

ACADEMIC REGULATIONS (R25)

COURSE STRUCTURE AND I & II SYLLABUS



COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

For
B.Tech. - Regular Four Year Degree Course
(Applicable for the Students Admitted from AY 2025-26)

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CMR ENGINEERING COLLEGE

UGC AUTONOMOUS

Approved by AICTE-New Delhi | Affiliated to JNTUH | Accredited by NAAC & NBA

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CMR ENGINEERING COLLEGE

Kandlakoya, Hyderabad

(Autonomous Institute, Approved by AICTE, Affiliated to JNTUH)



Established: 2010

EAMCET Code: CMRN

**Academic Regulations, Course Structure and Detailed
Syllabus under Autonomous Status**

BACHELOR OF TECHNOLOGY (B.TECH)

(CMREC-R-25 Regulations)

(Applicable for the batch admitted from 2025-2026)

PRELIMINARY DEFINITIONS AND NOMENCLATURES

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as Autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government of Telangana.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and supplementary semester.

Branch: Means specialization in a program like B.Tech degree program in Electronics and communication Engineering, B.Tech degree program in Computer Science and Engineering, etc.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Backlog Course: A course is considered to be a backlog course, if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry etc., are considered to be foundational in nature.

Commission: Means University Grants Commission (UGC), New Delhi.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial/lab hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the process of study for a degree.

Dropping from Semester: Student who does not want to register for any semester can apply in writing in prescribed format before the commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Honors: An Honors degree typically refers to a higher level of academic achievement at an undergraduate level.

Institute: Means CMR Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Courses (MOOC): MOOC courses inculcate the habit of self-learning. MOOC courses would be additional choices in all the elective group courses.

Minor: Minor are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech degree.

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, UG degree program: Bachelor of Technology (B.Tech) and PG degree program: Master of Technology (M.Tech).

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a program.

Regulations: The regulations, common to all B.Tech Programs offered by Institute, are designated as CMREC Regulations R-25 and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. Odd semester commences usually in July and even semester in December of every year.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, is an affiliating University.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of odd or even semester. However, he / she can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

FOREWORD

The autonomy is conferred to **CMR Engineering College (CMREC)**, Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies including JNT University Hyderabad (JNTUH), Hyderabad and AICTE, New Delhi. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf. Thus, an autonomous institution is given the freedom to have its own **examination system** and **monitoring mechanism**, independent of the affiliating University but under its observance.

CMREC is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies such as Academic Council and Board of Studies (BOS) are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure, and syllabi under autonomous status.

The autonomous regulations, course structure, and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute in order to produce a quality engineering graduate to the society.

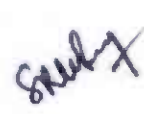
All the faculty, parents, and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and from the principal of the institute, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is requested for the successful implementation of the autonomous system in the larger interests of the institute and brighter prospects of Engineering Graduates.


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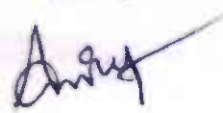
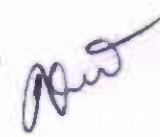











ACADEMIC REGULATIONS FOR B.TECH REGULAR STUDENTS
WITH EFFECT FROM THE ACADEMIC YEAR 2025-26 (R-25)

For pursuing four year under graduate Bachelor Degree Programme of study in Engineering (B.Tech) offered by CMR Engineering College under Autonomous status is here in referred to as CMREC (An Autonomous Institution)

All the rules specified here in approved by the Academic Council will be in force and applicable to students admitted from the Academic Year **2025-2026** onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for CMR Engineering College (An Autonomous Institution).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, CMR Engineering College shall be the chairman Academic Council.

1.0 Under-Graduate Degree Programme in Engineering & Technology (UG Pin E & T)

CMR Engineering College offers a 4-year (8 semesters) **Bachelor of Technology (B.Tech)** degree programme, under Choice Based Credit System (CBCS) with effect from the academic year **2025-26**.

2.0 Eligibility for Admission

- 2.1** Admissions to the under graduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified students at the entrance test conducted by Telangana State Government (EAPCET) or the University or on basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.
- 2.2** The medium of instructions for the entire under graduate programme in Engineering & Technology will be **English** only.

3.0 B.Tech Programme Structure

- 3.1** A student after securing admission shall complete the B.Tech programme in a minimum period of **four** academic years (eight semesters), and a maximum period of **eight** academic years starting from the date of commencement of first year first semester ,failing which student shall forfeit seat in B.Tech course. Each student has to secure a minimum of 160 credits out of 164 credits completion of the undergraduate programme and award of the B.Tech degree.
- 3.2** **UGC/AICTE** specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms.

3.2.1 Semester Scheme

The under graduate programme is off our academic years with each academic year divided into two semesters. There shall be a minimum of 15 weeks of instruction weeks, excluding the mid-term and semester-end exams. Around 15 instruction hours, 30 instruction hours and 45 hours of learning need to be followed per one credit of theory course, practical course and project/field-based learning respectively. In each semester, there shall be 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS). The curriculum/course structure suggested by AICTE is followed as a reference document.

3.2.2 Credit Courses

All courses offered in each semester are to be registered by the student. Against each course in the course structure, the L: T: P: C (lecture periods: tutorial periods: practical periods: credits) pattern has been defined.

- One credit is allocated for one hour per week in a semester for lecture (L) or Tutorial (T) session.
- One credit is allocated for two hours per week in a semester for Laboratory/ Practical (P) session.
- One credit is allocated for three hours per week in a semester for Project/Mini-Project session.

For example, a theory course with three credit weightage requires three hours of classroom instruction per week, totaling approximately 45 hours of instruction over the entire semester.

3.2.3 Subject Course Classification

All subjects/courses offered for the undergraduate programme in E&T (B.Tech degree programmes) are broadly classified as follows.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry courses
2		ES - Engineering Sciences	Includes Fundamental Engineering Courses
3		HS – Humanities and Social Sciences	Includes courses related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core courses related to the parent branch of Engineering.
5	Elective Courses (ElC)	PE – Professional Electives	Includes elective courses related to the parent branch of Engineering.
6		OE – Open Electives	Elective courses which include inter-disciplinary courses or courses in an area outside the parent branch of Engineering.
7	Project Core	Project Work	B.Tech. Project Work
8	Other Core Courses (OCC)	Industry Training/ Internship /Industry Oriented Mini-Project/ Skill Development Courses	Industry Training/ Internship/ Industry Oriented Mini-Project/Skill Development Courses

9		Seminar	Seminar based on core contents related to parent branch of Engineering.
10	Skill Development Courses (SDC)	-	Courses designed to help individuals gain, improve, or refine specific skills
11	Value Added Courses (VAC)	-	Courses to build professional values, traditional knowledge and sensitization of societal issues

4.0 Mandatory Induction Programme

An induction program of three weeks duration for the UG students entering the institution, right at the start is proposed. Normal classes start only after the induction programme is over. Following activities could be part of the induction programme: i) Physical Activity, ii) Creative Arts, iii) Imparting Universal Human Values, iv) Literary Activities, v) Lectures by Eminent People, vi) Visits to Local Areas and vii) Familiarization to department as well as entire institute and viii) Making students understand Innovative practices at the college premises etc.

5.0 Course Registration

- 5.1 A 'faculty advisor or mentor' shall be assigned to a group of around 20 students, who will advise the students about the under graduate programme, its course structure and curriculum, choices/ options of the courses, based on their competence, progress, pre-requisites and interest.
- 5.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The online registration requests for semester courses shall be completed before the commencement of SEEs (Semester End Examinations) of the preceding semester.
- 5.3 A student can apply for **on-line** registration, only **after** obtaining the '**written approval**' from faculty advisor/mentor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, faculty advisor/ mentor and the student.
- 5.4 A student shall register for all the courses offered in a semester as specified in the course structure
- 5.5 Course options exercised through **on-line** registration are final and **cannot** be changed; further, alternate choices also will not be considered. However, if the course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new course (subject to offering of such a course), or for another existing course. Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within a **week**, but before the commencement of class-work for the semester.
- 5.6 The Head of the Department / Course Coordinator should review vacant slots in the timetable of each section once in every week or fortnight. The vacant slots in the time-table may be

allocated to subject teachers who could not take classes proportional to the number of weeks completed from the commencement of the semester.

- 5.7 Two faculty members may be allocated for the tutorial session of Mathematics-I course for better interaction/practice and to minimise the failures in the subject.

- 5.8 **Professional Electives:** The students have to choose six Professional Electives (PE-I to PE-VI) from the six baskets of professional electives given.

Students have the flexibility to choose from the list of professional electives offered by the institute or opt to register for the equivalent MOOCS courses as suggested by the Institute. MOOCS subjects are allowed only for professional electives or open electives.

- 5.9 **Open Electives:** Students have to choose three Open Electives (OE-I, II & III) from three baskets of Open Electives given by other than the parent department. However, the student can opt for an Open Elective course offered by his parent department, if the student has not studied that course so far. Similarly, Open Elective courses being studied should not match with any courses of the forthcoming semesters.

- 5.10 **Provision for Early Registration of MOOCS Courses:**

For a professional elective in a semester, students are allowed to register for an equivalent MOOCs course listed from time to time by the Institute one semester in advance. For example, a Professional Elective of III Year II Sem shall be allowed to register under MOOCs platform in III year I Sem.

The credits earned in one semester in advance can be submitted in the subsequent semester for the assessment.

The students, who have registered in advance in an equivalent MOOCs course and fail to secure any pass grade in the MOOCs course, can register for the regular course offered in the following semester of their course structure.

- 5.11 **Conversion of Marks Secured in MOOCs into Grades:** Marks secured in the internal and external evaluations of a MOOCs course shall be scaled to 40 and 60 marks respectively. The sum of these two components shall be considered as the total marks out of 100. The corresponding grade shall then be determined as per the marks-to-grades conversion rules specified in Clause 10.3.

- 5.12 MOOCs are allowed only for professional elective courses and for a few Minors & Honors courses.

- 5.13 **Additional learning resources:**

Students are encouraged to acquire additional course-related knowledge by auditing learning resources from MOOCs platforms for each course offered in their course structure. These additional courses are not meant for earning credits but are intended to enhance knowledge. The Institute shall notify such courses from time to time through their portals for the benefit of students. They are categorized into three types: prerequisite, reinforcement, and aspirational. Prerequisite courses help students gain familiarity and provide sufficient background. Reinforcement courses aim to offer different perspectives on learning, while aspirational courses focus on next-level or advanced learning.

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6.0 Rules to offer Elective courses

- 6.1 An elective course may be offered to the students, only if a minimum of 25% class strength opt for it.
- 6.2 Same elective course for different sections may be offered by different faculty members. The selection of elective course by students will be based on first come first serve and / or CGPA criterion.
- 6.3 If the number of students registrations are more than the strength of one section, then it is choice of the concerned Department to offer the same course for more than one section based on the resources available in the department.

7.0 Attendance requirements:

- 7.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate attendance of all the courses for that semester.
- 7.2 Shortage of attendance in aggregate upto 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.
- 7.3 A stipulated fee shall be payable for condoning of shortage of attendance.
- 7.4 Shortage of attendance below 65% in aggregate shall in **NO** case be condoned.
- 7.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and will not be promoted to the next semester. Their registration for that semester shall stand cancelled, including internal marks. They may seek re-registration for that semester in the next academic year
- 7.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same semester.

8.0 Criteria for Earning of Credits in a Course

- 8.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course ,if student secures not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that subject/ course.
- 8.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Field Based Research Project/Industry Oriented Mini Project/Internship, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he (i) does not submit a report on Field-Based Research Project/Industry Oriented Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii)secures less than 40% marks in Field-Based Research Project/Industry Oriented Mini Project/Internship evaluations.

- 8.3 A student eligible to appear in the semester-end examination for any course, is absent from it or failed (thereby failing to secure 'C' grade or above) may re-appear for that course in the supplementary examination as and when it is conducted. In such cases, internal marks assessed in continuous internal evaluation (CIE) earlier for that course will be carried over, and added to the marks obtained in the SEE supplementary/make-up examination. If the student secures sufficient marks for passing, 'C' grade or above shall be awarded as specified in clause 10.3.

9.0 Distribution of Marks and Evaluation

- 9.1 The performance of a student in every course (including Value Added Courses and Skill Development Courses, Laboratory/Practical and Project Work) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination), irrespective of the credits allocated.

9.2.1 Continuous Internal Evaluation (CIE)

For theory courses, during a semester, there shall be two mid-term examinations. Each Mid- Term examination consists of two parts i) Part-A for 10 marks, ii) Part-B for 20 marks, totaling to 30 marks. Total duration of mid-term examination is two hours.

1. Mid Term Examination for 30 marks:

- a. Part-A: Short Answers for 10 marks ($5 \times 2 = 10$ Marks).
- b. Part-B: Descriptive paper for 20 marks.

The descriptive paper shall contain 6 questions out of which, the student has to answer 4 questions, each carrying 5 marks. The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (for 30 marks).

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Questions will be drawn from the mid-term exam syllabus, ensuring uniform coverage of all topics.

The remaining 10 marks of Continuous Internal Evaluation are distributed as follows:

2. Five marks for the assignment. For 5 marks student shall submit two assignments and the **average of 2 Assignments** each for 5 marks shall be taken. The first assignment should be submitted before the conduct of the first mid-term examination, and the Second assignment should be submitted before the conduct of the second mid-term examination.
3. Five marks for the Viva-Voce/PPT/Poster Presentation/Case Study on a topic in the concerned subject. This assessment shall be completed before II Mid-Term Examination. The Principals shall schedule these sessions in their semester plan.

9.2.2 Engineering Drawing and Computer Aided Drafting Course:

For this course, 20 marks will be allocated for day-to-day assessments conducted during drawing practice sessions, and another 20 marks will be allocated for the mid-term examination. In the mid-term examination, students shall attempt any four out of six

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given questions. The first mid-term exam will be conducted in the conventional mode using a drawing board, while the second mid-term exam will be conducted using a CAD package.

9.3 A Computer-Based Test (CBT) in a each course is available for students who either:

1. Missed one or two mid-term examinations due to unavoidable circumstances, or
2. Attended both mid-term examinations but wish to improve their internal marks.

The CBT will be conducted at the end of the semester and will carry a total of 30 marks. The average marks of the two mid exams (or) the CBT exam marks whichever is the best that marks will be considered as final marks. CBT exams shall be conducted by the College.

9.4 Semester End Theory Examination

9.4.1 Theory Courses:

The semester end examinations (SEE), for theory courses, will be conducted for 60 marks consisting of two parts viz. i) **PART- A** for 10 marks and ii) **PART - B** for 50 marks.

- PART-A is compulsory, consists of five short answer questions covering all units of syllabus; each question carries two marks.
- PART-B consists of five questions carrying 10 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units.

9.4.2 Engineering Drawing and Computer Aided Drafting Course:

Question paper consists of five questions carrying 12 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units. There shall be no section with short answer questions.

9.4.3 Duration of SEE:

The duration of Semester End Examination of Theory courses is 3 hours.

9.5 Semester End Practical Examination

For practical courses there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and semester-end examination for 60 marks. The breakup of the continuous internal evaluation for 40 marks is as follows:

1. 10 marks for a write-up on day-to-day experiments in the laboratory (in terms of aim, components/procedure, expected outcome)
2. 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. 10 marks for internal practical examination conducted by the laboratory teacher concerned.
4. The remaining 10 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App

Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory course teacher. The external examiner shall be appointed from the college outside their cluster and not from group colleges.

In the Semester End Examination held for 3 hours, a rubric of evaluation for 60 marks is as given below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course.

For any change of experiment, 5 marks will be deducted from the total of 60 marks. If second time change of experiment is requested, another five marks will be deducted from the 60 marks. No third change will be permitted.

9.6 Field-based Research Project:

There shall be a Field-based Research Project in intervening summer between II-II and III-I Semester. Students will register for this project immediately after II Year II Semester examinations and pursue it during summer vacation. The Field-based Research Project shall be submitted in a report form and presented before the committee in III year I semester. It shall be evaluated for 100 external marks. The evaluation committee shall consist of an External Examiner, Head of the Department, and Supervisor of the Project and a Senior Faculty Member of the department. There shall be no internal marks for Real-Time Research Project (or) Field-based Research Project. Student shall have to earn 40%, i.e 40 marks out of 100 marks. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (iii) secures less than 40% marks in this course.

9.7 Internship/Industry Oriented Mini Project:

There shall be an Internship/Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after III Year II Semester Examinations and pursue it during summer vacation. Internship should be carried out at an organization (or) Industry. The Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in IV Year I Semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project/Internship, and a Senior Faculty Member of the Department. There shall be no internal marks for Internship/Industry Oriented Mini Project.

- 9.7.1 For evaluating industry-oriented mini-projects, it is preferable to appoint an external examiner from the industry, ideally from one of the organizations/ industries with which the institute has established / proposing to establish collaborations.

9.8 UG Project Work

9.8.1 The UG project work shall be initiated at the beginning of the IV Year II Semester and the duration of the project work is one semester. The student must present in consultation with his supervisor, the title, objective and plan of action of his Project work to the departmental committee for approval within two weeks from the commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start his project work.

9.8.2 Student has to submit project work report at the end of IV Year II Semester. The project work shall be evaluated for 100 marks. Out of which 40 marks and 60 marks are allocated for CIE and External Evaluation respectively

9.8.3 For internal evaluation, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 40 marks. The distribution of marks is as follows:

- Objective(s) of the work done - 05 Marks
- Methodology adopted - 15 Marks
- Results and Discussions - 15 Marks
- Conclusions and Outcomes - 05 Marks
- Total - 40 Marks

9.8.4 The External Evaluation shall be conducted by the external examiner for a total of 60 marks. It shall comprise the presentation of the work, communication skills, and viva-voce, with a weightage of 20 marks, 15 marks, and 25 marks respectively.

