Forecasting and Time Series Analysis", McGraw Hill Higher Education,2nd Edition 2001.

Reference Books

1. S.C Gupta,V.K Kapoor, "Applied Statistics",Sultan Chand &Sons,4th Edition 2014.
2. Peter .A.Brockwell,Richard.A.Davis,"Time Series: Theory & Methods",Springer Series in Statistics,2nd Edition1991
3. George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel,"Time series Analysis",Wiley Series in Probability & Statistics,2nd Edition2008.
4. W.Vandaele,"Applied Time Series and Box Jenkins Models",AcademicPress,Inc,1st Edition1983
5. Wayne.A.Fuller,"Introduction to Time Series Analysis", Wiley Series in Probability & Statistics,2nd Edition2009.

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2. https://www.youtube.com/watch?v=NtKrYqRGHgk
3. https://youtu.be/fA-Xm5K7Wkw
4. https://youtu.be/kH4U19nLbWg
5. https://youtu.be/xYxf-bXkQA0

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MI **23MBM01 General Management** **3 0 0 3**

Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23MBM01.1	Understand basic functions of management
23MBM01.2	Understand the planning process and strategic formulation
23MBM01.3	Know the nature of the organization process
23MBM01.4	Understand the staffing objectives and functions
23MBM01.5	Understand the directing process and controlling methods.

Unit I: Management introduction **09 Hours**

Concept,Nature,ProcessandSignificanceofManagement;ManagerialRoles(Mintzberg); An Overview of Functional areas of Management- Marketing, Finance, Production, HRM, IT,R&D; Development of Management Thought-Classical, Neo-classical **COs: CO1**

Unit II: Planning **09 Hours**

Process and Types; Decision-making concept and process; Bounded rationality; Management by objectives; Corporate Planning- Environment analysis and Diagnosis, Strategy Formulations. **COs: CO2**

Unit III: Organizing **09 Hours**

Concept, nature, process and significance; Authority and Responsibility relationships- Delegation, Decentralisation; Departmentation basis and formats (Project and Matrix); Formal and Informal Organisation; Changing patterns in Organisation structures in the Knowledge economy. **COs: CO3**

Unit IV: Staffing **09 Hours**

Human Resource Planning, Objectives, Factors influencing Human Resource Planning, HR Planning Process, Job Analysis, Recruitment, Process and Sources of Recruitment; Selection, Process of selection and Techniques, Errors in selection Retention of employees. **COs: CO4**

Unit V: Directing and control **09 Hours**

Motivating and Leading People at work-basic concepts; Communication-nature, process, networks and barriers; Effective Communication Managerial Control- Concept and process; Designing an Effective Control System; Techniques –Traditional and Modern (PERT and CPM). **COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Text Books

1. Singh,B.P.&andT.N.Chhabra,ManagementConceptsandPractices,DhanpatRai,NewDelhi.
2. Singh,B.P.andA.K.Singh, Essentials of Management, Excel Books, N.Delhi.
3. R.S. Dwivedi, Management–An Integrated Approach, National Publishing House

Reference Books

1. Weihrich, Heing and Harold Koontz, Management a Global Perspective, Mc-Graw Hill, New-Delhi.
2. Stoner,JamesA.F.,A.E.Freeman,andD.A.Gilbert(Jr.),Management,PrenticeHallofIndiaPvt.Ltd.
3. Ivancevich,JohnM.,J.H,Donnelly(Jr.),andJ.L.Gibson,Management:PrinciplesandFunctions,AITBS,Delhi.
4. Luthans, Fred, Introduction to Management, McGraw Hill.
5. Jones,GarethR. And Jennifer M.George,Contemporary Management,TataMcGrawHill.

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1. https://nptel.ac.in/courses/105/102/105102012/
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MI **23MBM02 Human Resource Planning** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23MBM02.1	Understand staffing concept Write sound job descriptions, job specifications.
23MBM02.2	Develop a structured, job-related interview for talent acquisition across all the verticals
23MBM02.3	Know the training and development strategies of a firm.
23MBM02.4	Understand compensation management and performance management process.
23MBM02.5	Understand the role of trade unions in a firm.

Unit I: Introduction **9 Hours**

Human resource planning concepts, Concept of Staffing, Factors affecting Staffing, Staffing Process.

Job Analysis-- Concept, Job-Specifications, Job-Description, Process and Methods, Advantages of Job Analysis. **COs: CO1**

Job Designing : Introduction, Definition, Modern Techniques, Factors affecting Job Design.

