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)

Computer Science and Engineering

Preamble: The curriculum of B. Tech (Computer Science and Engineering) program offered by the Department of Computer Science and 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 ACM and other Professional Bodies 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 stakeholders.

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 the Centre of Excellence for technically competent and innovative computer engineers

The Mission

- To provide quality education and spread professional & technical knowledge, leading to a career as computer professionals in different domains of industry, governance, and academia
- To provide state-of-the-art environment for learning and practices
- To impart hands on training in latest methodologies and technologies

Program Educational Objectives (PEOs)

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

The graduates of Computer Science and Engineering of NSRIT will

1. Exhibit new age talents that use critical thinking and problem-solving skills in the rapidly changing tech landscape demands dynamism in addition to the application of fundamental and conceptual knowledge meeting client business requirements
2. Sustain their satisfactory professional career in their own start-ups or as a team member/team lead in an IT or allied industry
3. Engage in self-directed learning and advanced studies based on the demand driven need of the industries for their professional and career accomplishments

Program Outcomes (POs)

The POs are the transactional statements of graduate attributes (GAs) that each graduating engineer should possess in terms of knowledge, skill and behavior with a minimum target performance level at the time of graduation as fixed by the program of study seeking continuous improvement year on year.

The graduates of Computer Science and Engineering of NSRIT will be able to demonstrate the following outcomes in terms knowledge, skill and behavioral competencies at the time of graduation with the expected target performance level

1. Apply the knowledge of basic sciences and fundamental engineering concepts in solving engineering problems (Engineering Knowledge)
2. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences (Problem Analysis)
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations (Design/Development of Solutions)
4. Perform investigations, design and conduct experiments, analyse and interpret the results to provide valid conclusions (Investigation of Complex Problems)
5. Select/develop and apply appropriate techniques and IT tools for the design & analysis of the systems (Modern Tool Usage)
6. Give reasoning and assess societal, health, legal and cultural issues with competency in professional engineering practices (The Engineer and Society)
7. Demonstrate professional skills and contextual reasoning to assess environmental/societal issues for sustainable development (The Environment and Sustainability)
8. Demonstrate Knowledge of professional and ethical practices (Ethics)
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary situations (Individual and Team Work)
10. Communicate effectively among engineering community, being able to comprehend and write effectively reports, presentation and give / receive clears instructions (Communication)
11. Demonstrate and apply engineering & management principles in their own / team projects in multidisciplinary environment (Project Finance and Management)
12. Recognize the need for, and have the ability to engage in independent and lifelong learning (Life Long Learning)

Program Specific Outcomes (PSOs)

1. Able to apply the theoretical knowledge of Computer Science and Engineering and the foundational principles of software development to provide sustainable solutions for the real world technical challenges in the tech landscape by maintaining professional standards, ethical values and integrity
2. Able to adopt to technological changes by initiating self-paced learning to meet the industry demands

List of Honors offered by Computer Science & Engineering Program

1. High Performance Computing
2. Data Analytics
3. Game Programming

List of Minor with Specialization offered by Computer Science & Engineering Program

1. Database Engineering

Category-wise Credit Distribution of Courses

Category		AICTE	APSCHE	NSRIT (A)
HS	Humanities and Social Science	12.0	10.5	10.5
BS	Basic Science	25.0	18.0	18.0
ES	Engineering Science	24.0	22.5	19.5
PC	Professional Core	48.0	55.5	58.5
PE	Professional Elective	18.0	15.0	15.0
OE	Open Elective	18.0	12.0	12.0
IN	Internship (s), Project & Seminars	15.0	16.5	16.5
SC	Skill Oriented Courses	-	10.0	10.0
MC	Mandatory Courses	-	-	-
AC	Audit Course	-	-	-
	Total no. of credits	160	160	160

Computer Science and Engineering

Credit requirement for the award of the degree under Academic Regulation 2023 for the candidates admitted from the academic year 2023 – 2024 onwards		
	Four Years	Three Years
B. Tech. (Regular Degree)	160	121
B. Tech. (Honors Degree)	180	141
B. Tech. (With Minor specialization other than Chosen Branch of Engg. & Tech.)	180	141

Semester I								Category
No.	Code	Course Title	POs / PSOs	L/D[1]	T[2]	P	Credit	
1	23BSX31	Engineering Physics	1, 2, 7	3	0	0	3.0	HS
2	23BSX11	Linear Algebra & Calculus	1, 2	3	0	0	3.0	BS
3	23ESX03	Basics of Civil & Mechanical Engineering	1	3	0	0	3.0	ES
4	23ESX02	Introduction to Programming	1, 2, 3	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	23ESX05	Computer Programming Lab	1, 2, 3, 4, 5	0	0	3	1.5	ES
8	23ESX07	Engineering Graphics	1, 10	2	0	2	3.0	ES
9	23SOC01	IT Workshop	1, 2, 3, 4, 5	0	0	2	1.0	SOC
10	23WLP01	Health, Wellness, Yoga & Sports	2, 7, 12	-	-	1	0.5	Wellness
						Total	20.5	
Semester II								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	Chemistry	1, 2, 7	3	0	0	3.0	BS
3	23BSX12	Differential Equations and Vector Calculus	1, 2, 5	3	0	0	3.0	BS
4	23CS201	Data Structures	1, 2, 3, PSO #1, 2	3	0	0	3.0	PC
5	23ESX01	Basics of Electrical and Electronics Engg.	1, 2, 3	3	0	0	3.0	ES
6	23BSX22	Chemistry Lab	1, 4	0	0	2	1.0	BS
7	23HSX02	Communicative English Lab	9, 10	0	0	2	1.0	HS
8	23ESX04	Electrical and Electronics Engineering Workshop	1, 2, 4	0	0	3	1.5	ES
9	23CS202	Data Structures Lab	1, 2, 3, 4, 5 PSO # 1, 2	0	0	3	1.5	PC
10	23CSP01	NSS/ NCC/Scouts & Guides/Community Service	7, 8, 12	-	-	1	0.5	CSP
						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

No	Code	Course	POs	Contact Hours				
				L	T	P	C	
01	23BSX16	Mathematical Foundations of Computer Science	1,2	3	0	0	3.0	BS
02	23HSX03	UniversalHumanValues– Understanding Harmony& Human Ethical Conduct	8,9,10	2	1	0	3.0	HS
03	23ES303	Digital Logic & Computer Organization	1,2,3, PSO #1,2	3	0	0	3.0	ES
04	23CS304	Software Engineering	1,2,3,12	3	0	0	3.0	PC
05	23CS305	Object Oriented Programming Through Java	1,2,3,12	3	0	0	3.0	PC
06	23CS306	Case Tools Lab	4,6,7,12, PSO# 1	0	0	3	1.5	PC
07	23CS307	Object Oriented Programming Through Java Lab	1,2,3,4,5	0	0	3	1.5	PC
08	23DSS01	Python Programming	1,2,3,12	0	1	2	2.0	SC
09	23ACX01	Environmental Science	1,12	2	0	0	-	AC
			Total	16	2	8	**20**	

Semester IV

No.	Code	Course	POs	Contact Hours				
				L	T[4]	P	C	
01	23HSX03	Managerial Economics and Financial Analysis	11,12	2	0	0	2.0	ME
02	23BSX19	Probability & Statistics	1,2	3	0	0	3.0	BS
03	23CS403	Operating Systems	1,2,3,12	3	0	0	3.0	PC
04	23CS404	Database Management Systems	1,2,3, PSO #1,2	3	0	0	3.0	PC
05	23CS405	Formal Languages and Automata Theory	1,2,3,4	3	0	0	3.0	PC
06	23CS406	Operating Systems Lab	1,2,3,4,5	0	0	3	1.5	PC
07	23CS407	Database Management Systems Lab	1,2,3,4,5	0	0	3	1.5	PC
08	23CSS01	Full Stack Development –I	1,2,3,4,5, PSO #1,2	0	1	2	2.0	SC
09	23ESX08	DesignThinking & Innovation	1,2	1	0	2	2.0	BS
			Total	14	2	10	**21.0**	
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation								

[4] Suggested tutorial hours will not carry any credits

Semester V								
No	Code	Course	POs	Contact Hours				
				L	T	P	C	
01		Data Warehousing & Data Mining		3	0	0	3.0	PC
02		Computer Networks		3	0	2	3.0	PC
03		Design and Analysis of Algorithms		3	0	0	3.0	PC
04		Professional Elective I		3	0	0	3.0	PE
05		Open Elective I		3	0	0	3.0	OE
06		Data Warehousing & Data Mining Lab		0	0	3	1.5	PC
07		Computer Networks Lab		0	0	3	1.5	PC
08		Full Stack Development - II		0	1	2	2.0	SC
09		Tinkering Lab		0	0	2	1.0	ES
10		Evaluation of Community Service Internship		-	-	-	2.0	
			Total	15	1	10	**23**	

Semester VI								
No	Code	Course	POs	Contact Hours				
				L	T	P	C	
01		Compiler Design		3	0	0	3.0	PC
02		Machine Learning		3	0	0	3.0	PC
03		Cryptography and Network Security		3	0	0	3.0	PC
04		Professional Elective II		3	0	0	3.0	PE
05		Professional Elective III		3	0	0	3.0	PE
06		Open Elective II		3	0	0	3.0	OE
07		Machine Learning Lab		0	0	3	1.5	PC
08		Cryptography and Network Security Lab		0	0	3	1.5	PC
09		Soft skills/ IELTS		0	1	2	2.0	SC
10		Technica Paper Writing & IPR		2	0	0	-	AC
			Total	20	1	08	**23.0**	
Mandatory Industry Internship of 08 weeks duration during summer vacation								

Semester VII								
No	Code	Course	POs	Contact Hours				
				L	T	P	C	
01		Deep Learning		2	1	0	3.0	PC
02		Human Resource Management		2	0	0	3.0	ME
03		Professional Elective-IV		3	0	0	3.0	PE
04		Professional Elective-V		3	0	0	3.0	PE
05		Open Elective-III		3	0	0	3.0	OE
06		Open Elective-IV		3	0	0	3.0	OE
07		Prompt Engineering		0	1	2	2.0	SC
08		Constitution of India		2	0	0	3.0	AC
		Evaluation of Industry Internship		-	-	-	2.0	IN
			Total	18	2	02	21.0	
Semester VIII								
01	-	Full semester Internship & Project Work		0	0	24	12.0	IN
			Total	0	0	24	12.0	
			Total Credits	-	-	-	160	