The topics for main Project shall be different from the topic of Industry Oriented Mini Project/ Internship/SDC. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

9.8.5 For conducting viva-voce exam of project work, Principal appoints an external examiner. The external examiner may be selected from the list of experts submitted by the Head of the Department.

9.8.6 A student, who has failed, may re-appear once for the above evaluation, when it is scheduled again; if student fails in such 'one re-appearance' evaluation also, he has to reappear for the same in the next subsequent year, as and when it is scheduled.

9.9 Skill Development Courses:

Four Skill Development Courses included in the Curriculum in II Year I Semester & II Semester and III Year I Semester & II Semester. Each Skill Development course carries one credit. The evaluation pattern will be the same as that for a laboratory course including internal and external assessments.

The objective of Skill Courses is to develop the cognitive skills as well as the psycho-motor skills.

9.10 Value-Added Courses:

The evaluation of Value-Added Courses shall be similar to that of theory courses. However, the scheduling of these mid-term exams and semester-end examinations may not be combined with main-stream examinations. One hour /45 mins proctored mid-term examination shall be conducted in the regular class by the same subject teacher. It should not impact the conduct of other classes on that day.

10.0 Grading Procedure

10.1 Absolute grading system is followed for awarding the grades to each course.

10.2 Grades will be awarded to indicate the performance of students in each Theory Course, Laboratory/Industry-Oriented Mini Project/Internship/Skill development course/ Project Work. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

10.3 As a measure of the performance of a student, a 10-point absolute grading system is followed. The mapping between the percentage of marks secured and the corresponding letter grade is as follows:

Range of percentage of Marks Secured in a course	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90	O(Outstanding)	10
80 and less than 90	A+(Excellent)	9
70 and less than 80	A(Very Good)	8
60 and less than 70	B+(Good)	7
50 and less than 60	B(Average)	6
40 and less than 50	C(Pass)	5
Below 40	F(FAIL)	0
Absent	Ab	0

10.4 A student shall be declared successful or 'passed' in a semester, if he/she secures 'C' grade or above in every course (i.e. $GP \geq 5$)

10.5 A student who has obtained an 'F' grade in any course shall be deemed to have 'failed' and is required to reappear for a supplementary exam as and when conducted. In such cases, internal marks in those courses will remain the same as those obtained earlier.

10.6 To a student who has not appeared for an examination in any course, 'Ab' grade will be allocated in that course, and he is deemed to have 'Failed'. Such student will be required to re-appear for supplementary /make up exam as and when conducted. The internal marks in those courses will remain the same as those obtained earlier.

10.7 A student earns Grade Point (GP) in each course, on the basis of the letter grade secured in that course. Every student who passes a course will receive grade point $GP \geq 5$ ('C' grade or above)

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- 10.8 The Credit Points (CP) are computed by multiplying the grade point with credits for a given course.

$$\text{Credit Points (CP)} = \text{Grade Point (GP)} \times \text{Credits}$$

- 10.9 The Semester Grade Point Average (SGPA) is calculated only when all the courses offered in a semester are passed by a student. It is calculated by dividing the sum of credit points (ΣCP) secured from all courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA for each semester is thus computed as

$$\text{SGPA} = \{ \sum_{i=1}^N C_i G_i \} / \{ \sum_{i=1}^N C_i \}$$

where 'i' is the course indicator index (considering all courses in a semester), 'N' is the no. of courses '**registered**' for the semester (as listed under the course structure of the branch), C_i is the no. of credits allotted to the i^{th} course, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} course.

- 10.10 If a student earns more than 160 credits, only the courses corresponding to the best 160 credits shall be considered for the computation of CGPA of B.Tech degree.
- 10.11 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student out of **all** registered courses in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed at the end of each semester, from the I year II semester onwards, as per the formula

$$\text{CGPA} = \{ \sum_{j=1}^M C_j G_j \} / \{ \sum_{j=1}^M C_j \}$$

where 'M' is the **total** no. of courses corresponding to the best 160 credits from the courses registered in all eight semesters, 'j' is the course indicator index (takes into account all courses from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} course, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} course.

Illustration of calculation of SGPA:

Course	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	$4 \times 8 = 32$
Course 2	3	O	10	$3 \times 10 = 30$
Course 3	3	C	5	$3 \times 5 = 15$
Course 4	3	B	6	$3 \times 6 = 18$
Course 5	3	A	8	$3 \times 8 = 24$
Course 6	2	A+	9	$2 \times 9 = 18$
Course 7	1	C	5	$1 \times 5 = 5$
Course 8	1	O	10	$1 \times 10 = 10$
	20			152

$$\text{SGPA} = 152/20 = 7.6$$

The CGPA of the entire B. Tech Programme shall be calculated considering the best 160 credits earned by the student.

- 10.12** For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.
- 10.13** SGPA of a semester will be mentioned in the semester Memorandum of Grades if all courses of that semester are passed in first attempt. Otherwise, the SGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester.

11.0 Declaration of Results and issue of Grade Memo

- 11.1 While declaring the results, the web-version should display the marks earned by the students with the internal and external marks break-up. However, in the memorandum of grades, the marks need not be shown.
- 11.2 After the completion of each semester, a certificate of memorandum of grades shall be issued to all the registered students, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, course title, no. of credits), letter grade and credits earned.

12.0 Withholding of Results

- 12.1** If the student has not paid the fees to the college at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

13.0 Supplementary Examinations:

- 13.1** At the end of each semester, along with regular semester examinations, supplementary examinations shall be conducted for the students who have back-log subjects.
- 13.2** Advanced supplementary examinations in IV Year II Semester courses may be conducted for those who failed in any course offered in IV Year II Semester. It may enable the students to receive their B.Tech provisional certificate at an early date. Advanced supply examinations may be scheduled within one month period after the declaration of the final semester results.

There shall be no supplementary examination in the successive semester. The students who could not secure any pass grade in advance supplementary examinations have to wait for regular series examination of next batch to write their back-log examination.

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14.0 Promotion Rules

S.No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester and fulfillment of attendance requirement.
2	First year second semester to Second year first semester	(i) Regular course of study of first year second semester and fulfillment of attendance requirement (ii) Must have secured at least 25% of the total credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Second year first semester to Second year second semester	Regular course of study of second year first semester and fulfillment of attendance requirement.
4	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester and fulfillment of attendance requirement. (ii) Must have secured at least 25% of the total credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to Third year second semester	Regular course of study of third year first semester and fulfillment of attendance requirement.
6	Third year second semester to Fourth year first semester	Regular course of study of third year second semester and fulfillment of attendance requirement.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfillment of attendance requirement.

15.0 Re-admission after Detention

- i) A student detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of credits.
- ii) A student detained due to shortage of attendance shall be admitted in the same semester in the successive academic years.
- iii) When a student is readmitted in the following academic years, the academic regulations under which the student seeks re-admission shall only be applicable to this student, not the academic regulations in which he got admitted in his/her first year of study.

16.0 Credit Exemption

A student (i) shall register for all courses covering 164 credits as specified and listed in the course structure and (ii) earn 160 or more credits to successfully complete the undergraduate programme.

- Best 160 credits shall be considered for CGPA computation. The student can avail exemption of courses totaling up to **4 Credits** other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project / Industry Oriented Mini Project / Internship, for optional drop out from these 164 credits registered;
- The semester grade point average (SGPA) of each semester shall be mentioned at the bottom of the grade card, when all the subjects in that semester have been passed by the student
- Credits earned by the student in either a Minor or Honors program cannot be counted towards the required 160 credits for the award of the B.Tech degree.

17.0 Award of Degree

17.1 A student who registers for all the courses specified in the course structure and secures the required number of 160 credits within 8 academic years from the date of commencement of the first academic year shall be declared to have '**qualified**' for the award of B.Tech degree in the branch of Engineering selected at the time of admission.

17.2 A student who qualifies for the award of the degree as listed in item 17.1 shall be placed in the following classes.

17.3 A student with final CGPA (at the end of the undergraduate programme) > 7.5 , and fulfilling the following conditions - shall be placed in '**First Class with Distinction**'.

- (i) Should have passed all the courses in '**First Appearance**'.
- (ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA > 7.5 shall be Placed in '**First Class**'.

17.4 Students with final CGPA (at the end of the undergraduate programme) ≥ 6.5 but < 7.5 shall be placed in '**First Class**'.

17.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 5.5 but < 6.5 shall be placed in '**Second Class**'.

17.6 All other students who qualify for the award of the degree (as per item 17.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 5.5 , shall be placed in '**pass class**'.

17.7 Grace Marks

Grace marks shall be given to those students who complete the course work of four year B. Tech. degree, not secured pass grade in not more than three subjects and adding a specified

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grace marks enables the student to pass the subject(s) as well as gets eligibility to receive the provisional degree certificate.

Grace marks for students admitted under the R-25 Academic Regulations should not exceed **0.15%** of the total maximum marks in all eight semesters (excluding the marks allocated for value added courses and skill development courses).

18.0 Award of Gold Medals

18.1 Students fulfilling the conditions listed under item 17.3 alone will be eligible for award of 'Gold Medal'.

18.2 If more than one student secures the same highest CGPA, then the following tie resolution criteria, in the same order of preference shall be followed for selecting the Gold Medal winner, until the tie is resolved: 1) more number of times secured highest SGPAs, ii) more number of O and A+ grades in that order and iii) highest SGPA in the order of first semester to eight semester

19.0 Conversion of CGPA into equivalent Percentage of Marks

19.1 The following formula shall be used for the conversion of CGPA into equivalent marks, whenever it is necessary

$$\% \text{ of Marks} = (\text{final CGPA} - 0.5) \times 10$$

20.0 Honours and Minor Degree Programs

Honours and Minor Degree programs will be available in all Branches of B.Tech degree. Minor Degree programs will commence from II Year II Semester and continue till IV Year I semester and Honours Degree programs will commence from III Year I Semester and continue till IV Year II semester.

College shall undertake the responsibility of assessing the infrastructure requirements necessary to support Minor Degree programs as well as Honours degree programs during the fact-finding committee (FFC) visits to the affiliated colleges. During FFC visits, JNTUH team will physically verify the facilities available for offering the proposed Minors and Honours courses along with other regular verifications. Only the Institute approved Minors shall be offered at the affiliated colleges.

21.0 Multiple Entry Multiple Exit Scheme (MEME)

21.1 Exit Option after Second Year:

Students enrolled in the 4-Year B.Tech programme are permitted to exit the program after successful completion of the second year (B.Tech II Year II Semester). The students who desire to exit after the II year shall formally inform the exit plan one semester in advance i.e. at the commencement of II Year II Semester itself. Such students need to fulfil the additional requirements as specified in Clause 21.2 described below.

Upon fulfilling the requirements like earning all the credits up to II Year II Semester and successfully completing the additional requirements, the students will be awarded a 2-Year Undergraduate (UG) Diploma in the concerned engineering branch.

21.2 Additional Requirements for Diploma Award

To qualify for the diploma under the exit option, students must also complete 2 additional credits through one of the following college-prescribed pathways:

Work-based Vocational Course:

Participation in a practical, hands-on vocational training program relevant to the engineering field, typically conducted during the summer term.

Internship/Apprenticeship:

Completion of a minimum 8-week internship or apprenticeship in their related field to gain practical industry exposure.

In addition, students must clear any associated course(s) or submit the Internship/apprenticeship report as per the College schedule and guidelines.

21.3 Re-entry into the B.Tech Programme

Students who have exited the B.Tech Programme with a 2-Year UG Diploma may apply for re-entry into the Third Year (Fifth Semester) of the B.Tech programme. Re-entry is subject to the following conditions:

- The student must surrender the awarded UG Diploma Certificate.
- Students who wish to rejoin in III Year must join the same B.Tech programme and same college from which the student exited. Before rejoining, students should check for the branch closure. If the branch is closed in that particular college, then student should consult the college for the Possible Alternative Solutions.
- Re-registered students will be governed by the academic regulations in effect at the time of re-entry, regardless of the original regulations under which they were admitted.
- If a student opts to continue their studies without a gap after being awarded the diploma, they must register for the third-year courses before the commencement of class work.

21.4 Break in Study and Maximum Duration

Students are allowed to take a break of up to four years after completion of II Year II Semester with prior Institute permission through the Principal of the college.

Re-entry after such a break is subject to the condition that the student completes all academic requirements within twice the duration of the program (i.e., within 8 years for a 4-year B.Tech program).

22.0 Transitory Regulations For the students re-admitted in R-25 Regulations:

22.1 Transitory regulations are applicable to the students detained due to shortage of attendance as well as detained due to the shortage of credits and seek permission to re-join the B.Tech programme, where R-25 regulations are in force.

22.2 A student detained due to shortage of attendance and re-admitted in R-25 regulations: Such students shall be permitted to join the same semester, but in R-25 Regulations.

students shall be permitted to join the same semester, but in R-25 Regulations.

22.3 A student detained due to shortage of credits and re-admitted in R-25 regulations: Such students shall be promoted to the next semester in R-25 regulations, only after acquiring the required number of credits as per the corresponding regulations of his/her previous semester.

22.4 A student who has failed in any course in a specific regulation has to pass those courses in the same regulations.

22.5 If a student is readmitted to R-25 Regulations and has any course with 80% of syllabus common with his/her previous regulations, that particular course in R-25 Regulations will be substituted by an equivalent course of R-22 regulations by the Institute. All these details are summarized in a set of look-up Table; one set for each B. Tech. branch.

22.6 Look Up Table of equivalence courses

22.6.1 A lookup table will be provided for the benefit of students. This lookup table will include all the courses to be registered by students who have been re-admitted under the R25 Academic Regulations from the R22 Academic Regulations. Separate lookup tables will be provided for the following categories of students:

1. Students re-admitted into the I Year II Semester of the R25 Regulations
2. Students re-admitted into the II Year I Semester of the R25 Regulations
3. Students re-admitted into the II Year II Semester of the R25 Regulations,
4. Students re-admitted into the III Year I Semester of the R25 Regulations
5. Students re-admitted into the III Year II Semester of the R25 Regulations
6. Students re-admitted into the IV Year I Semester of the R25 Regulations
7. Students re-admitted into the IV Year II Semester of the R25 Regulations

For every B.Tech branch there shall be separate set of lookup tables.

22.6.2 Applicability of Look-up Table: The above look-up table shall be applicable for i) students who seek readmission from R22 regulations to R25 regulation and are going to be re-admitted in the same autonomous college ii) detained students of one autonomous college who seek admission into another autonomous college.

For these two categories of students, the Principals of the affiliated colleges need not consult the University for the Equivalence Courses. However the Principals need to inform in the specified format, the list of such students and equivalences derived from the transitory regulations.

22.7 Look-Up Table is not applicable for the students who seek transfer from i) other Universities to JNTUH affiliated colleges, ii) autonomous to non-autonomous colleges iii) one autonomous to another autonomous colleges and iv) non-autonomous to autonomous colleges under JNTUH. Such students should consult the University regarding equivalent courses, as was done in previous practice.

22.8 The R-25 Academic Regulations are applicable to a student from the year of re-admission. However, the student is required to complete the study of B.Tech degree within the stipulated period of eight academic years from the year of first admission.

23.0 Student Transfers

23.1 There shall be no branch transfers after the completion of admission process.

- 23.2 There shall be no transfers from one college to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.
- 23.3 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions is having back-logs at the previous University/institute, have to pass the courses offered at JNTUH which are equivalent to the failed courses at the previous University/institute.
- 23.4 The transferred students from other Universities/Institutions to JNTUH affiliated colleges shall be given a chance to write CBTs for getting CIE component in the equivalent course(s) as per the clearance letter issued by the University.
- 24.0 Value Added Courses**
- 24.1 Faculty members who have received a certificate in Innovation and Entrepreneurship / Entrepreneurship from a reputed foundation/organization should be given preference to teach the "Innovation and Entrepreneurship" course. This certificate course should include an assessment. Total training duration (online or physical), excluding assessment, should be at least 32 hours. Faculty members from all disciplines with the right aptitude are eligible to teach this subject.
- 24.2 Faculty members who have credited a course on Intellectual Property Rights in their UG or PG programme or credited an equivalent course in MOOCs platform/ reputed foundation/ organization in which assessment is a part, may be given preference to teach the elective course on Intellectual Property Rights.
- 24.3 To ensure quality delivery and standardization in teaching the Indian Knowledge System (IKS) and other value-added courses, the following guidelines must be adhered to: i) faculty members must undergo a Faculty Development Program (FDP) organized by UGC-MMTTC 16 (Malaviya Mission Teacher Training Centre), or Any other recognized and competent institution/organization offering similar certified programs, ii) the total instructional duration of the FDP should be a around 32 hours or more, III) all sessions in the FDP must be conducted by certified and qualified resource persons with recognized expertise in the respective domains, iv) A formal assessment component must be included as part of the FDP.
- 25.0 Mapping with the Sustainable Development Goals**
All the courses specified in the course structure of every programme are mapped with the one or more sustainable development goals.
- 26.0 Scope**
- 26.1 The academic regulations should be read as a whole, for the purpose of any interpretation.
- 26.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
- 26.3 The college may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the college authorities.
- 26.4 Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME)
FROM THE A.Y 2026-27 (R25)

Eligibility for the award of B.Tech degree (LES):

1. The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.
2. The student shall register for 123/124 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech Programme (LES) for the award of B.Tech degree.
3. The student can avail exemption of courses totaling up to 3/4credits other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project/Industry Oriented Mini Project/Internship, for optional drop out.
4. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.
5. The attendance requirements of B.Tech (Regular) shall be applicable to B.Tech (LES).
6. **Promotion Rule:**

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to Second year second semester	Regular course of study of second year first Semester and fulfillment of attendance requirement.
2	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester and fulfillment of attendance requirement. (ii) Must have secured at least 25% of the total credits up to second year second semester from all the relevant regular and supplementary examinations ,whether the student takes those Examinations or not.
3	Third year first semester to Third year second semester	Regular course of study of third year first semester and fulfillment of attendance requirement.
4	Third year second semester to Fourth year first semester	Regular course of study of third year second Semester and fulfillment of attendance requirement.
5	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester And fulfillment of attendance requirement.