Unit II: Talent Acquisition **9 Hours**

Recruitment and selection: Needs-recruitment process-alternative to recruitment, Concept of Selection, Criteria for Selection, Process. Screening – Pre and Post Criteria for Selection, Interviewing– Types and Guidelines for Interviewer & Interviewee, Types of Selection Tests, Selection Hurdles and Ways to Overcome Them, Current trends in Recruitment and Selection **COs: CO2**

Unit III: Training & Development **9 Hours**

Induction– Concept, Types- Formal/Informal Induction, Advantages of Induction, Training Vs Development, Need, Process of Training, Methods of Training, Development techniques, need for development, Career Planning, training and development policies, linking training and development to company's strategy. **COs: CO3**

Unit IV: Compensation and Performance Management **9 Hours**

Compensation management process, Forms of pay, Financial and non-financialcompensation - Factors influencing Wage fixation ,Performance Appraisal System, Methods of Performance Appraisal,Performance management process **COs: CO4**

Unit V: Managing Industrial relations **9 Hours**

Managing Industrial Relations – Components of IR - Trade Unions, Functions of Trade Union – Employee Participation – Importance and Schemes, Collective Bargaining – Grievance Redressal, Industrial Dispute – Settlement mechanism.Discuss case studies from every unit **COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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Text Books

1. P.Subba Rao, Human Resource Management Himalaya, Mumbai.
2. Aswathappa.K. Human Resources and Personnel Management, Tata MC Grail.
3. Armstrong,M.,Performancemanagement:Keystrategiesandpracticalguidelines,KoganPage,Londn.

Reference Books

1. Gary Dessler, Human Resources Management. Pearson publication
2. C.B.Mammoria, Personnel Management.

3. Recruitment and Selection: Theories and Practices, Dipak Kumar Bhattacharyya, Cengage India.

Web References

1. https://nptel.ac.in/courses/105/102/105102012/
2. https://onlinecourses.swayam2.ac.in/nou20_cs14/

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MI **23MBM03 Organisational Behaviour** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23MBM03.1	Understand basic concepts of organizational behavior and its nature
23MBM03.2	Understand the basic concepts personality, values and motivation
23MBM03.3	Understand inter personal behavior and its significance
23MBM03.4	Know the group behavior and its dynamics
23MBM03.5	Know about organizational climate, culture and organizational change

Unit I: Introduction **9 Hours**

Organisational Behaviour-Concept and Emergence of OB Concept; Nature and Theoretical frameworks; Disciplines contributing to the field of OB; Historical Background- Hawt Horne Studies, Psychological foundations. **COs: CO1**

Unit II: Individual Behaviour **9 Hours**

Personality, Learning, Values and Attitudes, Perception, Learning-Behaviourist, cognitive and social learning; Stress at work. Motivation -Maslow's Need Hierarchy, Herzberg's Two Factors Theory. **COs: CO2**

Unit III: Inter-Personal Behaviour **9 Hours**

Interpersonal communication and Feedback; Transactional Analysis (TA); Johari Window. Managingm is behaviour at work, Substance abuse, cyber slacking, Aggression, and Violence. **COs: CO3**

Unit IV: Group Behaviour **9 Hours**

Group Dynamics, Cohesiveness and Productivity; Management of Dysfunctional groups; Group Decision Making; Organisational Politics.
Leadership- Concept and Styles; Fielder's Contingency Model; House's Path -Goal Theory; Leadership Effectiveness. **COs: CO4**

Unit V: Organisational Process **9 Hours**

Organisational Climate: Concept, Determinants, Organisation Culture-Concept, Forming, Sustaining, and Changing a Culture, Organisational effectiveness-concept and measurement; Organisational change-resistance and management. Discuss case studies from every unit. **COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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Text Books

1. Singh,B.P.&andT.N.Chhabra,ManagementConceptsandPractices,DhanpatRai,NewDelhi.
2. Singh,B.P.andA.K.Singh, Essentials of Management, Excel Books, N.Delhi.
3. R.S. Dwivedi, Management–An Integrated Approach, National Publishing House

Reference Books

1. Udai Pareek, Organizational Behavior, 3rd Edition, Oxford University Press, 2011
2. Subba Rao P., "Management and Organizational Behavior", 3rd Edition, Himalaya Publishing House, 2017
3. Ghuman, K. and K.Aswathappa, Management: Concepts, Practice and Cases, Tata McGraw Hill.