List of Electives

Professional Elective #1								
1		Object Oriented Analysis and Design	-	3	0	0	3.0	PE
2		Artificial Intelligence	-	3	0	0	3.0	PE
3		Microprocessors & Microcontrollers	-	3	0	0	3.0	PE
4		Cloud Computing	-	3	0	0	3.0	PE
5		12-week MOOC Swayam/NPTEL course recommended by the BoS	-	3	0	0	3.0	PE
Professional Elective #2								
6		Software Testing Methodologies	-	3	0	0	3.0	PE
7		Cyber Security	-	3	0	0	3.0	PE
8		DevOps	-	3	0	0	3.0	PE
9		Embedded Systems	-	3	0	0	3.0	PE
10		12-week MOOC Swayam/NPTEL course recommended by the BoS	-	3	0	0	3.0	PE
Professional Elective #3								
11		Software Project Management	-	3	0	0	3.0	PE
12		Mobile Adhoc Networks	-	3	0	0	3.0	PE
13		Natural Language Processing	-	3	0	0	3.0	PE
14		Distributed Systems	-	3	0	0	3.0	PE
15		12-week MOOC Swayam/NPTEL course recommended by the BoS	-	3	0	0	3.0	PE
Professional Elective #4								
16		Software Architecture & Design Patterns	-	3	0	0	3.0	PE
17		Blockchain Technology	-	3	0	0	3.0	PE
18		Augmented Reality & Virtual Reality	-	3	0	0	3.0	PE
19		Internet of Things	-	3	0	0	3.0	PE
20		12-week MOOC Swayam/NPTEL course recommended by the BoS	-	3	0	0	3.0	PE
Professional Elective #5								
21		Agile methodologies		3	0	0	3.0	PE
22		Metaverse		3	0	0	3.0	PE
23		Computer Vision		3	0	0	3.0	PE
24		Cyber Physical Systems		3	0	0	3.0	PE
25		12-week MOOC Swayam/NPTEL course recommended by the BoS		3	0	0	3.0	PE
Open Elective #1								
1		Java Programming	-	3	0	0	3.0	OE
Open Elective #2								
2		Operating Systems	-	3	0	0	3.0	OE
Open Elective #3								
3		Base Management Systems	-	3	0	0	3.0	OE
Open Elective #4								
4		Data Computer Networks	-	3	0	0	3.0	OE

B. Tech. (Honors) **Any of the MOOC Course recommended by the BoS**							
	Unmanned Arial Systems & Robotics	-	3	0	0	3.0	HO
	Social Network Analysis	-	3	0	0	3.0	HO
	Applied Linear Algebra in AI & ML	-	3	0	0	3.0	HO
	Applied Time-Series Analysis	-	3	0	0	3.0	HO
	Parallel Computer Architecture	-	3	0	0	3.0	HO
	Privacy and Security in Online social media	-	3	0	0	3.0	HO
	Reinforcement Learning	-	3	0	0	3.0	HO
	GPU Architecture and Programming	-	3	0	0	3.0	HO
	Principles of Knowledge Graphs	-	3	0	0	3.0	HO

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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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 $A=\begin{bmatrix} 2 & 3 & -1 \\ 0 & 1 & 2 \\ 3 & -4 & -2 \end{bmatrix}$
2. Reduce the matrix A to echelon form where $A = \begin{bmatrix} 1 & 2 & 4 & -3 \\ -2 & 7 & 5 & 2 \\ 4 & 13 & 0 & -4 \\ 6 & 5 & -3 & 3 \end{bmatrix}$
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 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)

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)

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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Chairman
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 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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Board of Studies (CSE)

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			DoK
		PO1	PO10	PSO1	
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, Sectional views and True shape of section, 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

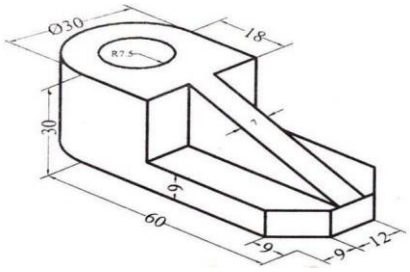
4. Show a regular pentagon in a circle of 100 mm diameter

L2: Understand

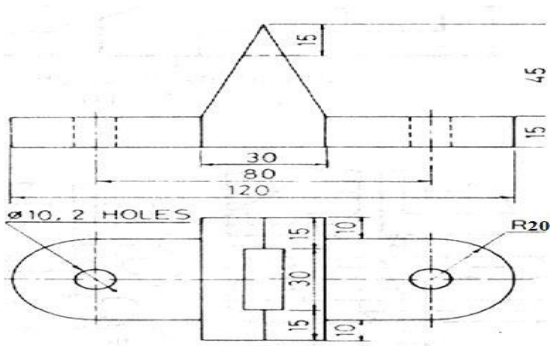
1. Cconstruct a cycloid for a generating circle of radius 30 mm. Also draw a tangent and normal at any point on the cycloid
2. A line AB is on HP and its one end A is 20 mm in front of VP. The line makes an angle of 45° with VP and its front view is 60 mm long. Draw the projections of the line and determine 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)

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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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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Board of Studies (B S & H)

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 **COs: CO3**

Grammar: Verbs-tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations

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 **COs: CO4**

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

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 **COs: CO5**

Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

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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Board of Studies (B S & H)

BS 23BSX21 Chemistry 3 0 0 3

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO2	PO7	
23BSX21.1	Compare the differences between temporary and permanent hardness of water	3	2	1	L1 - L3
23BSX21.2	Apply Nernst equation for calculating electrode, cell potentials and Pilling-Bedworth rule for corrosion	3	2	1	L1 - L3
23BSX21.3	Explain different types of polymers and their applications & solve the numerical problems based on Calorific value, octane number, refining of petroleum and cracking of oils.	3	2	1	L1 - L3
23BSX21.4	Explain the constituents of composites and its classification & the constituents of Portland cement & enumerate the reactions at setting and hardening of the cement	3	2	1	L1 - L3
23BSX21.5	Summarize the concepts of colloids, micelle and nanomaterials	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: Water Technology **9 Hours**

Soft and hard water, Estimation of hardness of water by EDTA Method, Estimation of dissolved oxygen - Boiler troubles – Priming, foaming, scale and sludge, caustic embrittlement, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards (BIS) and World Health Organization (WHO) standards, Ion-exchange processes - desalination of brackish water, Reverse Osmosis (RO) and electro dialysis

COs: CO1

Self – Learning Topic: Advanced softening methods

Unit II: Electrochemical Cells and Corrosion and Its Applications **9 Hours**

Electrodes – electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad), and lithium ion batteries - working principle of the batteries including cell reactions; Fuel cells - Basic concepts, the principle and working of hydrogen-oxygen fuel cell.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling - Bedworth ratio and uses, factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

COs: CO2

Self – Learning Topic: Nano electrochemical sensor

Unit III: Polymers and Fuel Chemistry **9 Hours**

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization.

Thermoplastics and Thermo-setting plastics: Preparation, properties and applications of poly styrene. PVC Nylon 6,6 and Bakelite.

Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol rubbers.

Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid fuels, refining of petroleum, Octane and Cetane number-alternative fuels-propane, methanol, ethanol and bio fuel-bio diesel.

COs: CO3

Self – Learning Topic: Advanced techniques of synthetic petrol

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

Composites-Definition, Constituents, Classification- Particle, Fibre and structural reinforced composites, properties and Engineering applications
Refractories-Classification, Properties, Factors affecting the refractory materials and Applications.
Lubricants-Classification, Functions of lubricants, Mechanism, Properties of lubricating oils–Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and applications. **COs: CO4**
Building materials-Portland Cement, constituents, Setting and Hardening of cement.

Self – Learning Topic: Design materials

Unit V: Surface Chemistry and Nanomaterials **9 Hours**

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, characterization of surface by physicochemical methods (SEM, TEM, X-ray diffraction), solid-gas interface, solid-liquid interface, adsorption isotherm, BET equation (no derivation) applications of colloids and nanomaterials – catalysis, medicine, sensors **COs: CO5**

Self – Learning Topic: Optical methods

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	Corrosion and material protection	CO1	PO1, PO2, PO7
2	Principles and applications of chemical energy sources	CO2, CO3	PO1, PO2, PO7

Text Books

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. Taylor H. F. W., "Cement Chemistry", 2nd Edition, Thomas Telford Publications, 1997

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 soft water & hard water?
2. What are the salts causing hardness?
3. Define corrosion & give an example
4. Write any four applications of fuel cells
5. Define octane number
6. List any three properties of PVC
7. Define Flash point

L2: Understand

1. Explain estimation of hardness of water by EDTA Method
2. Explain Ion-exchange process with neat sketch
3. Differentiate between primary cells & secondary cells
4. Explain electroplating and electro less plating process
5. Differentiate chain growth polymerization and step growth polymerization
6. Explain about Ultimate analysis of coal
7. Explain about various types of lubricants

L3: Apply

1. Estimate the hard water can be converted into soft water by ion exchange process
2. Explain how estimation of hardness of water by EDTA method can be used to measurement of hardness
3. Discuss the challenges that need to be overcome for fuel cells to become more widely used
4. Automotive tires, gaskets for industrial machinery, or medical devices, can you choose an appropriate elastomer material based on its properties, such as elasticity, chemical resistance, and durability? Justify your answer
5. Explain the choice of refractory materials, their composition, and how they can withstand extreme temperatures, chemical reactions, and mechanical stresses
6. Describe the choice of a nanomaterial, its synthesis method, and how it enhances catalytic activity for a particular chemical reaction
7. Discuss the use of colloidal nanoparticles as catalysts in industrial processes

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Board of Studies (BS & H)

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 $z=px+qy-2\sqrt{pq}$
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 $Ø = xy^2 + yz^3$ 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 = xyı̂ + z²ĵ + 2yzk̂ 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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PC **23CS201 Data Structures** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs / PSOs PO1	PO2	PO3	PSO1	PSO2	DoK
23CS201.1	Illustrate the role of linear data structures in organizing and accessing data efficiently in algorithms	3	3	2	3	2	L1 – L3
23CS201.2	Analyze linked lists for dynamic data storage, demonstrating understanding of memory allocation.	3	3	2	3	2	L1 – L4
23CS201.3	Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems	3	3	3	3	2	L1 – L3
23CS201.4	Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges	3	3	3	3	2	L1 – L4
23CS201.5	Identify scenarios where hashing is advantageous and develop hash-based solutions for specific problems	3	3	3	3	2	L1 – L4

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

Unit I: Introduction to Data Structures **9 Hours**

Types of Data Structures, Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Importance of Non-Linear Data Structures, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search. Sorting Techniques: Bubble sort, Selection sort, Insertion Sort

COs: CO1

Self - Learning Topic: Analyze Time Complexity of Binary search

Unit II: Linked Lists **9 Hours**

Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

COs: CO2

Self - Learning Topic: Swap nodes in a Linked List (without Swapping data)

Unit III: Stacks **9 Hours**

Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

COs: CO3

Self - Learning Topic: Types of stacks

Unit IV: Queues & Deques **9 Hours**

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications. **COs: CO4**

Self - Learning Topic: Different types of Queues

Unit V: Trees, Hashing **9 Hours**

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversals.

Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc, Applications of Data Structures **COs: CO5**

Self - Learning Topics: Types of Binary Trees

Board of Studies		Computer Science and 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	Graphs	CO4	PO1, PO2, PO3
2	AVL Tree, B Tree, B+ Tree	CO5	PO1, PO2, PO3

Text Books

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2002
2. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press, 2014

Reference Books

1. Kurt Mehlhorn and Peter Sanders, "Algorithms and Data Structures: The Basic Toolbox", Springer, 2008
2. Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft, "Data Structures and Algorithms", 1st Edition, Pearson Education India, 2002
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", PHI Learning Pvt. Ltd., 3rd Edition, 2010
4. Robert Sedgewick, "Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms", Addison-Wesley; 3rd Edition, 2001
5. Reema Thareja, "Data Structures Using C", 2nd Edition, Oxford Publication, 2014

Web References

1. https://github.com/topics/data-structures-c
2. https://www.hackerrank.com/domains/data-structures
3. http://cslibrary.stanford.edu/
4. https://www.tutorialspoint.com/dsa_using_c/dsa_using_c_quick_guide.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	35	35
L3	40	40
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List any five operations in single linked list
2. What is the principle of stack?
3. What are the operations of queue?
4. Define single linked list with suitable example
5. List any two linear data structure

L2: Understand

1. Explain the bubble sort and selection sort algorithms with an example
2. Write an algorithm to insert new node at the beginning, at middle position and at the end of a Singly Linked List
3. Explain the queue ADT with an example
4. Write the algorithm to insert new node at the beginning, at middle position and at the end of a Double Linked List with an example
5. Describe insertion sort algorithm and trace the steps of insertion sort for sorting the list -12, 19, 33, 26, 29, 35, 22, and 37. Find the total number of comparisons made

L3: Apply

1. Convert the given infix Expression ((A+B)*C-(D-E)^(F+G)) into its Equivalent Prefix and Postfix Notations
2. Write an algorithm for evaluating a postfix expression using stack. Evaluate the following postfix Notation 123*+5-
3. Illustrate the given infix expression A+B^C+(D*E/F)*G into its postfix expression, and evaluate the same using stack. Here A=3, B=5, C=2, D=7, E=4, F=1, G=8

L4: Analyze

1. Inspect single linked list operations to maintain student marks obtained for various courses
2. Write an algorithm and examine it to construct binary search tree with no duplicate values

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Board of Studies (CSE)

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

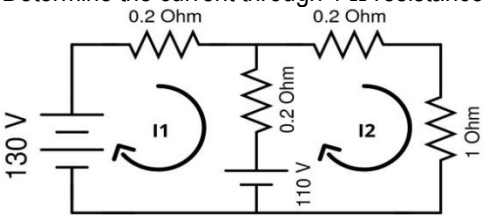
1. What is ohm's law?
2. Define RMS and peak values
3. What is form factor?
4. List any 2 types of rectifiers
5. List any 4 applications of operational amplifiers

L2: Understand

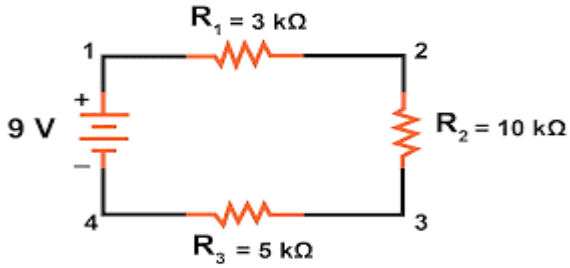
1. Explain in detail about Kirchhoff's current and voltage Law
2. Explain working principle of DC shunt generator
3. Explain the operation of single phase transformer

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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BS 23BSX22 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
23BSX22.1	Determine the physical properties like surface tension, adsorption and viscosity	3	3
23BSX22.2	Estimate the Iron and Calcium in cement	3	3
23BSX22.3	Explain advanced polymer materials	3	3
23BSX22.4	Compare the total hardness for different water samples	3	3
23BSX22.5	Illustrate the functioning of the instruments such as pH and Potentiometric meters	3	3

List of Experiments

1.	Determination of Mn using standard oxalic acid solution (Redox titration)	**COs: CO1,CO2**
2.	Determination of temporary and permanent hardness of water using standard EDTA solution	**COs: CO1,CO3**
3.	Determination of strength of an acid in Pb-Acid battery	**COs: CO1,CO2**
4.	Preparation of a polymer (Bakelite)	**COs: CO3**
5.	Determination of percentage of Iron in cement sample by colorimetry	**COs: CO1,CO2**
6.	Preparation of nanomaterials by precipitation method	**COs: CO1,CO2**
7.	Adsorption of acetic acid by charcoal	**COs: CO1,CO2**
8.	Determination of percentage moisture content in a coal sample	**COs: CO1,CO2**
9.	Determination of the concentration of acetic acid using sodium hydroxide (pH-Metry method)	**COs: CO1,CO5**
10.	Determination of viscosity of lubricating oil by Redwood Viscometer 1	**COs: CO1**
11.	Determination of viscosity of lubricating oil by Redwood Viscometer 2	**COs: CO1**
12.	Determination of calorific value of gases by Junker's gas calorimeter	**COs: CO1**

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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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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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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PC **23CS202 Data Structures 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
23CS202.1	Implement linear data structures in organizing and accessing data efficiently in algorithms	3	3	3	2	2	3	3
23CS202.2	Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation	3	3	3	3	2	3	3
23CS202.3	Implement small scale programming challenges involving data structures such as stacks, trees	3	3	3	3	2	3	3
23CS202.4	Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges	3	3	3	3	2	3	3
23CS202.5	Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems	3	3	3	3	2	3	3

List of Experiments

1. Write C programs to implement Array Manipulation **COs: CO1**
2. Write C programs to implement operations on Linked List **COs: CO2**
3. Write C programs to implement Linked List Applications **COs: CO2**
4. Write C programs to implement operations on Double Linked List **COs: CO2**
5. Write C programs to implement operations on Stack **COs: CO3**
6. Write C programs to implement operations on Queue **COs: CO4**
7. Write C programs to implement Stack Applications **COs: CO3**
8. Write C programs to implement Queue Applications **COs: CO4**
9. Write C programs to implement operations on Binary Search Tree **COs: CO5**
10. Write C programs to implement Hashing **COs: CO5**

Exercise Problems

1. Write a program to reverse an array
2. Write C programs to implement the searching techniques – linear & binary search
3. Write C programs to implement sorting techniques – bubble, selection and insertion sort
4. Implement a singly linked list and perform insertion and deletion operations
5. Develop a program to reverse a linked list iteratively and recursively
6. Solve problems involving linked list traversal and manipulation
7. Create a program to detect and remove duplicates from a linked list
8. Implement a linked list to represent polynomials and perform addition
9. Implement a double-ended queue (deque) with essential operations
10. Implement a doubly linked list and perform various operations to understand its properties and applications
11. Implement a circular linked list and perform insertion, deletion and traversal
12. Implement a stack using arrays and linked lists
13. Write a program to evaluate a postfix expression using a stack
14. Implement a program to check for balanced parentheses using a stack

15. Implement a queue using arrays and linked lists
16. Develop a program to simulate a simple printer queue system
17. Solve problems involving circular queues
18. Use a stack to evaluate an infix expression and convert it to postfix
19. Create a program to determine whether a given string is a palindrome or not
20. Implement a stack or queue to perform comparison and check for symmetry
21. Implement BST using linked list
22. Implement traversing of BST
23. Implement a hash table with collision resolution techniques
24. Write a program to implement a simple cache using hashing

References

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson, 2002
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Silicon Press, 2008
3. Lab Manual for Data Structures, Department of Computer Science & Engineering, NSRIT

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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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SOC **23SOC07 Plumbing** **0 0 0 2**

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

Code	Course Outcomes
23SOC07.1	Demonstrate the principles of designing plumbing systems for different types of fluids, including gas, air, steam, sewage and water
23SOC07.2	Demonstrate competency in the use of specialized tools and equipment essential for professional pipe installation
23SOC07.3	Diagnose and troubleshoot common plumbing problems in residential, commercial and industrial settings

Min. 60 Hours

Plumbing tools, levelling instruments, valves and meters, soft soldering, rigging and hoisting, Pipe Materials & Joining Methods, Plumbing Fixture, Distribution Piping, Drain, Waste & Vent System, Water Heating / Fuel Storage Equipment, Site & Drain Design, installing water supply piping, septic systems, storm ater and sumps, reapiring water supply systems, supporting and testing pipe.

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Board of Studies (ME)

SOC 23SOC08 Refirgeration and Air Conditioning 0 0 0 2

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

Code	Course Outcomes
23SOC08.1	Develop the knowledge and practical skills required to install, troubleshoot, and repair a wide range of R&AC systems, including heating, ventilation, air conditioning, furnaces, and water heaters
23SOC08.2	Demonstrate the procedures for conducting warranty services, including documenting issues, ordering replacement parts, and completing repairs within warranty coverage
23SOC08.3	Learn to assess and identify maintenance issues in refrigeration and air condition equipment, as well as recommend preventive measures to improve system longevity and performance

Min. 60 Hours

Refrigeration and Air Conditioning: Types of refrigerants, study of refirgeartion cycles, Vapour absorption system, Vapour compression refrigeration test rig, study of compressors, valves, types of air conditioning, Summer and winter air conditioning, Fitting and Welding, Thermal Insulation,Commercial RAC Plants & Car Air Conditioner, Commercial Compressor & Capacity Control, Water Softening Plants & Chiller, three fulid refrigeration

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Board of Studies (ME)

SOC 23SOC09 Mobile Troubleshooting 0 0 0 2

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

Code	Course Outcomes
23SOC09.1	Demonstrate the Basic electronics concepts and Basics of mobile communications and different mobile technologies.
23SOC09.2	Gain proficiency in various components of PCB and different Sections on Motherboard and Different ICs used in MotherBoard.
23SOC09.3	Gain proficiency in Hardware and Software tools and trouble Shootings.

Min. 60 Hours

Basic Electronics - Current, Voltage, AC Current & DC Current, Resistor, Transistor, Capacitor, Diode, Inductor / Coil, Transformer, Integrated Circuit , Study of Digital Electronics, Study of Various components inside the mobile phone, Assembling and disassembling of various models of mobile phones,Study of various tools and equipment used in mobile phone repairs, Using a multi-meter, Use of DC Power Supply, Introduction and study of Printed Circuit Board (Motherboard), Details of various components on the PCB, Circuits and Different Sections on Motherboard: Power Circuit, Charging Circuit, SIM Circuit, Display Circuit, Keypad Circuit, Touch Screen Circuit, Audio Circuit, Memory card Circuit, Speaker and Microphone Circuit, Network Circuit, Bluetooth Circuit, Wi-fi Circuit, Testing of various parts and components, Study of different ICs (chips) used on the motherboard, How to recognize various ICs, Soldering & de-soldering of components by using a soldering iron, Soldering & de-soldering of components by using a rework station, Reheating and mounting of various BGA and SMD chips. Use of various secret codes. Fault finding, troubleshooting and repairing of various faults, Common repair procedure for hardware related faults, Common repair procedure for software related faults, Water damaged repair techniques, Circuit tracing, jumper techniques and solutions, Troubleshooting through schematic diagrams, Advanced troubleshooting techniques.