7. All the other regulations as applicable to B.Tech 4-year degree course (Regular) will hold good for B. Tech (Lateral Entry Scheme).
8. LES students are not permitted to exit the B.Tech Program after completion of second year (B.Tech II Year II Semester).

Malpractices Rules

Disciplinary Action For / Improper Conduct in Examinations

S. No	Nature of Malpractices/Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for

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		two consecutive semesters from class work and all institution examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all Institute examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in-charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all Institute examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for

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		the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Exam branch for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CMR ENGINEERING COLLEGE

B. Tech. in DATA SCIENCE
Course Structure & Syllabus (R25 Regulations)
Applicable from AY 2025-26 Batch

I Year I Semester

S.No.	Course Code	Category	Course Title	L	T	P	Credits
1	MA101BS/ MA203BS	BSC	Matrices and Calculus	3	1	0	4
2	AP102BS/ AP202BS	BSC	Advanced Engineering Physics	3	0	0	3
3	EE103ES/ EE201ES	ESC	Basic Electrical Engineering	3	0	0	3
4	CS104ES	ESC	Programming for Problem Solving	3	0	0	3
5	ME105ES/ ME205ES	ESC	Engineering Drawing and Computer Aided Drafting	1	0	2	2
6	AP106BS/ AP206BS	BSC	Advanced Engineering Physics Lab	0	0	2	1
7	EE107ES/ EE209ES	ESC	Basic Electrical Engineering Lab	0	0	2	1
8	CS108ES	ESC	Programming for Problem Solving Lab	0	0	2	1
9	CM109ES/ CS210ES	ESC	IT Workshop	0	0	2	1
10	MS110HS	HSC	Introduction to Social Innovation	0	0	2	1
			Induction Program				
			Total Credits	13	1	12	20

I Year II Semester

S.No.	Course Code	Category	Course Title	L	T	P	Credits
1	MA102BS/ MA201BS	BSC	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2	CH101BS/ CH202BS	BSC	Engineering Chemistry	3	0	0	3
3	EN103HS/ EN203HS	HSC	English for Skill Enhancement	3	0	0	3
4	CS204ES	ESC	Data Structures	3	0	0	3
5	EC105ES/ EC205ES	ESC	Electronic Devices and Circuits	3	0	0	3
6	CH106BS/ CH206BS	BSC	Engineering Chemistry Lab	0	0	2	1
7	CS207ES	ESC	Data Structure Lab	0	0	2	1
8	CS109ES/ CM208ES	ESC	Python Programming Lab	0	0	2	1
9	EN107HS/ EN209HS	HSC	English Language and Communication Skills Lab	0	0	2	1
10	MS211HS	HSC	Social Innovation in Practice	0	0	2	1
			Total Credits	15	0	10	20

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

II YEAR I SEMESTER

S. No.	Course Code	Category	Course Title	L	T	P	Credits
1	MA301BS	BSC	Mathematical and Statistical Foundations	3	1	0	4
2	CS302PC	PCC	Computer Organization and Architecture	3	0	0	3
3	CS303PC	PCC	Object Oriented Programming through Java	3	0	0	3
4	CM304PC/ CS404PC	PCC	Software Engineering	3	0	0	3
5	CS305PC	PCC	Database Management Systems	3	0	0	3
6	CS306PC	PCC	Object Oriented Programming through Java Lab	0	0	2	1
7	CM307PC/ CS408PC	PCC	Software Engineering Lab	0	0	2	1
8	CS308PC	PCC	Database Management Systems Lab	0	0	2	1
9	MA309BS/ MA406BS	BSC	Computational Mathematics Lab	0	0	2	1
10	CS310SD	SDC	Skill Development Course-I: NodeJS	0	0	2	1
			Total Credits	15	1	10	21

II YEAR II SEMESTER

S. No.	Course Code	Category	Course Title	L	T	P	Credits
1	CS301PC/ CM401PC	PCC	Discrete Mathematics	3	0	0	3
2	CS402PC	PCC	Computer Networks	3	0	0	3
3	CS403PC	PCC	Design and Analysis of Algorithms	3	1	0	4
4	CS304PC/ CM404PC	PCC	Operating Systems	3	0	0	3
5	CD405PC	PCC	Introduction to Data Science	3	0	0	3
6	CS307PC/ CM406PC	PCC	Operating Systems Lab	0	0	2	1
7	CS407PC	PCC	Computer Networks Lab	0	0	2	1
8	CD408PC	PCC	Data Science Using R Lab	0	0	2	1
9	CS410SD	SDC	Skill Development Course-II: Data Visualization using Power BI/ R	0	0	2	1
10	VA311HS/ VA411HS	HSC	Environmental Science	1	0	0	1
			Total Credits	16	1	8	21

***Note:** Students who wish to exit after II Year II Semester has to register for this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer R25 Academic Regulations for more information.

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III YEAR I SEMESTER

S. No.	Course Code	Category	Course Title	L	T	P	Credits
1	CS501PC	PCC	Automata Theory & Compiler Design	3	0	0	3
2	CD502PC	PCC	Data Mining	3	0	0	3
3	MS503HS	HSC	Business Economics and Financial Analysis	3	0	0	3
4			Professional Elective-I /*MOOCS	3	0	0	3
5			Open Elective-I	3	0	0	3
6	CD504PC	PCC	Data Mining Lab	0	0	2	1
7	EN505HS	HSC	Advanced English Communication Skills Laboratory	0	0	2	1
8	CD506PROJ	PCC	Field Based Project/Internship	0	0	4	2
9	CS507SD	SDC	Skill Development Course-III: UI Design-Flutter	0	0	2	1
10	VA508HS/ VA608HS	HSC	Gender Sensitization*/Human Values and Professional Ethics*	1	0	0	1
			Total Credits	16	0	10	21

*Note: For the courses Gender Sensitization Lab and Human Values and Professional Ethics, one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization Lab is conducted this week, then a one-hour class for Human Values and Professional Ethics will be conducted in the following week.

*Moocs : Subject to the availability of NPTEL Equivalent courses

III YEAR II SEMESTER

S. No	Course Code	Category	Course Title	L	T	P	Credits
1	CD601PC	PCC	Data Stream Processing	3	0	0	3
2	CD602PC	PCC	Big Data Technologies	3	0	0	3
3	CD603PC	PCC	Machine Learning	3	0	0	3
4			Professional Elective-II/*MOOCS	3	0	0	3
5			Open Elective-II	3	0	0	3
6	CD604PC	PCC	Data Stream Processing Lab	0	0	2	1
7	CD605PC	PCC	Big Data Technologies Lab	0	0	2	1
8	CD606PC	PCC	Machine Learning Lab	0	0	2	1
9	CM607SD	SDC	Skill Development Course-IV: Prompt Engineering	0	0	2	1
10	VA510HS/ VA609HS	HSC	Indian Knowledge System	1	0	0	1
			Total Credits	16	0	08	20

*Moocs : Subject to the availability of NPTEL Equivalent courses

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CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

IV YEAR I SEMESTER

S. No.	Course Code	Category	Course Title	L	T	P	Credits
1	CD701PC	PCC	Predictive Analytics	3	0	0	3
2	CD702PC	PCC	Deep Learning	3	0	0	3
3			Professional Elective-III/*MOOCS	3	0	0	3
4			Professional Elective-IV/*MOOCS	3	0	0	3
5			Open Elective-III	3	0	0	3
6	CD703PC	PCC	Predictive Analytics Lab	0	0	2	1
7	CD704PC	PCC	Deep Learning Lab	0	0	2	1
8	CD705PROJ	PCC	Industry Oriented Mini Project/Summer Internship	0	0	4	2
9	CD706SEM	PCC	Technical Seminar	0	0	4	2
			Total Credits	15	0	12	21

*Moocs : Subject to the availability of NPTEL Equivalent courses

IV YEAR II SEMESTER

S. No.	Course Code	Category	Course Title	L	T	P	Credits
1			Professional Elective-V/*MOOCS	3	0	0	3
2			Professional Elective-VI/*MOOCS	3	0	0	3
3	CD801PROJ	PCC	Project Work	0	0	28	14
			Total Credits	6	0	28	20

*Moocs : Subject to the availability of NPTEL Equivalent courses

PROFESSIONAL ELECTIVES**Professional Elective-I**

1	CS511PE	Computer Graphics	3	0	0	3
2	CD512PE	Artificial Intelligence	3	0	0	3
3	CS513PE	Software Testing Methodologies	3	0	0	3
4	CS514PE	Adhoc & Sensor Networks	3	0	0	3
5	CS515PE	Web Programming	3	0	0	3
6	CS516PE	Distributed Systems	3	0	0	3

Professional Elective-II

1	CD621PE	Multi Agent Systems	3	0	0	3
2	CD622PE	Cryptography and Network Security	3	0	0	3
3	CS623PE	Software Project Management	3	0	0	3
4	CS624PE	Mining Massive Datasets	3	0	0	3
5	CS625PE	Full Stack Development	3	0	0	3
6	CS626PE	Generative AI	3	0	0	3

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26**CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD****Professional Elective-III**

1	CS731PE	Computer Vision	3	0	0	3
2	CD732PE	Blockchain Technology	3	0	0	3
3	CD733PE	Data Wrangling with R	3	0	0	3
4	CD734PE	Devops	3	0	0	3
5	CS735PE	Cloud Computing	3	0	0	3
6	CS736PE	Information Retrieval Systems	3	0	0	3

Professional Elective-IV

1	CS741PE	Augmented Reality & Virtual Reality	3	0	0	3
2	CS742PE	Agile Methodology	3	0	0	3
3	CD743PE	Web and Social Media Analytics	3	0	0	3
4	CS744PE	Quantum Computing	3	0	0	3
5	CS745PE	Robotic Process Automation	3	0	0	3
6	CS746PE	Cyber Forensics	3	0	0	3

Professional Elective-V

1	CS851PE	Social Media Mining	3	0	0	3
2	CS852PE	Nature-Inspired Computing	3	0	0	3
3	CS853PE	Internet of Things	3	0	0	3
4	CD854PE	Game Theory	3	0	0	3
5	CS855PE	Mobile Application Development	3	0	0	3
6	CS856PE	Human Computer Interaction	3	0	0	3

Professional Elective-VI

1	CS861PE	High Performance Computing	3	0	0	3
2	CS862PE	Edge Computing	3	0	0	3
3	CD863PE	Data Stream Mining	3	0	0	3
4	CD864PE	UI/UX design	3	0	0	3
5	CS865PE	Sustainable Engineering	3	0	0	3
6	CS866PE	Distributed Databases	3	0	0	3

OPENELECTIVES**Open Elective I:**

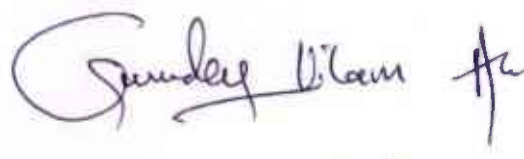
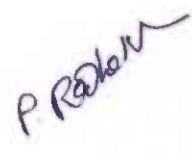
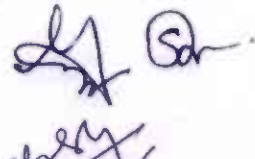
1	CM511OE	Fundamentals of AI	3	0	0	3
2	CD512OE	R Programming	3	0	0	3

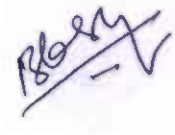
Open Elective II:

1	CM621OE	Introduction to Natural Language Processing	3	0	0	3
2	CD622OE	MERN Stack Development	3	0	0	3

Open Elective III:

1	CM731OE	Chatbots	3	0	0	3
2	CD732OE	Android Application Development	3	0	0	3



(Common to CSD, CSE, CSM, and ECE)

L	T	P	C
3	1	0	4

Objectives: To learn

1. Applying basic operations on matrices and their properties.
2. Concept of rank of the matrix and applying this concept to know the consistency and solve the system of linear equations.
3. Concept of eigenvalues and eigenvectors, and to reduce the quadratic form to canonical form
4. Geometrical approach to the mean value theorems and their application to mathematical problems
5. Finding maxima and minima of functions of two and three variables.
6. Evaluation of multiple integrals and their applications.

1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations
2. Find the eigenvalues and eigenvectors
3. Reduce the quadratic form to canonical form using orthogonal transformations.
4. Solve the applications of the mean value theorems.
5. Find the extreme values of functions of two variables with/ without constraints.
6. Evaluate the multiple integrals and apply the concept to find areas, volumes.

8L

Rank of a matrix by Echelon form and Normal form-Inverse of Non-singular matrices by Gauss-Jordan method. System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations. Gauss-Seidel Iteration Method.

10L

Linear Transformation and Orthogonal Transformation: 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 form by Orthogonal Transformation.

10L

Limits and Continuous of functions and its properties. Mean value theorems: Rolle's theorem - Lagrange's Mean value theorem with their Geometrical Interpretation and applications - Cauchy's Mean value Theorem - Taylor's Series (All the theorems without proof).

Curve Tracing: Curve tracing in Cartesian coordinates.

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UNIT-IV: Multivariable Calculus (Partial Differentiation and applications) 10

L Definitions of Limit and continuity-Partial Differentiation: Euler's Theorem-Total derivative-Jacobian - Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using the method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration) 10

L Evaluation of Double Integrals (Cartesian and polar coordinates)-change of order of integration (only Cartesian form) - Change of variables for double integrals (Cartesian to polar). Evaluation of Triple Integrals - Change of variables for triple integrals (Cartesian to Spherical and Cylindrical polar coordinates). Applications: Areas by double integrals and volumes by triple integrals.

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

AP102BS/ AP202BS: ADVANCED ENGINEERING PHYSICS

(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year I Sem.

L T P C
3 0 0 3

Pre-requisites: 10+2 Physics

Course Objectives:

1. To study crystal structures, defects, and material characterization techniques like XRD and SEM.
2. To understand fundamental concepts of quantum mechanics and their applications in solids and nanomaterials.
3. To introduce quantum computing principles, quantum gates, and basic quantum algorithms.
4. To learn the properties and applications of magnetic and dielectric materials.
5. To explore the working and applications of lasers and fiber optics in modern technology.

Course Outcomes:

1. **CO1:** Analyze crystal structures, identify defects, and apply XRD and SEM techniques for material characterization.
2. **CO2:** Apply quantum mechanical principles to explain particle behavior and energy band formation in solids.
3. **CO3:** Understand quantum computing concepts, use quantum gates, and explain basic quantum algorithms.
4. **CO4:** Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
5. **CO5:** Explain the principles of lasers and fibre optics and their applications in communication and sensing.

UNIT-I: Crystallography & Materials Characterization

Introduction: Unit cell, space lattice, basis, lattice parameters; crystal structures, Bravais lattices, packing factor: SC, BCC, FCC; Miller indices, inter-planar distance; defects in crystals (Qualitative): point defects, line defects, surface defects, and volume defects. concept of nanomaterials: surface to volume ratio, X-ray diffraction: Bragg's, powder method, calculation of average crystallite size using Debye Scherrer's formula, scanning electron microscopy (SEM): block diagram, working principle.

UNIT-II: Quantum Mechanics

Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics; operators in quantum mechanics, eigen values and eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, effective mass of electron, formation of energy bands, origin of bandgap, classification of solids, concept of discrete energy levels and quantum confinement in nanomaterials.

UNIT-III: Quantum Computing

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, evolution of quantum systems, quantum measurements, entanglement, quantum gates, challenges and advantages of quantum computing over classical computation, quantum algorithms: Deutsch-Jozsa, Shor, Grover.

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UNIT-IV: Magnetic and Dielectric Materials

Introduction to dielectric materials, types of polarization (qualitative): electronics, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM), load cell and fire sensor.

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, CO₂ laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle.

TEXTBOOKS:

1. Walter Borchardt-Ott, *Crystallography: An Introduction*, Springer.
2. Charles Kittel, *Introduction to Solid State Physics*, John Wiley & Sons, Inc.
3. Thomas G. Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove

1. Jozef Gruska, *Quantum Computing*, McGraw-Hill
2. Michael A. Nielsen & Isaac L. Chuang, *Quantum Information*, Cambridge University Press.
3. John M. Senior, *Optical Fiber Communications Principles and Practice*, Pearson Education Limited.

- <https://shijuinipallotti.wordpress.com/wp-content/uploads/2019/07/optical-fiber-communications-principles-and-pr.pdf>
- https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf
- <https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-Physics-Charles-Kittel.pdf>
- <https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf>
- <https://www.fi.muni.cz/usr/gruska/qbook1.pdf>
- <https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum-information-nielsen-chuang.pdf>

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

E103ES/ EE201ES: BASIC ELECTRICAL ENGINEERING
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year I Sem.