Web References

1. https://nptel.ac.in/courses/105/102/105102012/

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MI **23MBM04 Compensation Management & Employee Welfare Laws** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23MBM04.1	Understand different pay structures and pay levels
23MBM04.2	Know about wage act 1936 and its implications
23MBM04.3	Understand the factors influence the wage fixation
23MBM04.4	Understand the components of bonus act 1965
23MBM04.5	Understand various incentive plans and international compensation concept

Unit I: Compensation Management **9 Hours**

Compensation management process, forms of pay, financial and non-financial compensation. Compensation Strategies, Assessing job values, pay structures; Designing pay levels, construction of optimal pay structure. Paying forperformance,skills and competence. International pay systems: comparing costs and systems. **COs: CO1**

Unit II: The Payment of Wages Act, 1936 **9 Hours**

Objects; Application; Responsibility for payment of wages; Fixation of wage periods; time-limits; Deduction from wages; Remedies available to worker, Powers ofauthorities,Penaltyforoffences. **COs: CO2**

Unit III: The Minimum Wages Act,1948 **9 Hours**

Objects; application; minimum fair and living wages; determination of minimum wage; taxation of minimum wage; advisory board; remedy to worker for non-payment of minimum wages **COs: CO3**

Unit IV: The Payment of Bonus Act, 1965 **9 Hours**

Objects; Scope and Application; Definitions; Calculation ofamount payable as Bonus; Eligibility and Disqualifications for Bonus; Minimum & maximum Bonus; Application of Act in Establishment in Public Sector; Bonus linked withProductionorProductivity **COs: CO4**

Unit V: Incentives Incentive Plan **9 Hours**

Individual incentives, pay for performance, compensation of special group Benefits, legally required benefits: Retirement, medical and other benefits, Employee profit sharing, employee stock option, gain sharing International Compensation: Recognizing variation, the social contract, Culture and pay, Preliminary considerations of international compensation. **COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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Text Books

1. Belchor,DavidW."CompensationAdministration",PrenticeHall,EnglewoodCliffs.NT.
2. Henderson,R.I.CompensationManagementinaKnowledgeBasedWorld.NewDelhi:PearsonEducation
3. Milkovich.G;Newman.JandRatnam,C.S.V,Compensation,TataMcGrawHill,Special Indian Edition.

Reference Books

1. Armstrong,M.&Murlis,H.RewardManagement:AHandbookofSalaryadministration,London:KeganPaul
2. Sharma, J.P. An Easy approach to Company and Compensation Laws. New Delhi: Ane Books Pvt Ltd.
3. Malik, P.L.HandbookofLabourerandIndustrialLaw, EasternBookcompany.
4. GovernmentofIndiaReportoftheNationalCommissiononLabourMinistryofLabourandEmployment,NewDelhi.(lates)

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MI **23MBM05 Entrepreneurship and Business Venture planning** **3 0 0 3**

Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23MBM05.1	Know the role of entrepreneurship development in economy
23MBM05.2	Understand the entrepreneurship and creativity.
23MBM05.3	Understand the concept of project planning
23MBM05.4	Understand the sources of financing to ventures
23MBM05.5	Know the methods of entrepreneurship training

Unit I: Introduction **9 Hours**

Concept of Entrepreneurship; Role of entrepreneurship in economic Development; factors impacting emergence of entrepreneurship, types of entrepreneurs. Characteristic of successful entrepreneurs; Women Entrepreneurs; Social entrepreneurship; Entrepreneurial challenges. **COs: CO1**

Unit II: Entrepreneurship Development **9 Hours**

Types of start-ups; Entrepreneurial class Theories;Entrepreneurial training; EDP Programmes; Characteristics of entrepreneurial leadership, ComponentsofEntrepreneurial Leadership; Source of innovative ideas; Entrepreneurship and creativity **COs: CO2**

Unit III: Project Planning **9 Hours**

Concept of Project and classification of Project, Identification, Project Formulation, Project Report, Project Design, Project Appraisal, Profitability Appraisal, Social cost benefit analysis, Financial analysis, Developing a Marketing plan-customer analysis, sales analysis, steps in marketing research, Marketing Mix; business plan preparation, elements of a business plan; Business plan failures. **COs: CO3**

Unit IV: Project financing &Venture capital **9 Hours**

Financing Stages; Sources of Finance; Venture Capital; Criteria for evaluating new-venture proposals; Evaluating the Venture Capital-process; Sources of financing for Indian entrepreneurs **COs: CO4**

Unit V: Entrepreneurship Training **9 Hours**

Designing appropriate training programmers to inculcate entrepreneurial spirit, significance of entrepreneurial training, training for new and existing entrepreneurs, role of entrepreneurship development institutes, MSMES in providing entrepreneurial training. Discuss case studies from every unit **COs: CO5**

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Text Books

1. Kumar, Arya, and Entrepreneurship: Creating and Leading an Entrepreneurial Organization, Pearson, India.
2. Hishrich., Peters, Entrepreneurship: Starting, Developing and Managing New Enterprise, Irwin.