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Chairman
Board of Studies (ECE)

SOC 23SOC10 Computer Servicing 0 0 0 2

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

Code	Course Outcomes
23SOC10.1	Demonstrate system Assembling and hardware troubleshooting
23SOC10.2	Identify automated backups of your system
23SOC10.3	Build systems to safeguard from various types of user activities
23SOC10.4	Solve and configure Networking related issues

Min. 60 Hours

Identify motherboard components and connections, understand error code for fault troubleshooting, verify components with the configuration of CMOS BIOS set up, Test and understand various beep sounds in case of trouble, Assemble and disassembling a Computer System, Upgrade RAM, HDD and other parts. Test fault finding and troubleshooting techniques, Configuration of camera, mic, WLAN and Bluetooth etc, install any popular antivirus software – View its various options, Explore Firewall options, use various disk cleanup utilities to remove junk files from hard disk, create automated backups, identify various Network devices – Switch, Router, Rack, crimping LAN cables, installing a printer and carrying self-test, Replacement of toner cartridge of laser printers.

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Chairman
Board of Studies (CSE)

SOC 23SOC11 Digital Marketing

0 0 0 2

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

Code	Course Outcomes
23SOC11.1	Identify the Market and the behaviour of the customer and how the digital marketing will be useful
23SOC11.2	Search engines, methods to identify the search engines and their optimization in both on page and off page
23SOC11.3	Exercise on the Social media marketing and Email Marketing and gaining the reputation through online management
23SOC11.4	Demonstrate cognitive knowledge of the skills required in conducting online research and research on online markets

Min. 60 Hours

Introduction to Digital Marketing: Nature and Scope of Digital Marketing, Evolution of Digital Marketing, Traditional versus digital marketing, Integration of Market Place from conventional to the virtual, Social Media and Communication Mix – Benefits & Challenges – social media and Customer Engagement – ROC – New Role of Customers – The Social Business Eco system – REAN, RACE, integrating social media with Overall Market efforts – Developing Social Media Marketing plan. Social Media Business Blocks: Segmenting B2C Market – B2B Markets – managing the cyber social Campaign – Joining the Conversation – Lurking and Listening – Engagement with Audience – Staying Engaged – Engagement on the Social Web – Social Objects – Social graph – Social Applications – leveraging Search Engine Optimization (SEO) for social media – Optimizing social media for Search Engines. Digital Media Mix: Blogs, Podcasts, Vlogs – Blog – Create a Podcast – Producing the Video cast – Measuring Blogging, Podcasting, Vlogging Metrics using any social media like Facebook, Twitter, LinkedIn etc. Measuring the Results – Other Social Media Marketing Sites – Communities.

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Chairman
Board of Studies (CSE)

SOC 23SOC12 Machining 0 0 0 2

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

Code	Course Outcomes
23SOC12.1	Demonstrate the various components and parts of a lathe machine, and to Understand the types of cutting tools, tool holders, and tool materials
23SOC12.2	Develop proficiency in performing fundamental lathe operations, such as turning, facing, drilling, boring, threading, and taper turning
23SOC12.3	Learn and adhere to safety guidelines, including the use of personal protective equipment (PPE), safe work habits, and hazard recognition in a lathe shop environment

Min. 60 Hours

Precision and Non Precision Instruments, Various Lathe Parts, Centering of Job in 4 Jaw and 3 Jaw Chuck, Lathe Operations like Straight Turning, TaperTurning, Facing Operation, Boring, Grooving, Knurling Operation, Metric and SSW Thread Cutting in Right Hand and Left Hand Direction, BSP Thread Cutting on the Pipe and Internal Thread Cutting on the Flange, Tool Grinding on Bench Grinder, Personal Safety and Safe Working Practices

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Board of Studies (ME)

SOC **23SOC13 Electrical Wiring** **0 0 0 2**

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

Code	Course Outcomes
23SOC13.1	Examine various tools and know their usage
23SOC13.2	Explain different joints, soldering practice andexecute wiring circuits
23SOC13.3	Perform various methods of earthing

Min. 60 Hours

Identify size, shape, purpose, speed and use of electrical wiring tools with respect to screw drivers, polers, drilling machines, Rawl plug jumpers, Line tester, Splicers, Standard wire gauge, Identify different types of electrical wiring accessories with respect to switches, Ceiling roses, Lamp holders and adopters, Sockets, Plug, Fuses, Identify different types of main switches with respect to SP, DP mains, TP, ICDP, ICTP, SPDT, DPDT, TPDT, Change over-Knife type, Rotary, Micro, Modular switches, 2-pole and 3-pole MCBs. Prepare straight joint/Married joint, T joint, Western union joint, Pig tail joint, Femialirisation to use soldering tools and components and soldering of simple electronic circuits on PCB. Make a circuit with one lamp controlled by one switch with PVC surface conduit system, two lamps controlled by two switches with PVC surface conduit system, Make a circuit with one lamp controlled by one switch and provision of 2/3-pin socket. Make a circuit for stair case wiring, Make a circuit for godown wiring, Control two lamps by series - Parallel connection using one 1-way switch & two 2-way switches with PVC surface conduit system, Controlt wosub – circuits through energy meter, MCB's and two1-way switches, Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor, Control and practice the wiring for fluorescent lamp, Connect computer by main switch board with a miniature circuit breaker. Prepare pipe earthing and plate earthing.

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Chairman
Board of Studies (EEE)

SOC **23SOC14 Masonry** **0 0 0 2**

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

Code	Course Outcomes
23SOC14.1	Identify the tools required for various purposes and its working in construction activity
23SOC14.2	Preparing the cement sand motor mix in appropriate proportions based on the suitability and type of work
23SOC14.3	Undergo the types of openings, floors and need for the slope and ceiling finish as per the drawings and standards

Min. 60 Hours

Introduction to the tools and their usage, materials, properties, ratios of the mix, types masonry, types of bonds in masonry, height and width of rooms based on the purpose, types of partition, materials for partition, openings, requirements of openings, height and width of openings and ventilators, types of materials used as ventilators, provision of grooves in the brick work, finishing materials, thickness of finish, motor ratio for the finishings, types of shuttering, checking of the level by the Plum bob or liquid levels. Performing the RCC works by rod cutting, bending & placing. Making of the different floors with various materials with determination and formation of slopes, performing the ceilings finishing for the slabs must be done as per the standards and with drawing specifications maintaining the accuracy.

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Board of Studies (CE)

SOC 23SOC15 Automobile Servicing and Maintenance 0 0 0 2

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

Code	Course Outcomes
23SOC15.1	Identify parts in a diesel and petrol engine of LMV/ HMV
23SOC15.2	Observe and report the reading of Tachometer, Odometer, temp. and Fuel gauge under ideal and on load condition
23SOC15.3	Engage in practical exercises to discern variances in the constituents of gasoline and diesel engines, and acquire hands-on experience in disassembling both light and heavy motor vehicle engines following established protocols

Min. 60 Hours

Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2 & 4 - stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, Technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such a gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine- malfunction light.

Different type of starting and stopping method of Diesel Engine Procedure for dismantling of diesel engine from a vehicle.

Petrol Engine Basics: 4-stroke spark-ignition engines- Basic 4-stroke principles. Spark-ignition engine components - Basic engine components, Engine cams & camshaft, Engine power transfer, Scavenging, Counter weights, Piston components. Intake & exhaust systems – Electronic fuel injection systems, Exhaust systems. Intake system components, Air cleaners, Carburettor air cleaners, EFI air cleaners, Intake manifolds, Intake air heating.

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Chairman
Board of Studies (ME)

BS 23BSX16 Mathematical Foundations of Computer Science **3 0 0 3**

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

Code	Course Outcomes			DoK
		PO1	PO2	
23BSX16.1	Construct and verify the correctness of statements using propositional and Predicate Logic	3	2	L1 – L4
23BSX16.2	Illustrate the operations on Discrete Structures such as Relations and Functions	3	2	L1 – L4
23BSX16.3	Interpret the concepts of divisibility,Prime number,Congruence and number theorems	3	2	L1 – L4
23BSX16.4	Solve Recurrence Relations and Generating Functions	3	2	L1 – L4
23BSX16.5	Demonstrate Graphs and Trees as Tools to Visualize and Simplify Situations	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:	**Mathematical Logic**	**9 Hours**
Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, and Equivalence of Formulas, Duality Law, Tautological Implications, and Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises and Indirect Method of Proof. Predicate Calculus: Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, InferenceTheory for Predicate Calculus. *Self Learning Topic: Disjuctive and conjunctive normal forms*		**COs: CO1**
Unit II:	**Functions & Relations**	**9 Hours**
Set Theory: Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion,Relations: Properties of Binary Relations, Relation Matrix and Digraph, Operations on Relations,Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering Relations, Hasse Diagrams, Functions: Bijective Functions, Composition of Functions, Inverse Functions, Permutation Functions, Recursive Functions, Lattice and its Properties *Self Learning Topic: Algebraic structures (definitions and simple illustrations)*		**COs: CO2**
Unit III:	**Algebraic Structures and Number Theory**	**9 Hours**
Algebraic Structures:Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism Number Theory:Properties of Integers, Division Theorem, The Greatest Common Divisor,Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem) *Self Learning Topic: Chinese remainder theorem*		**COs: CO3**
Unit IV:	**Recurrence Relations**	**9 Hours**
Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving In homogeneous Recurrence Relations		**COs: CO4**

Self Learning Topic: Algorithm analysis -Time and space complexity	
Unit V: Graph Theory	**9 Hours**
Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices,Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs,Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number,Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs) *Self Learning Topic: operations on Graphs*	**COs: CO5**

Board of Studies	Basic Science & Humanities (Mathematics)
Approved in : BoS No. IV	
Approved in : ACM No.	