L T P C
3 0 0 3

Prerequisites: Mathematics**Course Objectives:**

- To understand DC and Single & Three-phase AC circuits
- To study and understand the different types of DC, AC machines, and transformers.
- To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

Course Outcomes: After learning the contents of this paper, the student must be able to

- Understand and analyze basic Electrical circuits
- Study the working principles of Electrical Machines and Transformers
- Introduce components of Low Voltage Electrical Installations.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand DC and Single & Three-phase circuits.	3	2	1		2	0	0	1	2	0	1	2
To study and understand the different types of DC, AC machines, and Transformers.	3	2	1	1	3	0	0	0	2	0	1	1
To import the knowledge of various electrical installations and the concept of power, power factor, and its improvement.	3	2	0		3	0	0	0	1	2	1	1

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Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand and Analyze basic Electrical circuits	3	2	1	0	1	0	0	0	2	0	2	2
Study the working principles of Electrical Machines and Transformers	3	2	1	0	3	1	0	1	1	2	1	2
Introduce components of Low Voltage Electrical Installations.	3	2	1	1	3	2	0	0	1	0	2	2

UNIT-I:

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-II:

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting, L, C, RL, RC, RLC combinations (series and parallel), resonance in a series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

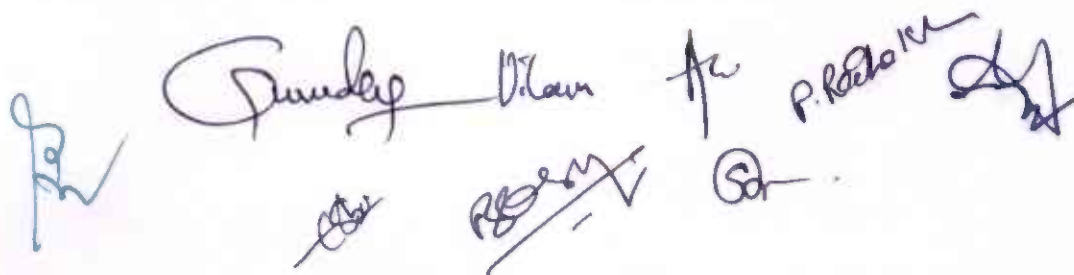
Transformers: Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV:

Electrical Machines: Construction and working principle of DC machine, performance characteristics of DC shunt machine. Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Significance of torque-slip characteristics. Single-phase induction motor, Construction and working. Construction and working of a synchronous generator.

UNIT-V:

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit(SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.



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TEXTBOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw-Hill, 2nd Edition, 2008.

REFERENCE BOOKS:

1. Basic Electrical Engineering ; Author, Dr. Ramana Pilla, Dr. M Surya Kalavathi & Dr. G T Chandra Sekhar ; Publisher, S. Chand Publishing
2. Kulshreshtha, D. C. (2009). *Basic Electrical Engineering*. McGraw-Hill.
3. Sukhija, M. S., & Nagsarkar, T. K. (2012). *Basic Electrical and Electronics Engineering* (1st ed.). Oxford University Press.
4. Chakrabarthy, A., Debnath, S., & Chanda, C. K. (2021). *Basic Electrical Engineering* (2nd ed.). McGraw-Hill.
5. Bobrow, L. S. (2011). *Fundamentals of Electrical Engineering*. Oxford University Press.
6. Hughes, E. (2010). *Electrical and Electronics Technology*. Pearson.
7. Toro, V. D. (1989). *Electrical Engineering Fundamentals*. Prentice Hall India.

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CS104ES: PROGRAMMING FOR PROBLEM SOLVING

(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of the C programming language.
4. To learn the usage of structured programming approaches in solving problems.

Course Outcomes: The student will learn

1. To write algorithms and to draw flowcharts for solving problems.
2. To convert the algorithms/flowcharts to C programs.
3. To code and test a given logic in the C programming language.
4. To decompose a problem into functions and to develop modular, reusable code.
5. To use arrays, pointers, strings, and structures to write C programs.
6. Searching and sorting problems.

UNIT - I: Overview of C/C Language Elements, Variable Declarations and Data Types, Executable Statements, General Form of a C Program, Arithmetic Expressions, Formatting Numbers in Program Output.

Selection Structures: Control Structures, Conditions, if Statement, if Statements with Compound Statements, Decision Steps in Algorithms.

Repetition and Loop Statements: Repetition in Programs, Counting Loops and the while Statement, computing a Sum or Product in a Loop, for Statement, Conditional Loops, Loop Design, Nested Loops, do-while Statement.

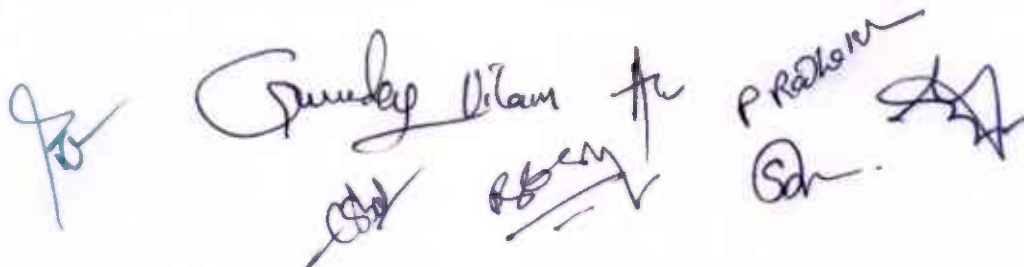
UNIT - II: Top-Down Design with Functions: Building Programs from Existing Information, Library Functions, Top-Down Design and Structure Charts, Functions without Arguments, Functions with Input Arguments.

Pointers and Modular Programming: Pointers and the Indirection Operator, Functions with Output Parameters, Multiple Calls to a Function with Input/ Output Parameters, Scope of Names, Formal Output Parameters as Actual Arguments.

UNIT -III: Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Using Array Elements as Function Arguments, Array Arguments, Searching and Sorting an Array, Parallel Arrays and Enumerated Types, Multidimensional Arrays.

Strings: String Basics, String Library Functions: Assignment and Substrings, Longer Strings: Concatenation and Whole-Line Input, String Comparison, Arrays of Pointers.

UNIT-IV: Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Recursive Functions with Array and String Parameters
 Structure and Union Types: User-Defined Structure Types, Structure Type Data as Input and Output Parameters, Functions with Structured Result Values, Union Types.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
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UNIT - V: Text and Binary File Pointers: Input/ Output Files - Review and Further Study, Binary Files, Searching a Database.

Searching and Sorting: Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort an array of elements (Bubble, Insertion, and Selection sort algorithms).

TEXTBOOKS:

1. Jeri R. Hanly and Elliot B. Koffman, Problem Solving and Program Design, 7th Edition, Pearson.
2. B.A. Forouzan and R.F. Gilberg, C Programming and Data Structures, Cengage Learning, (3rd Edition).

REFERENCE BOOKS:

1. Kernighan, B. W., & Ritchie, D. M. (1988). The C Programming Language. Prentice Hall of India.
2. Balagurusamy, E. (2008). Computer Fundamentals and C (2nd ed.). McGraw-Hill.
3. Kanetkar, Y. (2017). Let Us C (18th ed.). BPB Publications.
4. Dromey, R. G. (2008). How to Solve It by Computer (16th impression). Pearson.
5. Kochan, S. G. (2005). Programming in C (4th ed.). Pearson Education.
6. Schildt, H. (2000). C: The Complete Reference (4th ed.). McGraw-Hill.
7. Gottfried, B. (2010). Schaum's Outline of Programming with C. McGraw-Hill.

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Signature: Sundeep Kumar
Signature: P. Raghav
Signature: Ashish
Signature: Sar
Signature: Ravi
Signature: Chaitanya

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

ME105ES/ME205ES: COMPUTER AIDED ENGINEERING GRAPHICS LAB
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year I Sem.

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Course Objectives:

1. To introduce the fundamentals of engineering drawing and projection systems.
2. To develop skills in constructing orthographic, isometric, and sectional views.
3. To train students in interpreting and creating technical drawings using CAD tools.
4. To familiarize students with dimensioning standards and drafting conventions.
5. To bridge manual drafting techniques with computer-aided drafting practices.

Course Outcomes: At the end of the course, the student will be able to:

1. Understand and apply the principles of orthographic and isometric projections.
2. Create sectional views and dimensioned drawings using BIS standards.
3. Use CAD software to generate 2D engineering drawings.
4. Visualize and construct solid models from 2D views.
5. Interpret and produce engineering drawings of mechanical components and assemblies.
6. Demonstrated drafting skills for practical and industrial applications.

UNIT-I: Introduction to Engineering Graphics (Conventional)

Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales, Plain and Diagonal, Conic Sections, including the Rectangular Hyperbola, General method only. Cycloid, Epicycloid and Hypocycloid.

UNIT-II: Orthographic Projections (Conventional and Computer Aided)

Principles of Orthographic Projections, Conventions, Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer-aided orthographic projections, points, lines and planes. Introduction to Computer-Aided drafting, views, commands and conics.

UNIT-III: Projections of Regular Solids (Conventional and Computer Aided)

Auxiliary Views, Sections or Sectional views of Right Regular Solids, Prism, Cylinder, Pyramid, Cone, Auxiliary views, Computer-aided projections of solids, sectional views

UNIT-IV: Development of Surfaces (Conventional): Prism, Cylinder, Pyramid, and Cone.**UNIT-V: Isometric Projections (Conventional and Computer Aided)**

Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Isometric Views of Lines, Plane Figures, Simple and Compound Solids, Isometric Projection of objects having non-isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice Versa, Conventions. Conversion of orthographic projection into an isometric view.

Note:

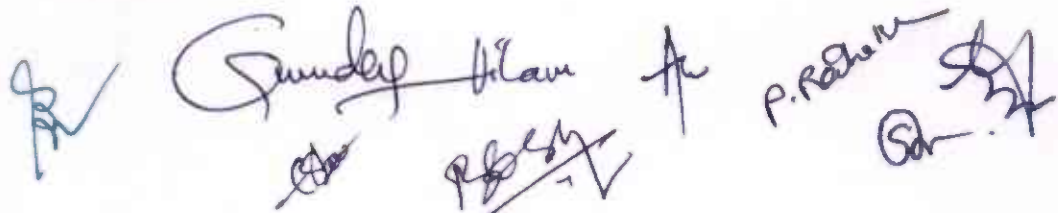
1. The End Semester Examination will be in conventional mode.
2. CIE-I will be in conventional mode.
3. CIE-II will be using a computer.

TEXTBOOKS:

1. Engineering Drawing, N.D. Bhatt, Charotar, 54th edition, 2023.
2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas, S. Chand and Company Ltd., 3rd Edition, 2010.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C.M. Agrawal, McGraw-Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley and Sons Inc., 3rd Edition, 2020.
3. Engineering Drawing, M.B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.
4. Engineering Drawing, N.S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. Computer-Aided Engineering Drawing, K. Balaveera Reddy, CBS Publishers, 2nd edition, 2015.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

AP106BS/ AP206BS: ADVANCED ENGINEERING PHYSICS LAB
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year I Sem.

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Course Objectives:

1. To provide practical exposure to advanced concepts in solid-state and modern physics.
2. To synthesize and study the physical properties of materials like semiconductors, ferromagnetic, and ferroelectric substances.
3. To perform semiconductor characterization using Hall effect and band gap experiments.
4. To explore the working principles of lasers and optical fibers through hands-on experiments.
5. To develop skills in data analysis, interpretation, and scientific reporting.

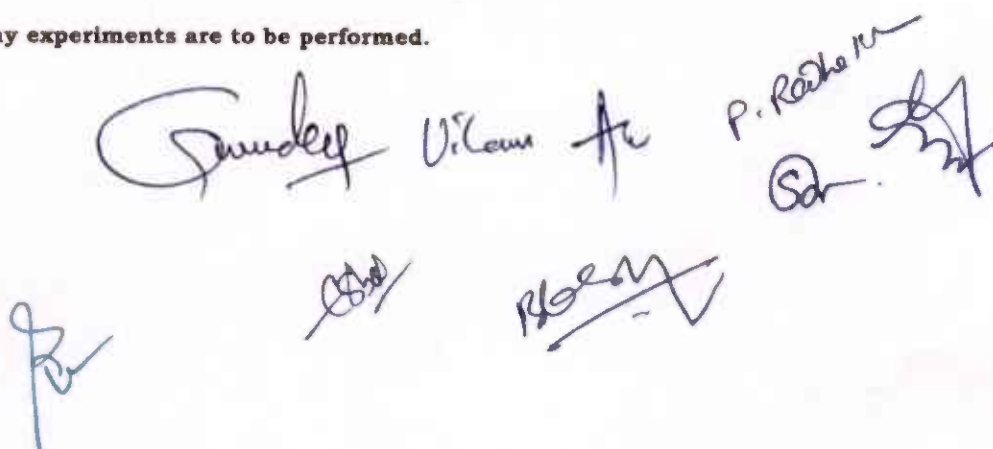
Course Outcomes:

1. **CO1:** Synthesize and analyze nanomaterials such as magnetite (Fe_3O_4) using chemical methods.
2. **CO2:** Determine key electrical, magnetic, and optical properties of semiconductors and other functional materials.
3. **CO3:** Characterizes semiconductors using Hall effect and energy gap measurement techniques.
4. **CO4:** Demonstrate working knowledge of laser systems and optical fiber parameters through experimental study.
5. **CO5:** Apply scientific methods for accurate data Collection, analysis, and technical report writing.

List of Experiments:

1. Synthesis of magnetite (Fe_3O_4) powder using the sol-gel method.
2. Determination of the energy gap semiconductor.
3. Determination of the Hall coefficient and carrier concentration of a given semiconductor.
4. Determination of magnetic moment of a bar magnet and horizontal earth magnetic field.
5. Study of the B-H curve of a ferromagnetic material.
6. Study of the P-E loop of a given ferroelectric crystal.
7. Determination of the dielectric constant of a given material.
8. Determination of Curie's temperature of a given ferroelectric material.
9. A) Determination of the wavelength of a laser using a diffraction grating.
 B) Study of V-I&L-I characteristics of a given laser diode.
10. A) Determination of the numerical aperture of a given optical fiber.
 B) Determination of bending losses of a given optical fiber.

Note: Any experiments are to be performed.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

EE107ES/ EE209ES: BASIC ELECTRICAL ENGINEERING LAB
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year I Sem.

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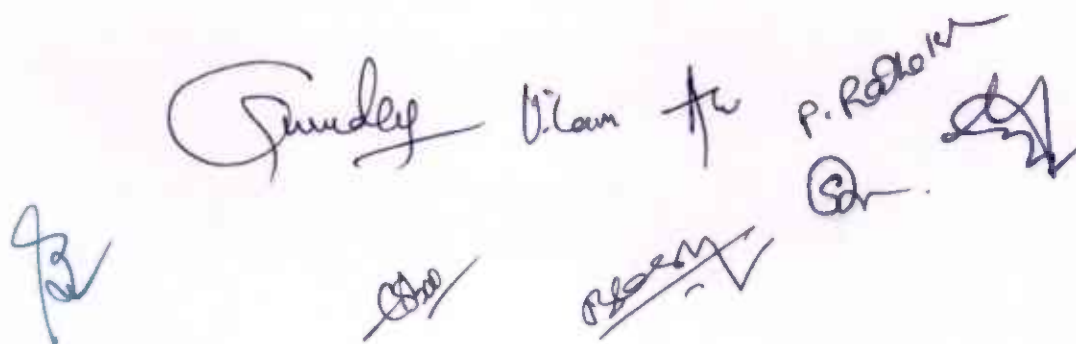
Prerequisites: Basic Electrical Engineering**Course Objectives:**

- To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
- To study the transient response of various R, L, and C circuits using different excitations.
- To determine the performance of different types of DC, AC machines, and transformers.

Course Outcomes: After learning the contents of this paper, the student must be able to

- Verify the basic electrical circuit through different experiments.
- Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
- Analyze the transient responses of R, L, and C circuits for different input conditions.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To measure the electrical parameters for different types of DC and AC circuits using the conventional and theorems approach	3	2	1		2	0	0	1	2	0	1	2
To study the transient response of various R, L, and C circuits using Different excitations	3	2	1	1	3	0	0	0	2	0	1	1
To determine the performance of different types of DC, AC machines And Transformers	3	2	0		3	0	0	0	1	2	1	1



 J. Suresh Kumar, P. Raghav, and other signatures.

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Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Verify the basic Electrical circuits through different experiments	3	2	1	0	1	0	0	0	2	0	2	2
Evaluate the performance calculations of Electrical Machines and Transformers through various Testing methods	3	2	1	0	3	1	0	1	1	2	1	2
Analyze the transient responses of R, L, and C circuits for different input conditions	3	2	1	1	3	2	0	0	1	0	2	2

List of experiments/ demonstrations:

PART-A(compulsory)

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorems
3. Transient Response of Series RL and RC Circuits for DC Excitation
4. Resonance in a Series RLC Circuit
5. Calculations and Verification of Impedance and Current of RL, RC, and RLC series circuits
6. Measurement of Voltage, Current, and Real Power in Primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

PART-B (any two experiments from the given list)

1. Verification of the Superposition Theorem.
2. Three-Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)
3. Load Test on Single-Phase Transformer (Calculate Efficiency and Regulation)
4. Measurement of Active and Reactive Power in a balanced three-phase circuit
5. No-Load Characteristics of a Three-phase Alternator

TEXTBOOKS:

1. D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", Tata McGraw-Hill, 4th Edition, 2019.
2. M S Naidu and S Kamakshiah, "Basic Electrical Engineering", Tata McGraw-Hill, 2nd Edition, 2008.

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Dr. P. Raghav
 Dr. R. Raghav
 Dr. R. Raghav
 Dr. R. Raghav

COMPUTER SCIENCE AND ENGINEERING-[DATA SCIENCE] 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

REFERENCEBOOKS:

1. Ramana, P., Suryakalavathi, M., & Chandrasheker, G. T. (2019). *Basic Electrical Engineering* (2nd ed.). S. Chand.
2. Kulshreshtha, D. C. (2009). *Basic Electrical Engineering*. McGraw-Hill.
3. Sukhija, M. S., & Nagsarkar, T. K. (2012). *Basic Electrical and Electronics Engineering* (1st ed.). Oxford University Press.
4. Chakrabarthy, A., Debnath, S., & Chanda, C. K. (2021). *Basic Electrical Engineering* (2nd ed.). McGraw-Hill.
5. Bobrow, L. S. (2011). *Fundamentals of Electrical Engineering*. Oxford University Press.
6. Hughes, E. (2010). *Electrical and Electronics Technology*. Pearson.
7. Toro, V. D. (1989). *Electrical Engineering Fundamentals*. Prentice Hall India.