Reference Books

1. Allen,K.R., Launching New Ventures: An Entrepreneurial Approach, Cengage Learning.
2. Ramachandran,K., Entrepreneurship Development, TataMc Graw Hill, India.
3. Roy, Rajeev, Entrepreneurship, Oxford University Press.
4. Vasant., Desai, Small-ScaleIndustriesandEntrepreneurship,HimalyaPublication,India.

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MI **23MBM06 Performance Management and Talent Management** **3 0 0 3**
Version 01.00

At the end of the course, students will be able to

Code	Course Outcomes
23MBM06.1	Know about performance management process
23MBM06.2	Understand the performance management system.
23MBM06.3	Understand the issues and challenges in implementation of performance management system
23MBM06.4	Understand the talent management approaches
23MBM06.5	Understand the talent management practices and process of companies

Unit I: Introduction **9 Hours**

Performancemanagementprocess;Objectives of performance management system; Historical development in India; Performance management and performance appraisal; Linkage of performance management system with Other HR practices **COs: CO1**

Unit II: Performance Management system **9 Hours**

Performance planning; Ongoing support andcoaching; Performance measurement and evaluation; Performance management and appraisal; Methods of performance appraisal; Appraisal Communication; Counselling, Identifying potential for development; Linking pay with performance. **COs: CO2**

Unit III: Issues in Performance Management **9 Hours**

Implementing performance management system- Strategies and challenges; Role of HR professionals in performance management; Performance management as an aid to learning and employee empowerment; Performance management documentation; Performance management audit; Ethical and legal issues in performance management **COs: CO3**

Unit IV: Talent Management **9 Hours**

Concept and approaches; Frame work of talent management; Talent identification, integration, and retention. **COs: CO4**

Unit V: Talent Management Practices and Process **9 Hours**

Building the talent pipeline; Managing employeeengagement; Key factors and different aspects of talent management; Using talent management processes todrive culture of excellence. **COs: CO5**

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Expert talk (To be delivered by SMEs from industries)		COs	POs
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Text Books

1. Bhattacharyya,D.K., Performancemanagementsystemsandstrategies,PearsonEducation.
2. RobertB.,Performancemanagement,McGraw-HillEducationIndia.
3. ASTD, Talentmanagement:Strategiesforsuccessfromsixleadingcompanies,CengageLearning.

Reference Books

1. Armstrong,M.&Baron,A.,Performancemanagementanddevelopment,JaicoPublishingHouse,Mumbai.
2. Rao, T.V., Hurconomics for talent management: Making the HRD missionary business-driven, Pearson Education.

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1. https://nptel.ac.in/courses/105/102/105102012/

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MI 23MBM06 Performance Management and Talent Management 3 0 0 3

At the end of the course, students will be able to

Code	CourseOutcomes
23MBM06.1	Know about performance management process
23MBM06.2	Understand the performance management system.
23MBM06.3	Understand the issues and challenges in implementation of performance management system
23MBM06.4	Understand the talent management approaches
23MBM06.5	Understand the talent management practices and process of companies

Unit I: Introduction **9 Hours**

Performancemanagementprocess;Objectives of performance management system; Historical development in India; Performance management and performance appraisal; Linkage of performance management system with Other HR practices

Unit II: Performance Management system **9 Hours**

Performance planning; Ongoing support andcoaching; Performance measurement and evaluation; Performance management and appraisal; Methods of performance appraisal; Appraisal Communication; Counselling, Identifying potential for development; Linking pay with performance.

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Unit V: Talent Management Practices and Process **9 Hours**

Building the talent pipeline; Managing employeeengagement; Key factors and different aspects of talent management; Using talent management processes todrive culture of excellence.

.**Discuss case studies from every unit.**

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2. RobertB.,*Performancemanagement,*McGraw-HillEducationIndia.
3. ASTD, *Talentmanagement:Strategiesforsuccessfromsixleadingcompanies,*CengageLearning.

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2. Rao, T.V., *Hurconomics for talent management: Making the HRD missionary business-driven,* Pearson Education.

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