Textbooks

1. J.P.Tremblay and R.Manohar, Discrete Mathematical Structures with Applications to CS,Tata Mc Graw Hill,1997
2. C.L.Liuand,Elements of Discrete Mathematics-A Computer Oriented Approach

Reference Books:

1. Kenneth.H.Rosen, Discrete Mathematics and its Applications,6/e,Tata Mc Graw-Hill,2009.
2. Discrete Mathematics for Computer Scientists and Mathematicians, J.L.Mott,A. Kandel, T. P.Baker,2ndEdition, Prentice Hall of India.
3. Dr.D S Chandrasekharaiah, Mathematical Foundations of Computer Science,Prism Book Pvt Ltd.
4. S.K.Chakraborthy and B.K.Sarkar, Discrete Mathematics,Oxford,2011

Web References:

1.http://nptel.ac.in/courses/
2.https://onlinecourses.nptel.ac.in
3.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

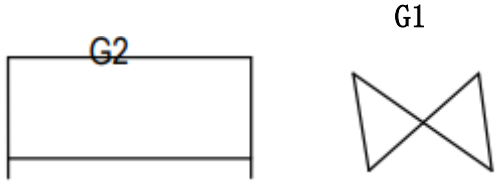
1. Define converse,contra positive and inverse of an implication
2. Define Binary Relation
3. State Divison Algorithm
4. Define Prime and Co-prime numbers
5. A complete binary Tree has 125 edges .How many vertices does it have?

L2: Understand

1. Show that (~P^(P→ Q)→ (~Q) statement is a Tautology
2. Write the matrix representation and directed graph of the relation on the set A= {1,2,3,4} where R= { (1,1), (1,2), (2,1), (2,2), (2,4), (3,3), (3,1), (4,3), (4,1), (3,2)}
3. Prove that a * b= a+b+1 is an abelian group in set of integer
4. Solve the recurrence relation $a_n - 2\,a_{n-1} - 3\,a_{n-2} = 0$, $n \geq 2$ given $a_0 = 3$, $a_1 = 1$
5. Explain minimal spanning tree of the Graph with suitable example

L3: Apply

1. **Find the gcd of 42823 and 6409 using Euclidean algorithm**
2. Prove that for all integers a, b, c, (i) if a|b , then a|bc (ii) if a|b and b|c then a|c for all a,b,c integers
3. Show that the hypotheses “It is not sunny this afternoon and it is a colder than yesterday”, “We will go swimming only if it is sunny”, “ If we do not go swimming, then we will take a canoe trip”, and “If we take a canoe trip, then we will be home by sunset” lead to the conclusion “ We will be home by sunset”
4. Show that the following two graphs are isomorphic



5.Find the Prime factorisation of 243,125 and 289 ?

HS

23HSX03 Universal Human Values

2 1 0 3

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 behaviour	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.		
Approved in : ACM No.		
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?

ES **23ES301 Digital Logic and Computer Organization** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs / PSOs PO1	PO2	PO3	PSO1	PSO2	DoK
23ES301.1	Differentiate between combinational and sequential circuits based on their characteristics and functionalities.	3	3	3	1	1	L2
23ES301.2	Demonstrate an understanding of computer functional units.	3	3	3	1	1	L2
23ES301.3	Analyze the design and operation of processors, including instruction execution, pipelining, and control unit mechanisms, to comprehend their role in computer systems.	3	3	3	1	1	L3
23ES301.4	Describe memory hierarchy concepts, including cache memory, virtual memory, and secondary storage, and evaluate their impact on system performance and scalability.	3	3	3	1	1	L3
23ES301.5	Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices, including interrupts, DMA, and I/O mapping techniques.	3	3	3	1	1	L3

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

Unit I: **9 Hours**

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes.

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, K-Map Simplification, Combinational Circuits, Decoders, Multiplexers **COs: CO1**

Minimization of Logic expressions.

Unit II: **9 Hours**

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Performance, multiprocessors and multi computers, Von- Neumann Architecture **COs: CO2**

Software, Computer Generations

Unit III: **9 Hours**

Computer Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control and Multi programmed Control **COs: CO3**

Multiple-Bus Organization

Unit IV: **9 Hours**

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes
The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Secondary Storage **COs: CO4**

Memory Management Requirements

Unit V: **9 Hours**

Input /Output Organization : Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits Difference between software Interrupts and hardware interrupts **COs: CO5**

Standard I/O Interfaces

Board of Studies		Computer Science and Engineering	
Approved in: BoS No. VI			
Approved in ACM: ACM No. VIII			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs / PSOs**
1	Pipelining	CO1 – CO5	PO1, PO2, PO3, PO12, PSO1, PSO2
2	Parallel Processing	CO2 – CO5	PO1, PO2, PO3, PO12, PSO1, PSO2

Text Books

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky," Computer Organization" , 6th edition, McGraw Hill.
2. M. Morris Mano,"Digital Design", 6th Edition, Pearson Education.

Reference Books

1. William Stallings,"Computer Organization and Architecture", 11thEdition, Pearson.
2. M.Moris Mano," Computer Systems Architecture" , 3rdEdition, Pearson.
3. David A. Paterson, John L. Hennessy, Elsevier,"Computer Organization and Design".
4. Roth,"Fundamentals of Logic Design", 5thEdition, Thomson.

Web References

1. https://nptel.ac.in/courses/106/103/106103068/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	10	10
L2	80	60
L3	10	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is instruction cycle?
2. Define Cache memory. Mention any two advantages.
3. List any five addressing modes.
4. What is an interrupt?
5. Write about auxiliary memory.
6. What are peripherals?

L2: Understand

1. Explain the structure of a basic computer system.
2. Explain the concept of virtual memory. Why it is significant?
3. Explain the steps involved in the complete execution of an instruction.
4. Differentiate between hardwired control and micro programmed control.
5. Explain the functions of typical input-output interface.

L3: Apply

1. Analyze the concept of virtual memory. Explain why it is significant?
2. With the help of neat sketch explain about the concept of set-associative mapping.

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Board of Studies (CSE)

PC **23CS304 Software 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	PO12	
23CS304.1	Perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance	3	2	2	1	L3
23CS304.2	Analyse various software engineering models and apply methods for design and development of software projects.	3	2	2	1	L4
23CS304.3	Develop system designs using appropriate techniques	3	2	2	1	L3
23CS304.4	Understand various testing techniques for a software project.	3	2	2	1	L2
23CS304.5	Apply standards, CASE tools and techniques for engineering software projects	3	2	2	1	L3
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**
Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering. **Software Life Cycle Models:** Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model. *Evloutionary process model*		**COs: CO1**
Unit II:	**Requirement Analysis and Specification**	**9 hours**
Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management. **Requirements Analysis And Specification:** Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, *Algebraic specification,Executable specification and 4GL.*		**COs: CO2**
Unit III:	**Software Design, Function-orineted software design,User Interface Design**	**9 hours**
Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design. **Agility**: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process **Function-Oriented Software Design:** Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review. **User Interface Design:** Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development . *User interface design methodology.*		**COs: CO3**

Unit IV:	Coding And Testing, Software Reliability And Quality Management	9hours
Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** Testing object-oriented programs, Smoke testing, and Some general issues associated with testing. **Software Reliability And Quality Management:** Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards *Six Sigma***.**		**COs: CO4**
Unit V:	**Computer-Aided Software Engineerting ,Software Maintenance And Software Reuse**	**9 hours**
Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment. **Software Maintenance:** Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost. **Software Reuse:** reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach *Reuse at organization level.*		**COs: CO5**

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 and Harold Bud Lawson"The Essential of Modern Software Engineering"ACM books ,2019
2. Pankaj jalote"Software Engineering " precise approach ,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 (%)
L2	20	40
L3	40	60
L4	40	-
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List phases in SDLC
2. What is Agile process model?
3. Define Software Design principles
4. What are the metrics for project size estimation
5. How tools play important role in Agile process model
6. Define cohesion and coupling .
7. What is integration testing
8. Define reuse
9. List Risk Management Activities
10. Define software reverse engineering.

L2: Understand

1. What is SQA role in software Engineering ?
2. Explain water fall model ?
3. Describe software development projects.
4. Explain COCOMO model in detail for project effort estimation
5. Summarize the Myths in software development
6. Demonostrate Requirement elicitation
7. Describe ISO 9000 ?
8. What is Need for software Maintenance?

L3: Apply

1. Illustrate Test staratagic for approach in software testing
2. Illustrate Software Requirements Specification (SRS)
3. Explain Developing the DFD model of a system
4. Illustrate risk mitigation plan for a software development
5. Expalin Architecture of a CASE Environment.

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Board of Studies

PC **23CS305 Object Oriented Programming through Java** **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	PO12	
23CS305.1	Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.	3	3	2	2	L4
23CS305.2	Design and implement classes to model real-world entities, with a focus on attributes, behaviours, and relationships between objects.	3	3	3	2	L4
23CS305.3	Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.	3	3	3	3	L3
23CS305.4	Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.	3	3	3	2	L3
23CS305.5	Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.	3	2	2	2	L3

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

Unit I:Object Oriented Programming **9 + 3 Hours**

Program Structure in Java: Basic concepts, Principles,introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with print() Method, Static Variables and Methods, Attribute Final,

Introduction to Operators: Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bit wise Logical Operators. **COs : CO1**

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

Nested looping structures,Precedence and Associativity of Operators

Unit II: Classes and Objects,Methods **9 Hours**

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Final Class and Methods, Passing Arguments by Value and by Reference.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static,keyword this. **COs: CO2**

Overloaded Constructor Methods, Nested Classes

Unit III: Arrays,Inheritance,Interfaces **9 Hours**

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding,Abstract Classes, Interfaces and Inheritance. **COs: CO3**

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface.

Three-dimensional Arrays,Dynamic Method Dispatch, Functional Interfaces, Annotations

Unit IV: Packages and Java Library,Exception Handling,Java I/O and File **9 Hours**

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes,Java util Classes and Interfaces, Formatter Class, Random Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks,Class Throwable, Unchecked Exceptions, Checked Exceptions. **COs: CO4**

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java

Auto-boxing and Auto-unboxing,Multiple Catch Clauses

Unit V:String Handling,Multi threading and Java FX GUI **9 Hours**

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States,Inter-thread Communication - Suspending, Resuming, and Stopping of Threads. **COs: CO5**

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph

Thread Priority-Synchronization, Deadlock and Race Situations,mouse events

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			
2			

Text Books

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books

1. The complete Reference Java, 11th edition, Herbert Schildt, TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson
3. Programming with java,7th Edition,G Balagurusamy,2023

Web References

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

Internal Assessment Pattern

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

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Write any four applications of OOP
2. Define class and Object
3. What is constructor overloading?
4. What is use of Threads?
5. What is Exception handling?
6. What is event handling?

L2: Understand

1. Explain any four object oriented principles.
2. Explain three types of constructors with examples.
3. Explain types of inheritance
4. Illustrate the use of super keyword with example
5. Explain the exception handling mechanism.
6. Explain event handling with example.

L3:Apply

1. Implement employee class to get and print details
2. Apply the concept of inheritance to read and print student information
3. Solve to find the area of different shapes using abstract class.

L4:Analyze

1. How does the scope of a variable affect its lifetime and visibility within a program? Provide an example demonstrating the scope of local, instance, and class variables.
2. Explain how symbolic constants improve code readability and maintenance. Provide a scenario where using symbolic constants is beneficial.
3. Explain the role of access modifiers in Java. How do they influence the design and security of a class? Provide examples with different access levels (public, private, protected, and default) and discuss the best practices for their usage.
4. Explain method overloading and its benefits. Provide a detailed example showing overloaded methods and discuss how Java differentiates between them at compile time.