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Dr. Ramana P. Suryakalavathi M. Chandrasheker G. T.

Dr. Kulshreshtha D. C.

Dr. Sukhija M. S. & Nagsarkar T. K.

Dr. Chakrabarthy A. Debnath S. & Chanda C. K.

Dr. Bobrow L. S.

Dr. Hughes E.

Dr. Toro V. D.

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS108ES: PROGRAMMING FOR PROBLEM SOLVINGLAB
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year I Sem.

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[Note: The programs may be executed using any available Open Source/freely available IDE. Some of the Tools available are:

CodeLite: <https://codelite.org/>

Code::Blocks: <http://www.codeblocks.org/>

DevCpp: <http://www.bloodshed.net/devcpp.html>

Eclipse: <http://www.eclipse.org>

This list is not exhaustive and is NOT in any order of preference.

Course Objectives: The students will learn the following:

1. To work with an IDE to create, edit, compile, run, and debug programs
2. To analyze the various steps in program development.
3. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements, etc.
4. To develop modular, reusable, and readable C Programs using concepts like functions, arrays, etc.
5. To write programs using the Dynamic Memory Allocation concept.
6. To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:

1. Formulate the algorithms for simple problems
2. Translate the given algorithms to a working and correct program
3. Correct syntax errors as reported by the compilers
4. Identify and correct logical errors encountered during execution
5. Represent and manipulate data with arrays, strings, and structures
6. Use pointers of different types
7. create, read and write to and from simple text and binary files
8. Modularize the code with functions so that they can be reused

PRACTICE SESSIONS:**Simple numeric problems:**

- a) Write a program for finding the max and min from the three numbers.
- b) Write the program for the simple, compound interest.
- c) Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:

5x 1=5
5x 2=10
5x 3=15

- d) Write a program that shows the binary equivalent of a given positive number between 0 to 255.

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P. Reddy
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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
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Expression Evaluation:

- a) Write a program which takes two integer operands and one operator from the user, performs the operation, and then prints the result. (Consider the operators +, -, *, /, %, and use Switch Statement).
- b) Write a program that finds if a given number is a prime number.
- c) Write a C program to find the sum of individual digits of a positive integer and test given number is a palindrome.
- d) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

Arrays, Pointers and Functions:

- a) Write a C program to find the minimum, maximum and average in an array of integers.
- b) Write a C program that uses functions to perform the following:
 - I. Addition of Two Matrices
 - II. Multiplication of Two Matrices
- c) Write a program for reading elements using a pointer into an array and display the values using the array.
- d) Write a program for display values reverse order from an array using a pointer.

Files:

- a) Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
- b) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).

Strings:

- a) Write a C program that uses functions to perform the following operations:
 - 1) To insert a sub-string into a given main string from a given position.
 - 2) To delete n Characters from a given position in a given string
- b) Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
- c) Write a C program that displays the position of a character ch in the string S or -1 if S doesn't contain ch.
- d) Write a C program to count the lines, words, and characters in a given text.

Sorting and Searching:

- a) Write a C program that uses a non-recursive function to search for a key value in a given list of integers using the **Linear Search** method.
- b) Write a C program that uses a non-recursive function to search for a key value in a given **sorted** list of integers using the **Binary Search** method.
- c) Write a C program that implements the **Bubble Sort** method to sort a given list of integers in ascending order.
- d) Write a C program that sorts the given array of integers using the **Selection Sort** method in descending order.
- e) Write a C program that sorts the given array of integers using the **Insertion Sort** method in ascending order.
- f) Write a C program that sorts a given array of **names** (strings).

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CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

TEXTBOOKS:

1. Hanly, J. R., & Koffman, E. B. (2012). *Problem Solving and Program Design in C* (7th ed.). Pearson.
2. Forouzan, B. A., & Gilberg, R. F. (2007). *C Programming and Data Structures* (3rd ed.). Cengage Learning.

REFERENCE BOOKS:

1. Kernighan, B. W., & Ritchie, D. M. (1988). *The C Programming Language*. Prentice Hall of India.
2. Balagurusamy, E. (2008). *Computer Fundamentals and C* (2nd ed.). McGraw-Hill.
3. Kanetkar, Y. (2017). *Let Us C* (18th ed.). BPB Publications.
4. Dromey, R. G. (2008). *How to Solve It by Computer* (16th impression). Pearson.
5. Kochan, S. G. (2005). *Programming in C* (4th ed.). Pearson Education.
6. Schildt, H. (2000). *C: The Complete Reference* (4th ed.). McGraw-Hill.
7. Gottfried, B. (2010). *Schaum's Outline of Programming with C*. McGraw-Hill.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CM109ES/ CS210ES: IT WORKSHOP

(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year I Sem.

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Course Objectives: The IT Workshop for engineers is a training lab course read over 60 hours. The modules include training on PC hardware, Internet & World Wide Web, and productivity tools including Word, Excel, PowerPoint and Publisher.

Course Outcomes:

- Perform Hardware troubleshooting
- Understand Hardware components and interdependencies
- Safeguard computers from viruses/worms
- Document/Presentation preparation
- Perform calculations using spreadsheets

PC Hardware

Task 1:

Identify the peripherals of a computer, components in a CPU, and their functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit it 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. Students also need to go through the video which shows the process of assembling a PC. A video will be provided as part of the course content.

Task 3:

Every student should individually install **MS Windows** on the personal computer. The lab instructor should verify the installation and follow it up with a viva.

Task 4:

Every student should install **Linux** on the computer (which already has Windows installed). The system should be configured as a **dual boot** with both Windows and Linux. Lab instructors should verify the installation and follow it up with a viva.

Internet & World Wide Web

Task 1:

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 websites and email.

If there is no internet connectivity, instructors should 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 them. A few topics will be given to the students for which they need to search on Google. This should be demonstrated to the instructors.


P. Reddy
Sah.

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Task 4:

Cyber Hygiene – Students will be exposed to various threats on the Internet and asked to configure their computers to be safe online. They need to customize their browsers to block pop-ups and block ActiveX downloads to avoid viruses and/or worms.

LaTeX and WORD**Task 1 – Word Orientation:**

The mentor needs to give an overview of **LaTeX** and **Microsoft (MS) Office** or equivalent **FOSS** tool Word.

Explain the importance of LaTeX and MS Office (or equivalent FOSS tool Word) as documentation tools.

LaTeX and WORD

Task1-Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word

to create a project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 3: Creating project abstract Features to be covered: -Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spellcheck, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and WordArt, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel

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.

Task1: Creating a Scheduler-Features to be covered: Gridlines, Format Cells, Summation, autofill, 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

Task3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

PowerPoint

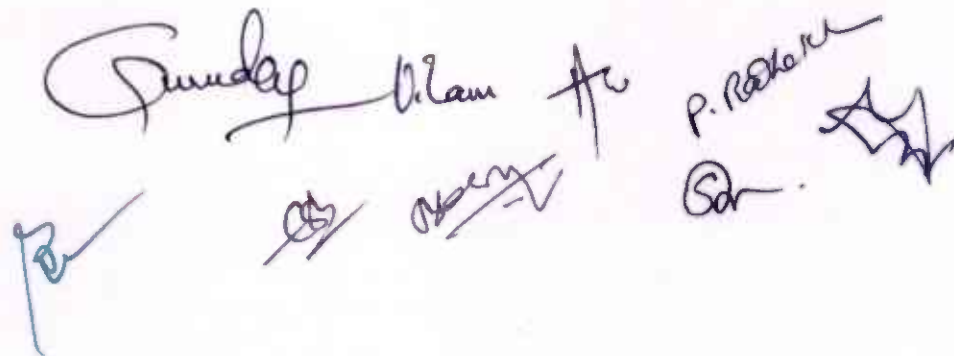
Task 1: Students will be Working on basic power point utilities and tools which help them create basic PowerPoint presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

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

Task3: Master Layouts(slide, template, and notes),Types of views(basic, presentation, slides lotter, notes etc), and Inserting - Background, textures, Design Templates, Hidden slides.

REFERENCEBOOKS:

- 1) Comdex Information Technology Course Toolkit - Vikas Gupta, WILEY Dreamtech.
- 2) The Complete Computer Upgrade and Repair Book, 3rd Edition - Cheryl A. Schmidt, WILEY Dreamtech.
- 3) Introduction to Information Technology - ITL Education Solutions Limited, Pearson Education.
- 4) PC Hardware: A Handbook - Kate J. Chase, PHI (Microsoft).
- 5) LaTeX Companion - Leslie Lamport, PHI/Pearson.
- 6) IT Essentials PC Hardware and Software Companion Guide, Third Edition - David Anfinson and Ken Quamme, CISCO Press, Pearson Education.
- 7) IT Essentials PC Hardware and Software Labs and Study Guide, Third Edition - Patrick Regan, CISCO Press, Pearson Education.


The block contains several handwritten signatures and initials in black ink. From left to right, there is a signature that appears to be 'Sundar', followed by 'V. Ram', and 'H. C.'. Below these are some initials, including 'P. R.' and 'S. R.'. To the right, there is a signature that appears to be 'P. R.' and another that appears to be 'S. R.' with a star-like symbol next to it.

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

MS110HS: Introduction to Social Innovation
(Common to CSD, CSE, CSM, and ECE)

B.Tech- I Year I Sem

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Course Objectives:

1. To understand the structure, features, and needs of various communities.
2. To introduce principles of service-based learning aligned with Sustainable Development Goals (SDGs).
3. To build skills in community engagement: visits, reporting, and resource mapping.
4. To familiarize students with the role of different social sectors.
5. To develop awareness of professional ethics and ethical decision-making in engineering.

Course Outcomes:

1. Identify and analyse different community types and their characteristics.
2. Apply service-learning concepts to real-world social and developmental goals.
3. Conduct community visits and prepare structured reports with visual mapping tools.
4. Evaluate the contributions of non-profits, government agencies, and businesses in community development.
5. Recognize ethical dilemmas in engineering practice and apply professional codes of conduct to resolve them.

Week 1: Explore different types of community's villages, towns, cities, and regions and their features.

Week 2: Learn about service-based learning, community project goals, and the United Nations' Sustainable Development Goals (SDGs).

Week 3: Visit a community, practice report writing, create resource maps, chapatti diagrams, and guided walks.

Week 4: Study roles of non-profits, government agencies, businesses, and informal groups in society.

Week 5: Prepare and present a poster on the four societal sectors studied.

Week 6: Learn the complete design thinking process for creative problem solving.

Week 7: Understand how social groups and movements support communities and bring change.

Week 8: Explore social software and open-source tools for collaboration and knowledge sharing.

Week 9: Introduction to ethics, values, and professional codes for engineers.

Week 10: Identify ethical issues in engineering and apply moral rules and codes to address them.

Week 11: Analyze real-life engineering ethics through case studies.

Week 12: Learn documentation, basics of patents and prepare a poster presentation.

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

REFERENCE BOOKS:

1. Project Management for the Unofficial Project Manager, Kory Kogon, Suzette Blakemore, James Wood, Ben Bella Books, 2015.
2. The Community Development Reader, James DeFilippis, Susan Saegert, Routledge, 2nd Edition, 2012.
3. Managing Community Projects: A Practical Guide, Richard P. Nathan, Kumarian Press, 2006.
4. Participatory Approaches in Community Development, Henry A. B. Quansah, Routledge, 2018.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

MA102BS/ MA201BS: ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.

L T P C
3 0 0 3

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn

1. Methods of solving the differential equations of first and higher order.
2. Concept, properties of Laplace transforms.
3. Solving ordinary differential equations using Laplace transform techniques.
4. The physical quantities involved in the engineering field related to vector-valued functions
5. The basic properties of vector-valued functions and their applications to line, surface, and volume integrals

Course outcomes: After learning the contents of this paper, the student must be able to

1. Identify whether the given differential equation of first order is exact or not
2. Solve higher differential equations and apply the concept of differential equations to real-world problems.
3. Use the Laplace Transform techniques for solving Ordinary Differential Equations.
4. Evaluate the line, volume integrals, and convert them from one to another.

UNIT-I: First Order Ordinary Differential Equations

8 L

Exact differential equations—Equations reducible to exact differential equations—linear and Bernoulli's equations—Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's cooling – Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order

10

L Higher order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in x , $e^{ax}V(x)$ and $xV(x)$ — Method of variation of parameters.

UNIT-III: Laplace Transforms

10L

Laplace Transforms: Laplace Transform of standard functions – First shifting theorem – Laplace transforms of functions multiplied by 't' and divided by 't' – Laplace transforms of derivatives and integrals of function – Evaluation of integrals by Laplace transforms – Laplace transform of periodic functions – Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by the Laplace Transform method.

UNIT-IV: Vector Differentiation

10L

Vector point functions and scalar point functions – Gradient – Divergence and Curl – Directional derivatives – Vector Identities – Scalar potential functions – Solenoidal and Irrotational vectors.

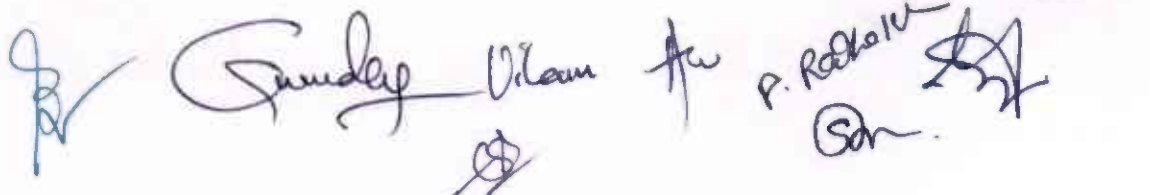
UNIT-V: Vector Integration

10L

Line, Surface, and Volume Integrals. Theorems of Green, Gauss, and Stokes (without proofs) and their applications

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

H101BS/ CH202BS: ENGINEERING CHEMISTRY

(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.

L T P C

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Course Objectives:

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes:

1. Students will be able to understand the fundamental properties of water and its applications in both domestic and industrial purposes.
2. Students will gain basic knowledge of electrochemical processes and their relevance to corrosion and its control methods.
3. Students will comprehend the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.
4. Students will learn the basic concepts and properties of polymers and other engineering materials.
5. Students will be able to apply the principles of UV-Visible, IR spectroscopy and Raman spectroscopy in analyzing pollutants in dye industries and biomedical applications.

UNIT-I: Water and its treatment:[8]

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break-point chlorination. Defluoridation - Nalgonda technique.

Boiler troubles: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods - Softening of water by ion-exchange processes. Desalination of brackish water - Reverse osmosis.

UNIT-II: Electrochemistry and Corrosion:[8]

Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - Numerical problems. Types of electrodes, reference electrodes - Primary reference electrode- Standard Hydrogen Electrode (SHE), Secondary reference electrode- Calomel electrode. Construction, working and determination of pH of unknown solution using SHE and Calomel electrode.

Corrosion: Introduction- Definition, causes and effects of corrosion - Theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion-Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.






COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

UNIT-III: Energy sources:[8]

Batteries: Introduction - Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium-ion battery. Fuel Cells - Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).

Fuels: Introduction and characteristics of a good fuel, Calorific value-Units-HCV, LCV-Dulong's formula - Numerical problems.

Fossil fuels: Introduction, Classification, Petroleum-Refining of Crude Oil, Cracking-Types of Cracking

-Moving bed catalytic cracking. LPG and CNG composition and use.

Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hydrothane and Green Hydrogen.

UNIT-IV: Polymers: [8]

Definition-Classification: Based on origin and tacticity with examples-Types of polymerizations - Addition (free radical addition mechanism) and condensation polymerization.

Plastics, Elastomers and Fibers: Definition and applications (PVC, Buna-S, Nylon-6,6).

Differences between thermoplastics and thermo-setting plastics, Fiber-reinforced plastics (FRP).

Conducting polymers: Definition and Classification with Examples-Mechanism of Conduction- poly-acetylene and applications of conducting polymers.

Biodegradable Polymers: Polylactic Acid and Its Applications.

UNIT-V- Advanced Functional Materials:[8]

Smart materials: Introduction, Classification with examples - Shape Memory Alloys - Nitinol, Piezoelectric materials - quartz and their engineering applications.

Biosensor-Definition, Amperometric Glucose Monitor sensor.

Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision security, Pollution Under Control-Cosensor (Passive Infrared detection), Raman spectroscopy (application) - Tumor detection in medical applications.

TEXTBOOKS:

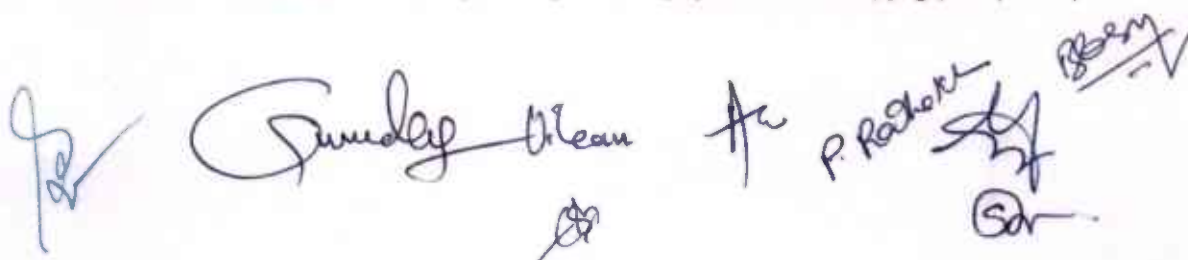
1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Dr.P. Aparna, and Rath, Cengage learning, 2025.

REFERENCE BOOKS:

1. Engineering Chemistry: by Thirumala Chary Laxmi Narayana & Shashikala, Pearson Publications (2020)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company(P)Ltd.Delhi 2011.
3. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
4. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
5. Challenges and Opportunities in Green Hydrogen by Editors: Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
6. Raman Spectroscopy in Human Health and Biomedicine,
<https://www.worldscientific.com/doi/epdf/10.1142/13094>

E-Content-<https://doi.org/10.1142/13094> | October 2023

E-books-<https://archive.org/details/EngineeringChemistryByShashiChawla/page/n111/mode/2u>



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

EN103HS/ EN203HS: ENGLISH FOR SKILL ENHANCEMENT

(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.