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PC **23CS306 Case Tools Lab** **0 0 3 1.5**

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

	Course Outcomes	Mapping with POs					
		P4	P6	P7	P12	PSO1	DOK
23CS306.1	To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development. Course Outcomes	3	3	3	3	3	L2
23CS306.2	Ability to translate end-user requirements into system and software requirements	3	3	3	3	3	L3
23CS306.3	Ability to generate a high-level design of the system from the software requirements	3	3	3	3	3	L5
23CS306.4	Will have experience and/or awareness of testing problems and will be able to develop a simple testing report	3	3	3	3	3	L4

List of Experiments

1. Development of problem statement.
2. Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents
3. Preparation of Software Configuration Management and Risk Management related documents
4. Study and usage of any Design phase CASE tool
5. Performing the Design by using any Design phase CASE tools.
6. Develop test cases for unit testing and integration testing
7. Develop test cases for various white box and black box testing techniques.

Sample projects

1. Passport automation System
2. Book Bank
3. Online Exam Registration
4. Stock Maintenance System
5. Online course reservation system
6. E-ticketing
7. Software Personnel Management System
8. Credit Card Processing
9. E-book management System.
10. Recruitment system

References Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modelling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education

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PC	**23CS307 Object Oriented Programming Through Java Lab**	**0**	**0**	**3**	**1.5**

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

Code	Course Outcomes	Mapping with POs					DOK
		PO1	PO2	PO3	PO4	PO5	
23CS307.1	Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling.	3	3	3	2	1	L2
23CS307.2	Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.	3	3	3	2	1	L3
23CS307.3	Familiar with commonly used Java libraries and APIs, including the Collections Framework, Java I/O, other utility classes	3	3	3	2	1	L2
23CS307.4	Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.	3	3	3	2	1	L3
23CS307.5	Proficiently construct graphical user interface (GUI) applications using JavaFX	3	3	3	2	1	L4

List of Experiments

1.	a) Write a JAVA program to display default value of all primitive data type of JAVA b) Write a java program that display the roots of a quadratic equation ax2+bx=0. Calculate the discriminate D and basing on value of D, describe the nature of root. c)Check whether given year is leap year or not?	**COs: CO1**
2.	a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism. b) Write a JAVA program to sort for an element in a given list of elements using bubble sort	**COs: CO1**
3.	a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method. b) Write a JAVA program implements method overloading. c) Write a JAVA program to implement constructor. d) Write a JAVA program to implement constructor overloading.	**COs: CO2**
4.	a) Write a JAVA program to implement Single Inheritance b) Write a JAVA program to implement multi-level Inheritance c) Write a JAVA program for abstract class to find areas of different shapes	**COs: CO2**
5.	a) Write a JAVA program give example for “super” keyword. b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? c) Write a JAVA program that implements Runtime polymorphism	**COs: CO3**
6.	a) Write a JAVA program that describes exception handling mechanism b) Write a JAVA program Illustrating Multiple catch clauses c)Write a JAVA program for creation of Java Built-in Exceptions d)Write a JAVA program for creation of User Defined Exception	**COs: CO3**

7.	a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable) b) Write a program illustrating is Alive and join () c) Write a Program illustrating Daemon Threads. d) Write a JAVA program Producer Consumer Problem	**COs: CO4**
8.	a) Write a JAVA program using String Buffer to delete, remove character. b) Write a JAVA program that import and use the user defined packages c) Without writing any code, build a GUI that display text in label and image in an Image View (use JavaFX) d) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI	**COs: CO5**

1. Write a JAVA program to search for an element in a given list of elements using Linear search mechanism
2. Write a JAVA program to implement ATM case study using classes and objects.
3. Write a JAVA program to implement Multiple inheritance using interfaces.
4. Write a JAVA Program to show array index out-of-bounds exception handling.
5. Write a JAVA Program to sort an array of strings alphabetically.
6. Write a JAVA Program to demonstrate the use of "finally" block for cleanup operations, ensuring resources are released.
7. Write a JAVA Program Program to demonstrate synchronization using 'synchronized 'keyword.
8. Write a JAVA Program Program to use wait () and notify () methods for inter-thread communication.
9. Write a JAVA program to copy the contents of one file to another.
10. Write a JAVA Program to design a simple calculator.

Exercise Problems:

1. Write a JAVA program to search for an element in a given list of elements using Linear search mechanism
2. Write a JAVA program to implement ATM case study using classes and objects
3. Write a JAVA program to implement Multiple inheritance using interfaces.
4. Write a JAVA Program to show array index out-of-bounds exception handling.
5. Write a JAVA Program to sort an array of strings alphabetically.
6. Write a JAVA Program to demonstrate the use of "finally" block for cleanup operations, ensuring resources are released.
7. Write a JAVA Program Program to demonstrate synchronization using 'synchronized 'keyword.
8. Write a JAVA Program Program to use wait () and notify () methods for inter-thread communication.
9. Write a JAVA program to copy the contents of one file to another.
10. Write a JAVA Program to design a simple calculator.

References

1. P. J. Deitel, H. M. Deitel, "Java for Programmers", Pearson Education, PHI, 4th Edition, 2007.
2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, 2nd Edition, 2007
3. Bruce Eckel, "Thinking in Java", Pearson Education, 4th Edition, 2006.
4. Sachin Malhotra, Saurabh Chaudhary, "Programming in Java", Oxford University Press, 5th Edition, 2010.

Online Learning Resources:

1. https://java-iitd.vlabs.ac.in/
2. http://peterindia.net/JavaFiles.html

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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.

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 PO1	PO12	DoK
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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Chairman Board of Studies(EnvironmentalScience)

BS 23BSX16 Mathematical Foundations of Computer Science **3 0 0 3**

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

Code	Course Outcomes			DoK
		PO1	PO2	
23BSX16.1	Construct and verify the correctness of statements using propositional and Predicate Logic	3	2	L1 – L4
23BSX16.2	Illustrate the operations on Discrete Structures such as Relations and Functions	3	2	L1 – L4
23BSX16.3	Interpret the concepts of divisibility,Prime number,Congruence and number theorems	3	2	L1 – L4
23BSX16.4	Solve Recurrence Relations and Generating Functions	3	2	L1 – L4
23BSX16.5	Demonstrate Graphs and Trees as Tools to Visualize and Simplify Situations	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:	**Mathematical Logic**	**9 Hours**
Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, and Equivalence of Formulas, Duality Law, Tautological Implications, and Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises and Indirect Method of Proof. Predicate Calculus: Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, InferenceTheory for Predicate Calculus. *Self Learning Topic: Disjuctive and conjunctive normal forms*		**COs: CO1**
Unit II:	**Functions & Relations**	**9 Hours**
Set Theory: Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion,Relations: Properties of Binary Relations, Relation Matrix and Digraph, Operations on Relations,Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering Relations, Hasse Diagrams, Functions: Bijective Functions, Composition of Functions, Inverse Functions, Permutation Functions, Recursive Functions, Lattice and its Properties *Self Learning Topic: Algebraic structures (definitions and simple illustrations)*		**COs: CO2**
Unit III:	**Algebraic Structures and Number Theory**	**9 Hours**
Algebraic Structures:Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism Number Theory:Properties of Integers, Division Theorem, The Greatest Common Divisor,Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem) *Self Learning Topic: Chinese remainder theorem*		**COs: CO3**
Unit IV:	**Recurrence Relations**	**9 Hours**
Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving In homogeneous Recurrence Relations		**COs: CO4**

Self Learning Topic: Algorithm analysis -Time and space complexity	
Unit V: Graph Theory	**9 Hours**
Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices,Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs,Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number,Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs) *Self Learning Topic: operations on Graphs*	**COs: CO5**

Board of Studies	Basic Science & Humanities (Mathematics)
Approved in : BoS No. IV	
Approved in : ACM No.	

Textbooks

1. J.P.Tremblay and R.Manohar, Discrete Mathematical Structures with Applications to CS,Tata Mc Graw Hill,1997
2. C.L.Liuand,Elements of Discrete Mathematics-A Computer Oriented Approach

Reference Books:

1. Kenneth.H.Rosen, Discrete Mathematics and its Applications,6/e,Tata Mc Graw-Hill,2009.
2. Discrete Mathematics for Computer Scientists and Mathematicians, J.L.Mott,A. Kandel, T. P.Baker,2ndEdition, Prentice Hall of India.
3. Dr.D S Chandrasekharaiah, Mathematical Foundations of Computer Science,Prism Book Pvt Ltd.
4. S.K.Chakraborthy and B.K.Sarkar, Discrete Mathematics,Oxford,2011

Web References:

1.http://nptel.ac.in/courses/
2.https://onlinecourses.nptel.ac.in
3.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

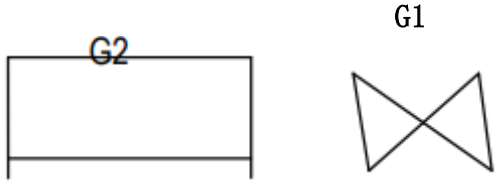
1. Define converse,contra positive and inverse of an implication
2. Define Binary Relation
3. State Divison Algorithm
4. Define Prime and Co-prime numbers
5. A complete binary Tree has 125 edges .How many vertices does it have?

L2: Understand

1. Show that (~P^(P→ Q)→ (~Q) statement is a Tautology
2. Write the matrix representation and directed graph of the relation on the set A= {1,2,3,4} where R= { (1,1), (1,2), (2,1), (2,2), (2,4), (3,3), (3,1), (4,3), (4,1), (3,2)}
3. Prove that a * b= a+b+1 is an abelian group in set of integer
4. Solve the recurrence relation $a_n - 2\,a_{n-1} - 3\,a_{n-2} = 0$, $n \geq 2$ given $a_0 = 3$, $a_1 = 1$
5. Explain minimal spanning tree of the Graph with suitable example

L3: Apply

1. **Find the gcd of 42823 and 6409 using Euclidean algorithm**
2. Prove that for all integers a, b, c, (i) if a|b , then a|bc (ii) if a|b and b|c then a|c for all a,b,c integers
3. Show that the hypotheses “It is not sunny this afternoon and it is a colder than yesterday”, “We will go swimming only if it is sunny”, “ If we do not go swimming, then we will take a canoe trip”, and “If we take a canoe trip, then we will be home by sunset” lead to the conclusion “ We will be home by sunset”
4. Show that the following two graphs are isomorphic



5.Find the Prime factorisation of 243,125 and 289 ?

BS 23BSX19 PROBABILITY & STATISTICS 3 0 0 3

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

Code	Course Outcomes		DoK	
		PO1	PO2	
23BSX19.1	Acquire knowledge in finding the analysis of the data quantitatively or categorically and various statistical elementary tools.	3	2	L1 – L4
23BSX19.2	Develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems	3	2	L1 – L4
23BSX19.3	Apply the theoretical probability distributions like binomial, Poisson, and Normal in the relevant application areas.	3	2	L1 – L4
23BSX19.4	Analyze to test various hypotheses included in theory and types of errors for large samples.	3	2	L1 – L4
23BSX19.5	Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real life problems.	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:	**Descriptive Statistics**	**9 Hours**
Statistics Introduction, Measures of Central tendency, Measures of Variability (spread or variance) Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines. *Self Learning Topic: Measures of Dispersion-Range-Quartile deviation*		**COs: CO1**
Unit II:	**Probability**	**9 Hours**
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, Cumulative Distribution Function, properties. *Self Learning Topic: Mathematical expectation*		**COs: CO2**
Unit III:	**Probability distributions**	**9 Hours**
Probability distributions: Binomial, Poisson and Normal-their properties. Approximation of the binomial distribution to normal distribution, Moment Generating function. *Self Learning Topic: Chebyshev's inequality*		**COs: CO3**
Unit IV:	**Estimation and Testing of hypothesis, large sample tests**	**9 Hours**
Population vs Sample, Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems *Self Learning Topic: Test for single proportion, difference of proportions*		**COs: CO4**

Unit V:	**Small sample tests**	**9 Hours**
Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), χ2 - test for goodness of fit, χ2 - test for independence of attributes. *Self Learning Topic: Test for Correlation and Regression Coefficients*		**COs: CO5**

Board of Studies	Basic Science & Humanities (Mathematics)
Approved in : BoS No. IV	
Approved in : ACM No.	

Textbooks

1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Books:

1. S. Ross, a First Course in Probability, Pearson Education India, 2002.
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/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

L1: Remember

1. Define conditional Probability
2. Define Population and Sample
3. Write about Skewness and Kurtosis
4. State Correlation and Regression
5. Define Sampling distribution

L2 : Understand

1. State and Prove Baye's theorem

2.Calculate the Mean,median ,mode of the following data

Marks	10-25	25-40	40-55	55-70	70-85	85-100
Frequency	6	20	44	26	3	1

3.A Population consists of five members 2,3,6,8 and 11.Consider all possible samples of size two each can be drawn with replacement from the population find

(a) Population mean
(b) Standard deviation of the population

(c) The mean of the sampling distribution of means
(d) The Standard deviation of the sampling distribution of means

4.A random variable X has the following probability function:

X	0	1	2	3	4	5	6	7
P(x)	0	K	2K	2K	3K	k^2	$2k^2$	$7k^2+k$

Determine (i) K (ii) Evaluate $P(X<6), P(X\geq 6), P(0<X<5)$
(iii) Mean and variance

5.Find the kurtosis to the following data

Class interval	0-10	10-20	20-30	30-40
Frequency	4	3	2	1

L3: Apply

1. Suppose the weights of 800 male students are normally distributed with mean 140 pounds and standard deviation 10 pounds .Find the number of students whose weights are (i)less than 135 pounds (ii) between 138 and 148 pounds (iii) more than 152 pounds

2.The content of urns I,II,III are as follows
1 white ,2 black and 3 red balls
2 white,1 black and 1 red ball
1 white,5 black and 3 red balls
2. One urn is choosen at random and two balls are drawn they happen to be white and red what is the probability that they come from urn II

3.The following table gives the number of breakdowns in a factory in various days of a week

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
No.of breakdowns	14	22	16	18	12	19	11

Check whether the breakdowns are uniformly distributed or not

4. 7 coins are tossed and no.of heads are noted .The experiment is repeated 128 times and follow the distribution is obtained

No.of heads	0	1	2	3	4	5	6	7
Observed frequencies	7	6	19	35	30	23	7	1

Fit a binomial distribution from the above data and check the goodness of fit if coin is unbaised

5.The 9 items of a sample have the following values 45,47,50,52,48,47,49,53,51.Does the mean of these values differ significantly from the assumed mean 47.5. Use a 0.05 level of significance.

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PC 23CS403 Operating Systems 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	PO12	
23CS403.1	Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication	3	1	1	1	L1
23CS403.2	Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection	3	2	2	1	L2
23CS403.3	Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system	3	3	3	1	L3
23CS403.4	Illustrate different conditions for deadlock and their possible solutions	3	3	3	1	L2
23CS404.5	Analyze the memory management and its allocation policies	3	3	3	1	L4

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

Unit I: Operating Systems Overview **9 Hours**

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems .

System Structures: Operating System Services, User and Operating-System Interface, System calls, Types of System Calls, System programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging.

COs : CO1

The Shell, kernel data structures ,Distributed Systems

Unit II: Process Management **9 Hours**

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication.

Threads and Concurrency: Multithreading models, Thread libraries, Threading issues.

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

COs: CO2

Process Termination, Multiprocess Architecture

Unit III: Process Synchronization **9 Hours**

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.

Deadlocks: System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.\

COs: CO3

Transactional Memory, Two Phase Locking

Unit IV: Memory Management **9 Hours**

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing.

Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

COs: CO4

Buddy System, Prepaging

Unit V: File System **9 Hours**

File System: File System Interface: File concept, Access methods, Directory Structure;

File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management;

File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing.

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

COs: CO5

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			
2			

Text Books

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne,"Operating System Concepts", Tenth Edition,John Wiley and Sons Inc., 2018
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016
3. William Stallings,"Operating Systems - Internals and Design Principles", Ninth Edition, Pearson, 2018

Reference Books

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach", First Edition, Tata McGrawHill Education, 2001
4. Dhananjay M. Dhamdhere, "Operating Systems: A Concept-Based Approach", Third Edition, McGrawHill Higher Education, 2017

Web References

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html
3. https://www.coursera.org/learn/iot/lecture/MrgxS/lecture-3-1-operating-systems

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	10
L2	50	40
L3	10	40
L4	-	10
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.

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 SJFscheduling: (i) Draw Gantt chart (ii) Calculate average waiting time.
8. Why semaphores are important? Suggest the solution for bounded bufferproblem with semaphores

L3: Apply

1. Define the Critical Section Problem in concurrent computing. Explain how it can lead to race conditions.
2. Compare and contrast mutex locks and semaphores in terms of functionality and usage in process synchronization.
3. Describe Peterson's solution for mutual exclusion. How does it ensure that only one process can enter its critical section at a time?
4. Explain the concept of a monitor in operating systems. How does it facilitate synchronized access to shared resources among concurrent processes?

L4: Analyze

1. Compare and contrast the different access methods used in file systems (e.g., sequential access, direct access). Discuss scenarios where each method is most suitable.
2. Explain how the buddy system algorithm can be applied to manage free space in a file system. Discuss its advantages over traditional allocation methods in terms of performance and fragmentation.

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Board of Studies (CSE)

PC **23CS404 Database Management Systems** **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	PSO 1	PSO 2	
23CS404.1	Understand the basic concepts of database management systems	3	3	2	3	2	L2
23CS404.2	Analyze a given database application scenario to use ER model for conceptual design of the database	3	3	3	3	2	L4
23CS404.3	Utilize SQL proficiently to address diverse query challenges	3	3	3	3	2	L3
23CS404.4	Employ normalization methods to enhance database structure	3	3	3	3	2	L3
23CS404.5	Assess and implement transaction processing, concurrency control and database recovery protocols in databases.	3	3	3	3	2	L4

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

Unit I: Introduction: Database system **9 + 3 Hours**

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence,Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams

COs : CO1

History of DBMS

Unit II: Relational Model and Relational Calculus **9 + 3 Hours**

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update)

COs: CO2

Expressive Power of Algebra and Calculus

Unit III :Introduction to SQL **9 + 3 Hours**

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations. **COs: CO3**

Compare all Database Languages, Importance of Null values

Unit IV: Introduction to Schema Refinement **9 + 3 Hours**

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, BoyceCodd normal form (BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF). **COs: CO4**

Compare all Normal Forms

Unit V:Introduction toTransaction Management **9 + 3 Hours**

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm. **COs: CO5**
Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing

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 – CO6	PO1, PO2, PO3, PO12, PSO1, PSO2
2	Current Real time applications of Database Management tools	CO2 – CO6	PO1, PO2, PO3, PO12, PSO1, PSO2

Text Books:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, 10th edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

Web References:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820 22456_shared/overview

Internal Assessment Pattern

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

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 and having(c)as select(d)schema
4. Explain the difference among Entity, EntityType and EntitySet
5. Illustrate different types of joins in SQL

L3: Apply

1. ApplyNormalizationtechniqueforthefollowingrelationupto3NF:

2. Bank(acno,cust_name,ac_type,bal,int_rate,cust_city,branchId,branch_nm,br_city)
3. Constructatransactionstatediagramanddescribeeachstatethatatransactiongoesthroughduringits execution?
4. 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'?
5. By considering relevant example, show insertion and deletion operations on a B-Tree.

L4: Analyze

1. What is the relational model?
2. What are the concepts of domain, attribute, tuple, and relation in the relational model?
3. Why are null values important in the relational model?
4. What are the different types of constraints in the relational model?
5. What is the importance of integrity constraints in the relational model?
6. What is Relational Calculus?
7. What is serializability in the context of transactions?
8. How are failures classified in database systems?
9. What is the role of storage and recovery in ensuring atomicity of transactions?
10. Can you explain the recovery algorithm used in database systems?

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PC **23CS405 Formal Languages and Automata Theory** **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	PO4	
23CS405.1	Classify machines by their power to recognize languages	3	3	3	3	L2
23C405.2	Summarize language classes & grammars relationship among them with the help of Chomsky hierarchy	3	3	3	3	L4
23CS405.3	Employ finite state machines to solve problems in computing	3	3	3	3	L3
23CS405.4	Illustrate deterministic and non-deterministic machines	3	3	3	3	L2
23CS405.5	Quote the hierarchy of problems arising in the computer science	3	3	3	3	L2

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

Unit I : Introduction to Finite Automata **9 Hours**

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata. **COs : CO1**

Conversion of Moore into melay

Unit II Regular Expressions and Grammars **9 Hours**

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion **COs: CO2**

Regular Grammars

Unit III: Context Free Grammars **9 Hours**

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars- Elimination of Useless Symbols, Є-Productions and Unit Productions, Normal Forms- Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties **COs: CO3**

Applications of Context Free Grammars.

Unit IV: Pushdown Automata **9 Hours**

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Application of Pushdown Automata. **COs: CO4**

Deterministic and Non – Deterministic Pushdown Automata

Unit V: Turing Machine **9 Hours**

Turning Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Classes of P and NP, NP-Hard and NP-Complete Problems **COs: CO5**

Modified PCP

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			
2			

Text Books

1. Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008
2. Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3rd Edition, PHI, 2007

Reference Books

1. Elements of Theory of Computation, Lewis H.P. & Papadimition C.H., Pearson /PHI
2. Theory of Computation, V. Kulkarni, Oxford University Press, 2013
3. Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill, 2014

Web References

1. https://nptel.ac.in/courses/106/104/106104028/

1. Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L2	40	80
L3	20	20
L4	40	-
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L2: Understand

1 Construct a deterministic finite automaton (DFA) that accepts strings over the alphabet {0, 1} where the number of 0s is divisible by 3.