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INTRODUCTION

National Education Policy-2020 aims at preparing students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. It also emphasizes language study and promotion of languages through understanding and proper interpretation. English language is central to the educational ecosystem. The importance of language as medium of communication for personal, social, official and professional needs to be emphasized for clear and concise expression. Teaching and learning of receptive and productive skills viz., Listening, Speaking, Reading and Writing (LSRW) are to be taught and learnt effectively in the undergraduate Engineering programs. Learners should be encouraged to engage in a rigorous process of learning to become proficient users of English language by adopting a deeply focused and yet flexible approach as opposed to rote learning.

In this connection, suitable syllabus, effective pedagogy, continuous assessments and students' involvement result in productive learning. This course supports the latest knowledge and skill requirements and shall meet specified learning outcomes. The main objectives of English language teaching and learning as medium of communication and for promotion of cultural values are embedded in this syllabus. Efforts are being made in providing a holistic approach towards value-based language learning which equips the learner with receptive as well as productive skills.

The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures in the areas of vocabulary, grammar, reading, and writing. For this, the teachers should use the prescribed textbook for detailed study. The students should be encouraged to read the texts, leading to reading comprehension. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, and promotional material.

LEARNING OBJECTIVES: This course will enable the students to:

- Improve their vocabulary.
- Use appropriate sentence structures in their oral and written communication.
- Develop their reading and study skills.
- Equip students to write paragraphs, essays, précis and draft letters.
- Acquire skills for technical report writing.

COURSE OUTCOMES: Students will be able to:

- Choose appropriate vocabulary in their oral and written communication.
- Demonstrate their understanding of the rules of functional grammar and sentence structures.
- Develop comprehension skills from known and unknown passages.
- Write paragraphs, essays, a precis and draft letters.
- Write abstracts and reports in various contexts.

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Gundep Alam, P. Reddy, and others.

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

SYLLABUS: The course content/study material is divided into five units.

UNIT -I

Theme: Perspectives

Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World*, published by Orient Black Swan Pvt. Ltd.

Vocabulary: The Concept of Word Formation-The Use of Prefixes and Suffixes-Words Often Misspelt - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech, particularly Articles and Prepositions - Degrees of Comparison

Reading: Reading and Its Importance-Sub Skills of Reading-Skimming and Scanning.

Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation-Techniques for Writing Precisely-Nature and Style of Formal Writing.

UNIT-II

Theme: Digital Transformation

Lesson on Emerging Technologies from the prescribed textbook titled *English for the Young in the Digital World*, published by Orient Black Swan Pvt. Ltd.

Vocabulary: Homophones, Homonyms, and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-Pronoun Agreement and Subject-verb Agreement.

Reading: Reading Strategies-Guessing Meaning from Context- Identifying Main Ideas- Exercises for Practice

Writing: Paragraph Writing - Types, Structures and Features of a Paragraph - Creating Coherence - Linkers and Connectives - Organizing Principles in a Paragraph - Defining- Describing People, Objects, Places and Events - Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

UNIT-III

Theme: Attitude and Gratitude

Poems on 'Leisure' by William Henry Davies and 'Be Thankful'-Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.

Vocabulary: Words Often Confused-Words from Foreign Languages and Their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading - Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume-Difference between Writing a Letter and an Email - Email Etiquette.

UNIT-IV

Theme: Entrepreneurship

Lesson on 'Why a Start-Up Needs to Find its Customers First' by Pranav Jain from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.

Vocabulary: Standard Abbreviations in English - Inferring Meanings of Words through Context - Phrasal Verbs - Idioms.

Grammar: Redundancies and Clichés in Written Communication - Converting Passive to Active Voice and Vice-Versa.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

Reading: Prompt Engineering Techniques-Comprehending and Generating Appropriate Prompts
- Exercises for Practice

Writing: Writing Practices- Note Making- Precis Writing.

UNIT-V

Theme: Integrity and Professionalism

Lesson on 'Professional Ethics' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.

Vocabulary: Technical Vocabulary and their Usage- One Word Substitutes-Collocations.

Grammar: Direct and Indirect Speech-Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Inferring the Meaning and Evaluating a Text- Exercises for Practice

Writing: Report Writing- Technical Reports-Introduction-Characteristics of a Report - Categories of Reports Formats- Structure of Reports (Manuscript Format)-Types of Reports- Writing a Technical Report.

Note: Listening and Speaking skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.

- **(Note:** As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech. First Year is **Open-ended**, besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.)

TEXTBOOK:

1. Board of Editors. 2025. *English for the Young in the Digital World*. Orient Black Swan Pvt. Ltd.

REFERENCE BOOKS:

1. Swan, Michael. (2016). *Practical English Usage*. Oxford University Press, New Edition.
2. Karal, Rajeevan. (2023). *English Grammar Just for You*. Oxford University Press, New Delhi.
3. (2024). *Empowering with Language: Communicative English for Undergraduates*. Cengage Learning India Pvt. Ltd., New Delhi.
4. Sanjay Kumar & Pushp Lata. (2022). *Communication Skills - A Workbook*. Oxford University Press, New Delhi.
5. Wood, F. T. (2007). *Remedial English Grammar*. Macmillan.
6. Vishwa mohan, Aysha. (2013). *English for Technical Communication for Engineering Students*. McGraw-Hill Education India Pvt. Ltd.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS204ES: DATA STRUCTURES
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.

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Prerequisites: A course on "Programming for Problem Solving"**Course Objectives**

- Exploring basic data structures such as stacks and queues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs.
- Introduces sorting and pattern-matching algorithms.

Course Outcomes

- Ability to select the data structures that efficiently model the information in a problem.
- Ability to assess efficiency trade-offs among different data structure implementations or combinations.
- Implement and know the application of algorithms for sorting and pattern matching.
- Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and AVL-trees.

UNIT-I

Introduction to Data Structures: Basic Terminology, Classification of Data Structures, Operation on Data Structures, abstract data types, selecting a Data Structure, Linear list – Introduction, singly linked list, Circular Linked Lists, Doubly Linked List, Stacks- Operations, Stack algorithm, Stack ADT, Stack applications, Queues- operations, Queue Algorithm, Queue ADT, Queue Applications.

UNIT-II

Trees: Introduction, Types of Trees, creating a Binary Tree from a General Tree, traversing a Binary Tree, Binary Search Trees (BST), BST Operations- Searching, Insertion and Deletion, BST ADT, BST Applications, Threaded Binary Trees, AVL Trees, Red -Black Trees, Splay Trees

UNIT-III

Multiway Search Trees: Introduction, B-Trees, B-Trees ADT, 2-3Trees, 2-3-Tree, B*Tree, B+ Trees Heaps: Binary Heaps, Binomial Heaps, Fibonacci Heaps, Comparison of Various Heaps, Applications Searching: Introduction, Interpolation Search, Jump search

UNIT-IV

Graphs: Introduction, Directed Graphs, Bi-connected Components, Representation of Graphs, Graph Traversal Algorithms, Graph ADT, Applications of Graphs
Sorting: Radix Sort, Heapsort, Shell Sort, Tree Sort,

UNIT-V

Hashing and Collision: Introduction, Hash Tables, Hash Functions, Different Hash Functions: Division Method, Multiplication Method, Mid-square Method, Folding Method; collisions: Collision Resolution by Open Addressing, Collision Resolution by Chaining
Files and their Organization: Introduction, Data hierarchy, File Attributes, Text and Binary Files, Basic File Operations, File Organization, Indexing

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

TEXTBOOKS:

1. Data Structures: A Pseudocode Approach with C, 2nd Edition, R.F.Gilberg and B.A.Forouzan, Cengage Learning
2. Data Structure using C-Reema Thareja, 3rd Edition, Oxford University Press.

REFERENCE BOOKS:

1. Data Structures using C-A.S.Tanenbaum, Y.Langsam and M.J.Augenstein, PHI/Pearson Education.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

EC105ES/ EC205ES: ELECTRONIC DEVICES AND CIRCUITS
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.

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Course Overview: This course introduces fundamental semiconductor devices and their behavior, including diodes, BJTs, and FETs. It covers their characteristics, applications, and the analysis of basic electronic circuits. The course also explores rectifiers, voltage regulation, amplifier design, and advanced semiconductor technologies like Fin FETs and CNTFETs. Emphasis is placed on developing a strong foundation for analog circuit design and understanding modern device technologies in electronics.

Course Outcomes: By the end of this course, students will be able to:

CO1: Analyze the electrical characteristics the min rectifier and clipping circuits.

CO2: Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) and analyze their input and output characteristics.

CO3: Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications.

CO4: Analyze transistor amplifier circuits using h-parameter models and assess performance for various configurations.

CO5: Analyze the structure, working, and characteristics of JFETs, MOSFETs, and advanced devices like Fin FETs and CNTFETs, and compare modern device technologies.

Course Articulation Matrix

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	1	-	-	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	-
CO3	3	3	3	2	1	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	1
CO5	3	3	2	2	2	1	-	-	-	-	2

Syllabus:

UNIT-I:

Diode Characteristics and Applications: PN junction diode – I-V characteristics, Diode resistance and capacitance, Diode models (Ideal, Simplified, Piece wise Linear), Rectifiers–Half-wave, Full-wave (Center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers, Zener diode – I-V characteristics and voltage regulation.

UNIT-II:

Bipolar Junction Transistor (BJT): Structure and working principle of BJT, Current components and transistor action, Configurations: Common Base (CB), Common Emitter (CE), Common Collector (CC), Input and output characteristics, Determination of h-parameters from transistor characteristics.

UNIT-III:

BJT Biasing: Need for biasing and stabilization, Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Voltage divider bias, Stability factors and thermal runaway

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

UNIT-IV:

Transistor Amplifiers: Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model – with and without emitter bypass capacitor.

UNIT-V:

Special Purpose Diodes: Principle of Operation of-SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode

Field Effect Transistors and Advanced Devices: JFET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion modes – Structure, operation, and characteristics, Advanced Devices: FinFETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET.

TEXTBOOKS:

1. Millman, Jacob, and Christos C. Halkias. *Electronic Devices and Circuits*. Tata McGraw-Hill, 1991.
2. Boylestad, Robert L., and Louis Nashelsky. *Electronic Devices and Circuit Theory*. Pearson, 11th ed., 2013.
3. Sedra, Adel S., and Kenneth C. Smith. *Microelectronic Circuits*. Oxford University Press, 7th ed., 2014.

REFERENCE BOOKS:

1. Bell, David A. *Electronic Devices and Circuits*. Oxford University Press, 5th ed., 2008.
2. Neamen, Donald A. *Electronic Circuit Analysis and Design*. McGraw-Hill, 2nd ed., 2001.
3. Salivahanan, S., and N. Suresh Kumar. *Electronic Devices and Circuits*. McGraw-Hill Education, 4th ed., 2017.
4. Razavi, Behzad. *Fundamentals of Microelectronics*. Wiley, 2nd ed., 2013.
5. Taur, Yuan, and Tak H. Ning. *Fundamentals of Modern VLSI Devices*. Cambridge University Press, 2nd ed., 2009.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CH106BS/ CH206BS: ENGINEERING CHEMISTRY LAB
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.**L T P C**
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Course Description: The course includes experiments based on fundamental principles of chemistry essential for engineering students, aiming to develop practical skills and reinforce theoretical concepts.

Course Objectives

1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon-6, 6 in the laboratory.
5. Students will learn to determine the unknown concentration of potassium permanganate (KMnO_4) using a calibration curve.

Course Outcomes:

1. Students will develop practical skills through hands-on chemistry experiments relevant to engineering.
2. Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions.
3. Students will be able to apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions.
4. Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6.
5. Students will understand the working principle of colorimetry and the relationship between absorbance and concentration (Beer-Lambert Law).

List of Experiments:**I. Volumetric Analysis:**

- Estimation of hardness of water by EDTA complexometry method.

II. Conductometry:

1. Estimation of the concentration of strong acid by Conductometry.
2. Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry.

III. Potentiometry:

1. Estimation of concentration of Fe^{2+} ion by Potentiometry using KMnO_4 .
2. Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone.

IV. pH Metry:

- Determination of an acid concentration using pH meter.

V. Colorimetry:

- Verification of Lambert-Beer's law using KMnO_4 .

VI. Preparations:

1. Preparation of Bakelite.
2. Preparation of Nylon-6,6.

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
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VII. Corrosion:

- Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

VIII. Virtual Lab Experiments:

1. Construction of fuel cell and its working.
2. Smart materials for biomedical applications.
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

REFERENCE BOOKS:

1. *Lab Manual for Engineering Chemistry* – B. Ramadevi and P. Aparna, S. Chand Publications, New Delhi (2022).
2. *Vogel's Textbook of Practical Organic Chemistry* (5th Edition).
3. *Inorganic Quantitative Analysis* – A. I. Vogel, ELBS Publications.
4. *College Practical Chemistry* – V. K. Ahluwalia, Narosa Publications Ltd., New Delhi (2007).

Gundeep Vilam for P. Rakesh
Ramesh
S. Ramesh

for

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS207ES: DATA STRUCTURES LAB
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.**LTPC**
0021**Prerequisites:** 1. A Course on "Programming for problem solving".**Course Objectives:**

1. It covers various concepts of the C programming language.
2. It introduces searching and sorting algorithms.
3. It provides an understanding of data structures such as stacks and queues.

Course Outcomes:

1. Ability to develop C programs for computing and real-life applications using basic elements like control statements, arrays, functions, pointers and strings, and data structures like stacks, queues and linked lists.
2. Ability to Implement searching and sorting algorithms

List of Experiments

1. Write a program that uses functions to perform the following operations on singly linked list.:
i) Creation ii) Insertion iii) Deletion iv) Traversal
2. Write a program that uses functions to perform the following operations on doubly linked list.:
i) Creation ii) Insertion iii) Deletion iv) Traversal
3. Write a program that uses functions to perform the following operations on circular linked list.:
i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Write a program that implement stack (its operations) using
i) Arrays ii) ADT
5. Write a program that implement Queue (its operations) using
i) Arrays ii) ADT
6. Sorting Algorithms
Write a program that implements the following sorting methods to sort a given list of integers in ascending order:
i) Radix Sort ii) Heap Sort iii) Shell Sort iv) Tree Sort
7. Tree Traversal
Write a program to implement the tree traversal methods:
 - Recursive Traversal
 - Non-Recursive Traversal
8. Advanced Tree Structures
Write a program to implement the following:
i) Binary Search Tree (BST) ii) B-Trees iii) B+ Trees iv) AVL Trees v) Red-Black Trees
9. Graph Traversal
Write a program to implement the graph traversal methods.
10. Hash Functions
Write a program to implement the following hash functions:
i) Division Method ii) Multiplication Method iii) Mid-square Method iv) Folding Method

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CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

TEXTBOOKS:

1. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
2. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI/Pearson Education.

REFERENCEBOOK:

1. Data Structures: A Pseudocode Approach with C, 2nd Edition, R.F. Gilberg and B.A. Forouzan, Cengage Learning.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS109ES/ CM208ES: PYTHON PROGRAMMING LAB
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.

L T P C
0 0 2 1

Course Objectives

The course aims to:

- Install and run the Python interpreter.
- Learn and apply control structures in Python.
- Understand and use core data structures such as Lists and Dictionaries.
- Handle Strings and perform File I/O operations in Python.

Course Outcomes

After successful completion of the course, students will be able to:

- Develop application-specific codes using Python.
- Understand and manipulate Strings, Lists, Tuples, and Dictionaries.
- Verify and test programs using modular approaches, file handling, and the Python Standard Library.
- Implement simple digital system simulations and problem-solving tasks using Python.

Note

The laboratory experiments will be similar to the following **example experiments**, ensuring both **practical coding skills** and **conceptual understanding** of Python fundamentals.