2 Design a pushdown automaton (PDA) to accept the language L = {a^n b^n c^n | n ≥ 1}.
3 Compare and contrast deterministic pushdown automata (DPDA) and non-deterministic pushdown automata (NPDA) with examples.
4 Design a Turing Machine that computes the function f(x) = 2x for binary input x (e.g., if input is 101, output should be 1010).
5 Prove that the language L = {ww^R | w ∈ {0, 1}*} is not regular using the pumping lemma for regular languages.

L3:Apply

1 Construct a context-free grammar (CFG) for the language L = {a^i b^j c^k | i ≠ j or j ≠ k}.
2 Compare and contrast leftmost and rightmost derivations in the context of context-free grammars.
3 Given the grammar G:
S → AB | BA
A → aA | ε
B → bB | ε
4 Is this grammar ambiguous? If so, provide an example of a string that has more than one parse tree.
5 For the grammar G:
S → aSb | T
T → cTd | ε
Construct a parse tree for the string "acccbdd".
6 Simplify the following context-free grammar by eliminating useless symbols, ε-productions, and unit productions:
S → AB
A → aA | ε
B → bB | ε
C → AB | ε
7 Convert the following context-free grammar into Chomsky Normal Form:
S → aSb | SS | ε

L4:Analyze

1 Construct a finite automaton that accepts the language described by the regular expression (a|b)∗abb(a|b)^* abb(a|b)∗abb.
2 Define a regular expression for the language over alphabet {a, b} where every 'a' is followed by at least one 'b'.
3 Use the Pumping Lemma to prove that the language L={anbn|n≥0}L = \{ a^n b^n \mid n \geq 0 \}L={anbn|n≥0} is not regular.
4 Prove that the class of regular languages is closed under intersection using closure properties and constructions.

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PC 23CS406 Operating System 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	PO3	PO4	PO5	DOK
23CS406.1	Trace different CPU Scheduling algorithms	3	3	3	2	1	L2
23CS406.2	Implement Bankers Algorithms to Avoid the Dead Lock	3	3	3	2	1	L3
23CS406.3	Evaluate Page replacement algorithms	3	3	3	2	1	L5
23CS406.4	Illustrate the file organization techniques	3	3	3	2	1	L4
23CS406.5	Illustrate Inter process Communication and concurrent execution of threads	3	3	3	2	1	L4

List of Experiments

1	Practicing of Basic UNIX Commands	**COs: CO1**
2.	Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir	**COs: CO1**
3.	Simulate UNIX commands like cp, ls, grep, etc.,	**COs: CO1**
4.	Simulate the following CPU scheduling algorithms a) FCFS b) SJF c) Priority d) Round Robin	**COs: CO1**
5.	Implement Bankers Algorithm for Dead Lock avoidance and prevention	**COs: CO2**
6.	Control the number of ports opened by the operating system with a) Semaphore b) Monitors.	**COs: CO2**
7.	Write a program to solve producer-consumer problem using Semaphores.	**COs: CO2**
8.	Simulate the following page replacement algorithms FIFO b) LRU c) LFU	**COs: CO3**
9.	Implement the following memory allocation methods for fixed partition a) First fit b) Worst fit c) Best fit	**COs: CO4**
10.	Simulate Paging Technique of memory management.	**COs: CO4**
11	Simulate the following file allocation strategies a) Sequential b) Indexed c) Linked	**COs: CO4**
12	Write a program to illustrate concurrent execution of threads using pthreads library.	**COs: CO5**

Exercise problems

1. Implement the memory management techniques of Multiprogramming with fixed number of tasks (MFT)
2. Implement the memory management techniques of Multiprogramming with variable number of tasks (MVT)
3. Implementation of fork ( ), wait ( ), exec ( ), and exit ( ), System calls

References

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson, 2016
3. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
4. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013
5. Lab Manual for Operating Systems Lab, Department of Computer Science and Engineering, NSRIT

Online Learning Resources:

1. https://www.cse.iitb.ac.in/~mythili/os/
2. http://peterindia.net/OperatingSystems.html

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PC	**23CS407 Database Management Systems Lab**	**0**	**0**	**3**	**1.5**

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

Code	Course Outcomes	Mapping with POs					DOK
		PO1	PO2	PO3	PO4	PO5	
23CS407.1	Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment.	2	2	3	3	3	L3
23CS407.2	Constructing and execute queries to manipulate and retrieve data from databases	2	2	3	3	3	L3
23CS407.3	Develop application programs using PL/SQL	2	2	3	3	3	L3
23CS407.4	Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality.	2	2	3	3	3	L4
23CS407.5	Establish database connectivity through JDBC (Java Database Connectivity)	2	3	3	3	3	L3

List of Experiments

1.	Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.	**COs: CO1**
2.	Queries (along with sub-Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example: - Select the roll number and name of the student who secured fourth rank in the class.	**COs: CO1**
3.	Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views	**COs: CO1**
4.	Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)	**COs: CO1**
5.	i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found) ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block	**COs: CO2**
6.	Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.	**COs: CO2**
7.	Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE APPLICATION ERROR	**COs: CO2**
8	Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES	**COs: CO3**

9	Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.	**COs: CO3**
10	Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.	**COs: CO4**
11	Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers	**COs: CO4**
12	Create a table and perform the search operation on table using indexing and non-indexing techniques.	**COs: CO4**
13	Write a Java program that connects to a database using JDBC	**COs: CO5**
14	Write a Java program to connect to a database using JDBC and insert values into it	**COs: CO5**
15.	Write a Java program to connect to a database using JDBC and delete values from it	**COs: CO5**

References

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007
4. RamezElmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
5. Database Principles Fundamentals of Design Implementation and Management, 10th edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

Online Learning Resources:

1. http://www.scoopworld.in
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

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SOC	23CSS01 Full Stack Development – 1	1	0	2	2

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	DOK
23CSS01.1	Design Websites.	3	3	3	2	2	3	3	L6
23CSS01.2	Apply Styling to web pages.	3	3	3	3	2	3	3	L3
23CSS01.3	Make Web pages interactive.	3	3	3	3	2	3	3	L3
23CSS01.4	Design Forms for applications.	3	3	3	3	2	3	3	L6
23CSS01.5	Choose Control Structure based on the logic to be implemented.	3	3	3	3	2	3	3	L4

Total hours - 45

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events

List of Experiments

1. **Lists, Links and Images**
   a. Write a HTML program, to explain the working of lists.
   Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
   b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
   c. Create a HTML document that has your image and your friend's image with a specific height and width. Also, when clicked on the images it should navigate to their respective profiles.
   d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full-sized version of the image. Create an image gallery using this technique

   COs: CO1

2. **HTML Tables, Forms and Frames**
   a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, row span, Col span)
   b. Write a HTML program, to explain the working of tables by preparing a timetable.
   (**Note:** Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, row span, Col span etc.).
   c. Write a HTML program, to explain the working of forms by designing Registration form.
   (**Note**: Include text field, password field, number field, date of birth field, checkboxes, radio

   COs: CO1

buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).

d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (**Note:** first frame → image, second frame → paragraph, third frame → hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. **HTML 5 and Cascading Style Sheets, Types of CSS**

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <fig caption>, <footer>, <header>, <main>, <nav>, <section>, , tags.

b. Write a HTML program, to embed audio and video into HTML web page. **COs: CO2**

c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. **Selector forms**

a. Write a program to apply different types of selector forms
   i. Simple selector (element, id, class, group, universal)
   ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
   iii. Pseudo-class selector **COs: CO2**
   iv. Pseudo-element selector
   v. Attribute selector

5. **CSS with Color, Background, Font, Text and CSS Box Model**

a. Write a program to demonstrate the various ways you can reference a color in CSS.

b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.

c. Write a program using the following terms related to CSS font and text:
   i. font-size ii. font-weight iii. font-style **COs: CO2**
   iv. text-decoration v. text-transformation vi. text-alignment

d. Write a program, to explain the importance of CSS Box model using
   i. Content ii. Border iii. Margin iv. padding

6. **Applying JavaScript - internal and external, I/O, Type Conversion**

a. Write a program to embed internal and external JavaScript in a web page.

b. Write a program to explain the different ways for displaying output.

c. Write a program to explain the different ways for taking input. **COs: CO3**

d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. **JavaScriptPre-defined and User-defined Objects**

a. Write a program using document object properties and methods.

b. Write a program using window object properties and methods.

c. Write a program using array object properties and methods.

d. Write a program using math object properties and methods.

e. Write a program using string object properties and methods. **COs: CO3**

f. Write a program using regex object properties and methods.

g. Write a program using date object properties and methods.

h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. **JavaScript Conditional Statements and Loops**

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER

NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".

b. Write a program to display week days using switch case.
c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
d. Write a program to print data in object using for-in, for-each and for-of loops
e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153] **COs: CO4**
f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. **Java Script Functions and Events**

a. Design a appropriate function should be called to display
   i. Factorial of that number
   ii. Fibonacci series up to that number
   iii. Prime numbers up to that number
   iv. Is it palindrome or not
b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
   i. Factorial of that number
   ii. Fibonacci series up to that number
   iii. Prime numbers up to that number **COs: CO5**
   iv. Is it palindrome or not
c. Write a program to validate the following fields in a registration page
   i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
   ii. Mobile (only numbers and length 10 digits)
   iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Text Books:

1. John Dean, "Web Programming with HTML5, CSS and JavaScript", Jones and Bartlett Publishers, 2019.
2. Robert. W. Sebesta, "Programming the World Wide Web", PearsonEducation,Fourth Edition, 2007
3. DT Editorial Services ,"Html 5 Black Book, Covers Css 3, Javascript, Xml, Xhtml, Ajax, Php And Jquery", Dreamtech Press, 2nd Edition,2016

Reference Books:

1. Robet W Sebesta ,"Programming the World Wide Web",Pearson, 7thEdition 2013.
2. Vasan Subramanian ,"Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", APress, O'Reilly ,2nd Edition, May 2019.

Online Learning Resources:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs
5. https://www.w3schools.com/typescript

References

1. Lab Manual for **Full Stack Development,** Department of Computer Science & Engineering, NSRIT

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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	DoK 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 **COs: CO1**

Self learning topic

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. **COs: CO2**

Self Learning Topic:

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. **COs: CO3**

Self Learning Topic

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. **COs: CO4**

Self Learning Topic:

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. **COs: CO5**

Activity: How to market our own product, About maintenance, Reliability and plan for startup

Self Learning

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in : BoS No. VI			
Approved in : ACM No. VIII			
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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