List of Experiments:**I. Basic Operations**

1.
 - a) Use a web browser to go to the Python website <http://python.org>.
 - b) This page contains information about Python, links to Python-related pages, and allows searching the Python documentation.
2. Start the Python interpreter and type `help()` to start the online help utility.
3. Start a Python interpreter and use it as a **Calculator**.
4. Write a program to calculate **compound interest** when principal, rate, and number of periods are given. Read the **name, address, email, and phone number** of a person through the keyboard and print the details.
5. Print the below triangle using a **for loop**:


```

5
44
333
2222
11111

```
6. Write a program to check whether the given input is a **digit**, **lowercase character**, **uppercase character**, or a **special character** (use if-else-if ladder).
7. Python program to print all **prime numbers** in a given interval (use break).
8. Write a program to convert a **list** and **tuple** into arrays.
9. Write a program to find **common values** between two arrays.
10. Write a function called **palindrome** that takes a string argument and returns True if it is a palindrome, and False otherwise.
(Hint: use `len()` function to check length of string)
11. Write a function called **is_sorted** that takes a list as a parameter and returns True if the list is sorted in ascending order, otherwise False.
12. Write a function called **has_duplicates** that takes a list and returns True if there is any element that appears more than once.
(It should not modify the original list)

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
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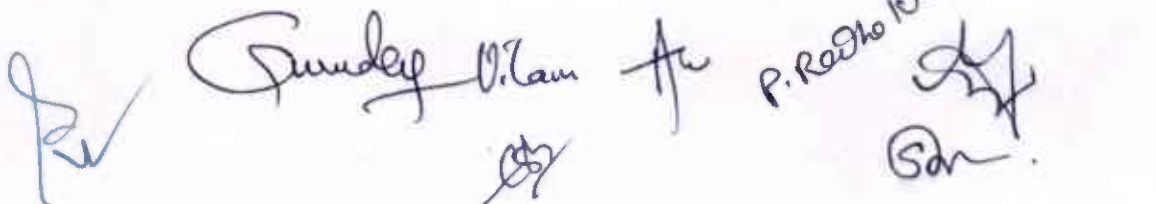
13. Write a function called **remove_duplicates** that takes a list and returns a new list with only the unique elements. (Hint: Order may differ from original)
14. The file words.txt doesn't contain single-letter words. Add "l", "a", and the **empty string** to the list.
15. Write a Python code to read **dictionary values** from the user. Construct a function to **invert its content** (keys become values, values become keys).
16. Add a comma between the characters of a word.
(Example: If input is "Apple", output should be "A,p,p,l,e")
17. Remove a given word in **all places** from a string.
18. Write a function that takes a **sentence** as input and replaces the first letter of every word with uppercase and the rest with lowercase, without using built-in functions.
19. Write a recursive function that generates **all binary strings** of n-bit length.
20. Write a Python program that defines a **matrix** and prints it.
21. Write a Python program to perform **multiplication of two square matrices**.
22. How do you make a **module**? Give an example of constructing a module using different **geometrical shapes** and operations on them as its functions.
23. Use the structure of **exception handling** for all general-purpose exceptions.
24. Write a function called **draw_rectangle** that takes a Canvas and a Rectangle as arguments and draws it on the Canvas. Add an attribute named **color** to your Rectangle objects and modify draw_rectangle to use the color as the fill color.
25. Write a function called **draw_point** that takes a Canvas and a Point as arguments and draws it on the Canvas.
26. Define a class called **Circle** with appropriate attributes and instantiate Circle objects. Write a function draw_circle to draw circles on the Canvas.
27. Write a Python code to read a **phone number and email-id** from the user and validate it for correctness.
28. Write a Python code to **merge two file contents** into a third file.
29. Write a Python code to open a file and construct a function to check for **given words** present in it and display when found.
30. Write a Python code to read text from a file and **find the word with the highest occurrences**.
31. Write a function that reads a file and displays the following:
 - Number of words
 - Number of vowels
 - Number of blank spaces
 - Number of lowercase letters
 - Number of uppercase letters
32. Import **NumPy, PlotPy, and SciPy** and explore their functionalities.
33. Install the **NumPy package** using pip and explore it.
34. Write a program to implement **Digital Logic Gates** – AND, OR, NOT, EX-OR.
35. Write a GUI program to create a **window wizard** having:
 - Two text labels
 - Two text fields
 - Two buttons: *Submit* and *Reset*

TEXTBOOKS

1. *Supercharged Python: Take your code to the next level*, Overland.
2. *Learning Python*, Mark Lutz, O'Reilly.

REFERENCE BOOKS

1. *Python Programming: A Modern Approach*, Vamsi Kurama, Pearson.
2. *Python Programming – A Modular Approach with Graphics, Database, Mobile, and Web Applications*, Sheetal Taneja, Naveen Kumar, Pearson.
3. *Introduction to Python Programming*, Gowrishakar S, Veena A, CRC Press.
4. *Programming with Python: A User's Book*, Michael Dawson, Cengage Learning, India Edition.
5. *Python for Data Science*, Dr. Mohd Abdul Hameed, Wiley Publications.
6. *Core Python Programming*, Dr. R. Nageswara Rao, Dreamtech Press.
7. *Introduction to Python*, Gowrishankar S, Veena A, CRC Press.



 P. Reddy

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
EN107HS/ EN209HS: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB
(Common to CSD, CSE, CSM, and ECE)

B.Tech. I Year II Sem.

L T P C
0 0 2 1

The **English Language and Communication Skills (ELCS) Lab** focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Objectives**Listening Skills**

1. To enable students to develop their active listening skills.
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds.

Speaking Skills

3. To improve their pronunciation and neutralize accent.
4. To enable students express themselves fluently and appropriately.
5. To practise speaking in social and professional contexts.

Learning Outcomes

After successful completion of the course, students will be able to:

1. Listen actively and identify important information in spoken texts.
2. Interpret speech and infer the intention of the speaker.
3. Improve their accent for intelligibility.
4. Speak fluently with clarity and confidence.
5. Use the language effectively in real-life situations.

Syllabus

The **English Language and Communication Skills Lab (ELCS)** has two parts:

- a) **Computer Assisted Language Learning (CALL) Lab** – focuses on listening skills.
- b) **Interactive Communication Skills (ICS) Lab** – focuses on speaking skills.

Exercise – I**CALL Lab**

- **Instruction:** Speech Sounds – Listening Skill – Importance – Purpose – Types – Barriers – Active Listening.
- **Practice:** Listening to distinguish speech sounds (Minimal Pairs) – Testing Exercises.

ICS Lab

- **Diagnostic Test:** Activity titled 'Express Your View'.
- **Instruction:** Spoken and Written language – Formal and Informal English – Greetings – Introducing oneself and others.
- **Practice:** Any Ice-Breaking Activity.

Exercise – II**CALL Lab**

- **Instruction:** Listening vs. Hearing – Barriers to Listening.
 - **Practice:** Listening for General Information – Multiple Choice Questions – Listening Comprehension Exercises.
- (Passages with exercises must be provided for practice.)*

ICS Lab

- **Instruction:** Features of Good Conversation – Strategies for Effective Communication.
- **Practice:** Role Play Activity – Situational Dialogues – Expressions in Various Situations – Making Requests & Seeking Permissions – Taking Leave – Telephone Etiquette.

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Exercise - III**CALL Lab**

- **Instruction:** Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI).
- **Practice:** British vs. American Pronunciation – Listening Comprehension Exercises.

ICS Lab

- **Instruction:** Describing Objects, Situations, Places, People, and Events.
- **Practice:** Picture Description Activity – Looking at a picture and describing it.
(Wide range of handouts/materials should be provided in the lab.)

Exercise - IV**CALL Lab**

- **Instruction:** Techniques for Effective Listening.
- **Practice:** Listening for Specific Details – Gap-Fill Exercises – Listening Comprehension.
(Passages with exercises must be provided for practice.)

ICS Lab

- **Instruction:** How to Tell a Good Story – Story Sequencing – Creativity.
- **Practice:** Storytelling and Retelling – Collage Activity.

Exercise - V**CALL Lab**

- **Instruction:** Identifying literal and implied meaning.
- **Practice:** Listening for Evaluation – Writing the Summary – Listening Comprehension Exercises.
(Passages with exercises must be provided for practice.)

ICS Lab

- **Instruction:** Understanding Non-Verbal Communication.
- **Practice:** Silent Speech – Dumb Charades Activity.

Post-Assessment Test: *Express Your View.*

Infrastructure Requirements for ELCS Lab**1. Computer Assisted Language Learning (CALL) Lab**

- Must accommodate **40 students** with **40 systems**, one **Master Console**, LAN facility, and English language learning software.

System Requirements (Hardware):

- Computers with suitable configuration.
- Computer network with LAN (minimum 40 multimedia systems).
- High-fidelity headphones.

2. Interactive Communication Skills (ICS) Lab

- Spacious room with movable chairs.
- Audio-visual aids with Public Address System.
- TV or LCD, digital stereo (audio & video system), and camcorder.

Note: English Language Teachers are requested to prepare **materials/handouts** for each activity for use in CALL & ICS Labs.

Suggested Software

- *Cambridge Advanced Learners' English Dictionary* (with CD).
- *Grammar Made Easy*, Darling Kindersley.
- *Punctuation Made Easy*, Darling Kindersley.
- *Oxford Advanced Learner's Compass*, 10th Edition.
- *English in Mind* (Series 1-4), Herbert Puchta & Jeff Stranks with Meredith Levy, Cambridge.
- *English Pronunciation in Use* (Elementary, Intermediate, Advanced), Cambridge University Press.
- *English Vocabulary in Use* (Elementary, Intermediate, Advanced), Cambridge University Press.
- *TOEFL & GRE* (Kaplan, Barron's, AARCO, *Cracking GRE* by CLIFFS).

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Reference Books

1. Shobha, K. N. & Rayen, J. Lourdes. (2019). *Communicative English – A Workbook*. Cambridge University Press.
2. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities*. Orient BlackSwan Pvt. Ltd.
3. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach*. Cambridge University Press.
4. (2022). *English Language Communication Skills – Lab Manual cum Workbook*. Cengage Learning India Pvt. Ltd.
5. Ur, Penny & Wright, Andrew. (2022). *Five Minute Activities – A Resource Book for Language Teachers*. Cambridge University Press.

Sunday Vilam to P. Radhakrishnan
~~to~~ ~~to~~ Son.

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

MS211HS: SOCIAL INNOVATION IN PRACTICE

(Common to CSD, CSE, CSM, and ECE)

B.Tech- I Year II Sem

L	T	P	C
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Course Objectives:

1. To highlight the distinction between science and engineering and build teamwork and communication skills.
2. To introduce the design process from problem identification to solution development.
3. To teach project organization skills and familiarity with basic machine components.
4. To develop 3D modelling and design capabilities.
5. To provide hands-on exposure to Arduino-based prototyping, programming, and testing.

Course Outcomes:

1. Differentiate science from engineering and demonstrate collaborative teamwork and communication.
2. Apply design-thinking methodologies to identify needs and create problem-solving approaches.
3. Use project-planning tools and explain the working of simple machine parts.
4. Create 3D digital models and integrate them with hardware platforms.
5. Build, program, and test functional Arduino prototypes and present results effectively.

Week 1: Learn differences between science and engineering, explore engineering branches, and develop teamwork and communication skills.

Week 2: Study basic machine parts, their motion and simple machines like levers and sliders.

Week 3: Identify real-world needs, define problems, and design solutions using simple tools.

Week 4: Apply planning tools lists, schedules and charts for project organization.

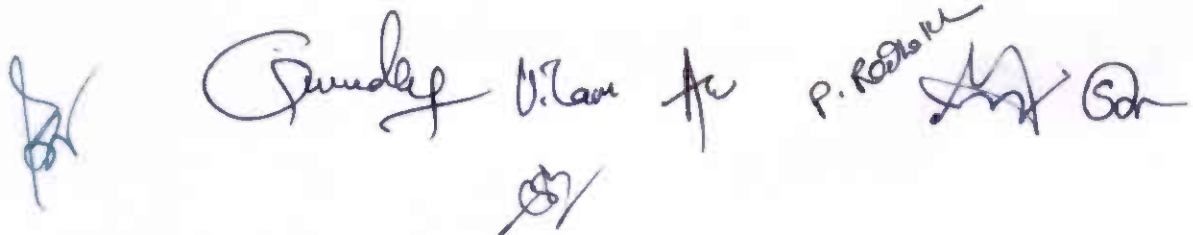
Week 5: Create a 3D model of a box with holes and curved parts.

Week 6: Design a 3D model of an electronic case and assemble two parts.

Week 7: Explore project platforms, learn basic components (sensors, motors), and practice with Tinker CAD software.

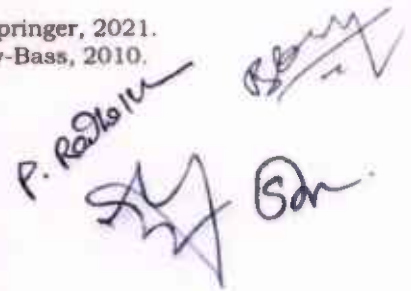
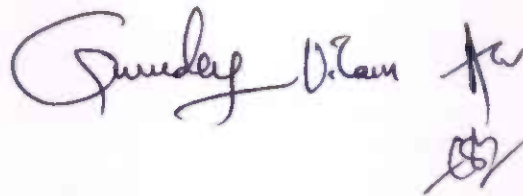
Week 8: Introduction to Arduino boards and simple programming.

Week 9: Connect Arduino with sensors and display units.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26**CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD****Week 10:** Connect Arduino with motors and other moving parts.**Week 11:** Build and assemble a functional working model.**Week 12:** Test the model, document results, and present the project.**Suggested Books:**

1. The Social Innovation Imperative, Sandra M. Bates, Berrett-Koehler Publishers, 2013.
2. Leadership in Nonprofit Organizations: A Reference Handbook, Kathryn A. Agard, SAGE Publications, 2nd Edition, 2018.
3. The Art of Mediation, Mark D. Bennett, Routledge, 2014.
4. Digital Tools for Social Innovation, Edited by Jeanette M. Santi, Springer, 2021.
5. The Networked Nonprofit, Beth Kanter and Allison H. Fine, Jossey-Bass, 2010.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
MA301BS: MATHEMATICAL AND STATISTICAL FOUNDATIONS
(Common to CSD, and CSM)

B.Tech. II Year I Sem.**LT P C**
3 0 0 3**Pre-requisites**

- Mathematics courses of first year of study.

Objectives

To learn:

1. The Number Theory basic concepts useful for cryptography etc.
2. The theory of Probability, and probability distributions of single random variables.
3. The sampling theory and testing of hypothesis and making inferences.
4. The curve fitting, correlation and regression for the given data.

Course Outcomes

After learning the contents of this paper, the student will be able to:

1. Apply the number theory concepts to cryptography domain.
2. Apply the concepts of probability and distributions to some case studies.
3. Correlate the material of one unit to the material in other units.
4. Resolve the potential misconceptions and hazards in each topic of study.
5. Fit the curve, correlation and regression for the given data.

Syllabus**UNIT-I: Basics of Number Theory (10L)**

Greatest Common Divisors and Prime Factorization:, Greatest common divisors – The Euclidean algorithm – The fundamental theorem of arithmetic – Factorization of integers and the Fermat numbers., Congruences: Introduction to congruences – Linear congruences.

UNIT-II: Random Variables and Probability Distributions (8L)

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions. Mean and Variance of a Random Variable. Discrete Probability Distributions: Binomial Distribution Poisson Distribution

UNIT-III: Continuous Distributions and Sampling (10L)

Continuous Distributions: Uniform Distribution – Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distribution .Fundamental Sampling Distributions: Random Sampling – Some Important Statistics – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

UNIT-IV: Tests of Hypotheses (Large and Small Samples) (10L)

Statistical Hypotheses: General Concepts – Testing a Statistical Hypothesis.

Single Sample Tests: Tests concerning a single mean. Tests concerning a single proportion.

Two Sample Tests: Tests on two means (unknown for equal variance). Tests on two proportions. Two-sample tests concerning variances (F-distribution).

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
CS403PC: DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSD, CSE, and CSM)

B.Tech. II Year II Sem.

L	T	P	C
3	1	0	4

Prerequisites: Programming for problem solving and Data Structures**Course Objectives**

1. Develop proficiency in evaluating algorithms using asymptotic notations, including best-, average-, and worst-case time/space complexities, and solving related recurrence relations.
2. Master various algorithmic strategies—divide-and-conquer, greedy, dynamic programming, backtracking, and branch-and-bound—identifying suitable use cases and demonstrating their application.
3. Critically assess and contrast different algorithms in terms of efficiency, scalability, and correctness through rigorous analytical reasoning and empirical evaluation.
4. Differentiate between tractable (polynomial-time) and intractable (super-polynomial or exponential-time) problems;
5. **Identify and classify** problems as P, NP, NP-hard, or NP-complete, and **assess** their relationships through polynomial-time reductions and Cook's theorem.

Course Outcomes

1. Able to Apply space and time complexity analysis using asymptotic notations.
2. Able to Design divide-and-conquer algorithms and critically assess their runtime and space trade-offs.
3. Able to Device backtracking and dynamic programming solutions.
4. Able to Apply greedy methods and graph traversal algorithms
5. Able to Analyse and Design branch-and-bound algorithms for NP-hard problems

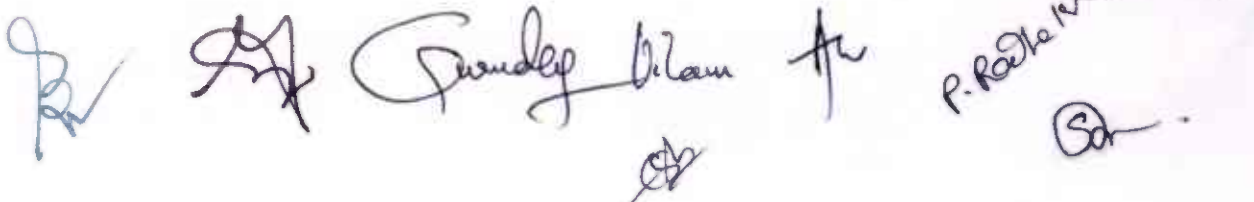
UNIT-I**Introduction:** Algorithm, Performance Analysis-

Space complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation, and Little oh notation.

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.**UNIT-II****Disjoint Sets:** Disjoint set operations, union and find algorithms, Priority Queue- Heaps,Heapsort **Backtracking:** General method, applications, n-

queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

UNIT-III**Dynamic Programming:** General method, applications-Optimal binary search tree, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.**UNIT-IV****Greedy method:** General method, applications- Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.**Basic Traversal and Search Techniques:** Techniques for Binary Trees, Techniques for Graphs, Connected components, Biconnected components.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
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UNIT - V

Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

TEXT BOOK:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI
2. Computer Networking: A Top-Down Approach – James F.Kurose, Keith W. Ross, Pearson

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
CS402PC: COMPUTER NETWORKS
(Common to CSD, CSE, and CSM)

B.Tech. II Year II Sem.**L T P C**
3 0 0 3**Prerequisites**

1. A course on "Programming for problem solving".
2. A course on "Data Structures".

Course Objectives

1. Equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.
3. Elucidate the students about working and implementation of protocols at various layers in protocols stack.
4. Appreciating the protocol working by observing and analysing output of the packet sniffer,

Course Outcomes

1. Gain the knowledge of the basic computer network technology.
2. Gain the knowledge of the functions of each layer in the ISO-OSI and TCP/IP reference model.
3. Obtain the skills of subnetting and routing mechanisms.
4. Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.
5. Understanding working of the protocols through traces captured by a packet sniffer

UNIT - I

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless Transmission.

Data link layer: Design issues, framing, Error detection and correction.

UNIT - II

Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.

Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols.

Medium Access sublayer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier senses multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

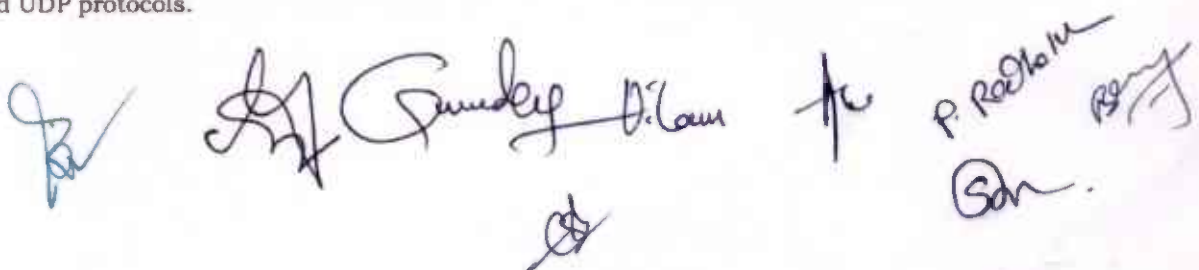
UNIT - III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, the Network

layer in the internet.

UNIT - IV

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE,(UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS301PC/ CM401PC: DISCRETE MATHEMATICS
(Common to CSD, CSE, and CSM)

B.Tech. II Year II Sem.**L T P C**
3 0 0 3**Course Objectives:**

1. Introduces elementary discrete mathematics for computer science and engineering.
2. Topics include formal logic notation, methods of proof, induction, sets, relations, algebraic structures, elementary graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

Course Outcomes:

1. Understand and construct precise mathematical proofs
2. Apply logic and set theory to formulate precise statements
3. Analyze and solve counting problems on finite and discrete structures
4. Describe and manipulate sequences
5. Apply graph theory in solving computing problems

UNIT-I

Mathematical logic: Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

UNIT-II

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

UNIT-III

Algebraic Structures: Introduction, Algebraic Systems, Semigroups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

UNIT-IV

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

UNIT-V

Graph Theory: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

TEXTBOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1st ed.
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joel. Mott, Abraham Kandel, Theodore P. Baker, Prentis Hall of India, 2nd ed.

REFERENCEBOOKS:

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph. P. Grimald, Pearson education, 5th edition.
2. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill Publishing co.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS310SD: Skill Development Course-I: NODEJS

(Common to CSD, CSE, and CSM)

B.Tech. II Year I Sem.**LT PC****0021****Prerequisites:** Object Oriented Programming through Java, HTML Basics.**Course Objectives**

1. To implement static web pages using **HTML** and do client-side validation using **JavaScript**.
2. To design and work with **databases using Java**.
3. To develop an **end-to-end application** using the **Java Full Stack**.
4. To introduce **NodeJS** implementation for server-side programming.
5. To experiment with **Single Page Application (SPA)** development using **React**.

Course Outcomes

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

1. Build a custom website with **HTML, CSS, Bootstrap**, and basic **JavaScript**.
2. Demonstrate advanced features of **JavaScript** and learn about **JDBC**.
3. Develop **server-side implementation** using Java technologies.
4. Develop **server-side implementation** using **NodeJS**.
5. Design a **Single Page Application (SPA)** using **React**.

Exercises

1. Build a responsive web application for a **shopping cart** with registration, login, catalog, and cart pages using **CSS3** features, flex, and grid.
2. Make the above web application **responsive** using the **Bootstrap** framework.
3. Use **JavaScript** for client-side validation of the pages implemented in Exercises 1 and 2.
4. Explore the features of **ES6** (arrow functions, callbacks, promises, async/await). Implement an application that reads weather information from **openweathermap.org** and displays it on a graph.
5. Develop a **Java standalone application** that connects with the database (Oracle/MySQL) and performs **CRUD operations** on the tables.
6. Create an **XML** for a bookstore and validate it using both **DTD** and **XSD**.
7. Design a **controller with Servlet** that interacts with the application developed in Exercise 1 and the database created in Exercise 5.
8. Explore various **session tracking mechanisms** (Cookies, HTTP Session) for maintaining user transaction history.
9. Create a **custom server** using the http module in **NodeJS** and explore other modules like **OS, Path, Event**.
10. Develop an **Express web application** that interacts with a **REST API** to perform **CRUD operations** on student data. (Use **Postman** for testing).
11. Create **authorized endpoints** for the above application using **JWT (JSON Web Token)**.
12. Create a **React application** for a student management system with registration, login, contact, and about pages. Implement **routing** for navigation.
13. Create a service in **React** that fetches weather data from **openweathermap.org** and displays both **current and historical weather** using **Chart.js**.
14. Create a **TODO application** in React with necessary components and deploy it to **GitHub**.

Reference Books

1. Jon Duckett, *Beginning HTML, XHTML, CSS, and JavaScript*, Wrox Publications, 2010.
2. Bryan Basham, Kathy Sierra, Bert Bates, *Head First Servlets and JSP*, O'Reilly Media, 2nd Edition, 2008.
3. Vasan Subramanian, *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node*, 2nd Edition, APress.

Textbooks

1. *MATLAB and its Applications in Engineering* – Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson.
2. *The Fundamentals of Python: First Programs* – Kenneth A. Lambert, 2011, Cengage Learning.
3. *Think Python* (First Edition) – Allen B. Downey, O'Reilly Publishing.
4. *Introduction to Python Programming* – William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
5. *Introduction to Python Programming* – Jacob Fredslund, 2007.

1. *An Introduction to Python* – John C. Lusth, The University of Alabama, 2011.
2. *Introduction to Python* – Dave Kuhlman, 2008.

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Beng

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

MA309BS/MA406BS: COMPUTATIONAL MATHEMATICS LAB
(Using Python)

(Common to CSD, CSE, CSM, and ECE)

B.Tech. II Year I Sem.**LTPC****0021****Pre-requisites:** Matrices, Iterative methods and ordinary differential equations**Course Objectives**

To learn:

1. Solve problems of **Eigenvalues and Eigenvectors** using Python/MATLAB.
2. Solve problems of **Algebraic and Transcendental Equations** using Python/MATLAB.
3. Solve problems of **Linear system of equations**.
4. Solve problems of **First-Order ODEs** and **Higher-order linear differential equations with constant coefficients**.

Course Outcomes

After learning the contents of this paper, the student must be able to:

1. Develop the code to find the **Eigenvalues and Eigenvectors** using Python/MATLAB.
2. Develop the code to find solutions of **Algebraic and Transcendental Equations** and **Linear system of equations** using Python/MATLAB.
3. Write the code to solve problems of **First-Order ODEs** and **Higher-order linear differential equations with constant coefficients**.

*Note: Visualize all solutions graphically through programs.***Syllabus****UNIT-I: Eigenvalues and Eigenvectors (6P)****Programs:**

- Finding real and complex Eigenvalues.
- Finding Eigenvectors.

UNIT-II: Solution of Algebraic and Transcendental Equations (6P)

Methods: Bisection Method, Newton-Raphson Method.

Programs:

- Root of a given equation using **Bisection Method**.
- Root of a given equation using **Newton-Raphson Method**.

UNIT-III: Linear System of Equations (6P)

Methods: Jacobi's Iteration Method and Gauss-Seidel Iteration Method.

Programs:

- Solution of given system of linear equations using **Jacobi's Method**.
- Solution of given system of linear equations using **Gauss-Seidel Method**.

UNIT-IV: First-Order ODEs (8P)

Exact and non-exact equations.

Applications: Exponential growth/decay, Newton's Law of Cooling.

Programs:

- Solving exact and non-exact equations.
- Solving exponential growth/decay and Newton's Law of Cooling problems.

UNIT-V: Higher Order Linear Differential Equations with Constant Coefficients (6P)**Programs:**

- Solving homogeneous ODEs.
- Solving non-homogeneous ODEs.

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P. Ramesh

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
CS308PC: DATABASE MANAGEMENT SYSTEMS LAB
(Common to CSD, CSE, and CSM)

B.Tech. II Year I Sem.**L T P C**
0 0 2 1**Course Objectives**

- Introduce **ER data model**, database design, and normalization.
- Learn **SQL basics** for data definition and data manipulation.

Course Outcomes

- Design database schema for a given application and apply normalization.
- Acquire skills in using SQL commands for data definition and data manipulation.
- Develop solutions for database applications using **procedures, cursors, and triggers**.

List of Experiments

1. Concept design with **E-R Model**
2. **Relational Model**
3. **Normalization**
4. Practicing **DDL commands**
5. Practicing **DML commands**
6. A) Querying (using ANY, ALL, UNION, INTERSECT, JOIN, Constraints, etc.)
B) Nested, Correlated subqueries
7. Queries using **Aggregate functions, GROUP BY, HAVING** and creation & dropping of **Views**
8. **Triggers** (creation of insert trigger, delete trigger, update trigger)
9. **Procedures**
10. Usage of **Cursors**

Textbooks

1. *Database Management Systems* – Raghurama Krishnan, Johannes Gehrke, Tata McGraw-Hill, 3rd Edition.
2. *Database System Concepts* – Silberschatz, Korth, McGraw-Hill, 5th Edition.

Reference Books

1. *Database Systems: Design, Implementation, and Management* – Peter Rob & Carlos Coronel, 7th Edition.
2. *Fundamentals of Database Systems* – Elmasri, Navathe, Pearson Education.
3. *Introduction to Database Systems* – C.J. Date, Pearson Education.
4. *Oracle for Professionals* – The X Team, S. Shah and V. Shah, SPD.
5. *Database Systems Using Oracle: A Simplified Guide to SQL and PL/SQL* – Shah, PHI.
6. *Fundamentals of Database Management Systems* – M.L. Gillenson, Wiley Student Edition.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD**CM307PC/CS408PC:SOFTWARE ENGINEERING LAB**
(Common to CSD, CSE, and CSM)**B.Tech. II Year I Sem.****L T P C**
0 0 2 1**Prerequisites**

- A course on **Programming for Problem Solving**

Co-requisite

- A course on **Software Engineering**

Course Objectives

- 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

- Ability to translate end-user requirements into system and software requirements.
- Ability to generate a high-level design of the system from the software requirements.
- Will have experience and/or awareness of testing problems and will be able to develop a simple testing report.

List of Experiments

Do the following seven exercises for **any two projects** given in the list of sample projects (or any other projects):

1. Development of problem statements.
2. Preparation of Software Requirement Specification (SRS) 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

Textbooks

1. *Software Engineering: A Practitioner's Approach* – Roger S. Pressman, 6th Edition, McGraw-Hill International Edition.
2. *Software Engineering* – Sommerville, 7th Edition, Pearson Education.
3. *The Unified Modeling Language User Guide* – Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

Reference Books

1. *Software Engineering: An Engineering Approach* – James F. Peters, Witold Pedrycz, John Wiley.
2. *Software Engineering: Principles and Practice* – Waman S. Jawadekar, McGraw-Hill.

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7. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: **Red, Yellow, or Green** using radio buttons. On selecting a button, an appropriate message such as **"Stop", "Ready", or "Go"** should appear above the buttons in the selected color. Initially, no message is shown.
8. Write a Java program to create an abstract class named **Shape** that contains two integers and an empty method named **printArea()**. Provide three classes named **Rectangle, Triangle, and Circle** such that each one of the classes extends the class **Shape**. Each one of the classes contains only the method **printArea()** that prints the area of the given shape.
9. Suppose that a table named **Table.txt** is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas.
 - o Write a Java program to display the table using Labels in GridLayout.
10. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (use Adapter classes).
11. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record is separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (Hint: use **Hashtables**).
12. Write a Java program that correctly implements the **producer-consumer problem** using the concept of inter-thread communication.
13. Write a Java program to list all the files in a directory including the files present in all its subdirectories.

1. *Java for Programmers* – P.J. Deitel and H.M. Deitel, 10th Edition, Pearson Education.
2. *Thinking in Java* – Bruce Eckel, Pearson Education.

1. *Java Programming* – D.S. Malik and P.S. Nair, Cengage Learning.
2. *Core Java, Volume I* – Cay S. Horstmann and G. Cornell, 9th Edition, Pearson.

2. Core Java, Volume - Cay S. Horstmann and G. Cornell, 9th Edition, Pearson.

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS306PC: OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

(Common to CSD, CSE, and CSM)

B.Tech. II Year I Sem.

L T P C
0 0 2 1

Course Objectives

1. To write programs using abstract classes.
2. To write programs for solving real-world problems using the Java Collection Framework.
3. To write multithreaded programs.
4. To write GUI programs using Swing controls in Java.
5. To introduce Java compiler and Eclipse platform.
6. To impart hands-on experience with Java programming.

Course Outcomes

1. Able to write programs for solving real-world problems using the Java Collection Framework.
2. Able to write programs using abstract classes.
3. Able to write multithreaded programs.
4. Able to write GUI programs using Swing controls in Java.

Note

1. Use **LINUX** and **MySQL** for the lab experiments. Though not mandatory, encourage the use of the Eclipse platform.
2. The list suggests the minimum program set. Hence, the concerned staff is requested to add more problems to the list as needed.

List of Experiments

1. Use Eclipse or NetBeans platform and acquaint yourself with the various menus. Create a test project, add a test class, and run it. See how you can use auto-suggestions, auto-fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step-by-step with a small program of about 10-15 lines which contains at least one *if-else* condition and a *for* loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.
3. a) Develop an applet in Java that displays a simple message.
b) Develop an applet in Java that receives an integer in one text field, and computes its factorial value and returns it in another text field, when the button named **"Compute"** is clicked.
4. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields **Num1** and **Num2**. The division of Num1 and Num2 is displayed in the result field when the Divide button is clicked.
 - o If Num1 or Num2 were not an integer, the program should throw a *NumberFormatException*.
 - o If Num2 were zero, the program should throw an *ArithmeticException*.
 - o Display the exception in a message dialog box.
5. Write a Java program that implements a multithread application that has three threads.
 - o The first thread generates a random integer every 1 second.
 - o If the value is even, the second thread computes the square of the number and prints it.
 - o If the value is odd, the third thread prints the cube of the number.
6. Write a Java program for the following:
 - o Create a doubly linked list of elements.
 - o Delete a given element from the list.
 - o Display the contents of the list after deletion.

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UNIT - V

Storage and Indexing: Data on external storage, file organization and indexing, cluster indexes, primary and secondary indexes, index data structures, hash-based indexing, tree-based indexing, comparison of file organizations.

B+ Trees and ISAM: Intuitions for tree indexes, Indexed Sequential Access Methods (ISAM), B+ trees as a dynamic index structure.

Textbooks

1. *Database System Concepts* – Silberschatz, Korth, and S.Sudharshan McGraw Hill, V Edition, 6th Edition.
2. *Database Management Systems* – Raghu Ramakrishnan, Johannes Gehrke, Tata McGraw Hill.
3. Pranab Kumar Das and P. Radha Krishna, *Database Management System Oracle SQL and PL/SQL*, PHI Learning, 2013, ISBN No.: 8120348427.

Reference Books

1. *Database Systems: Design, Implementation, and Management* – Peter Rob & Carlos Coronel, 7th Edition.
2. *Fundamentals of Database Systems* – Elmasri, Navathe, Pearson Education.
3. *Introduction to Database Systems* – C.J. Date, Pearson Education.
4. *Oracle for Professionals* – The X Team, S. Shah and V. Shah, SPD.
5. *Database Systems Using Oracle: A Simplified Guide to SQL and PL/SQL* – Shah, PHI.
6. *Fundamentals of Database Management Systems* – M.L. Gillenson, Wiley Student Edition.

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Center: A large signature, possibly "Sandeep", followed by "Dr. Ram" and "H". Below it is a small circular stamp.

Right: Two signatures, one of which appears to be "P. Radha" and another "S. Shah". Below them is a signature that looks like "San".

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS305PC:DATABASE MANAGEMENT SYSTEMS

(Common to CSD, CSE, and CSM)

B.Tech. II Year I Sem.

L T P C
3 0 0 3

PrerequisitesA course on **Data Structures**.**Course Objectives**

1. To understand the basic concepts and the applications of database systems.
2. To master the basics of SQL and construct queries using SQL.
3. To study topics such as data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures, and access techniques.

Course Outcomes

1. Gain knowledge of fundamentals of DBMS, database design, and normal forms.
2. Master the basics of SQL for retrieval and management of data.
3. Be acquainted with the basics of transaction processing and concurrency control.
4. Become familiar with database storage structures and access techniques.

UNIT - I**Database System Applications:** A historical perspective, file systems versus a DBMS, the data model, levels of abstraction in a DBMS, data independence, structure of a DBMS.**Introduction to Database Design:** Database design and ER diagrams, entities, attributes, and entity sets, relationships and relationship sets, additional features of the ER model, conceptual design with the ER model.**UNIT - II****Relational Model:** Integrity constraints over relations, enforcing integrity constraints, querying relational data, logical database design, introduction to views, destroying/altering tables and views.**Relational Algebra and Calculus:** Relational algebra, tuple relational calculus, domain relational calculus.**UNIT - III****SQL - Queries, Constraints, Triggers:** Forms of basic SQL query, UNION, INTERSECT, and EXCEPT, nested queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active databases.**Schema Refinement:** Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, First, Second, Third Normal Forms, BCNF, lossless join decomposition, multivalued dependencies, Fourth Normal Form, Fifth Normal Form.**UNIT - IV****Transactions and Concurrency Control:** Transaction concept, transaction state, implementation of atomicity and durability, concurrent executions, serializability, recoverability, implementation of isolation, testing for serializability.**Concurrency Protocols and Recovery:** Lock-based protocols, timestamp-based protocols, validation-based protocols, multiple granularity. Recovery and atomicity, log-based recovery, recovery with concurrent transactions.

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P. Rakesh
San.

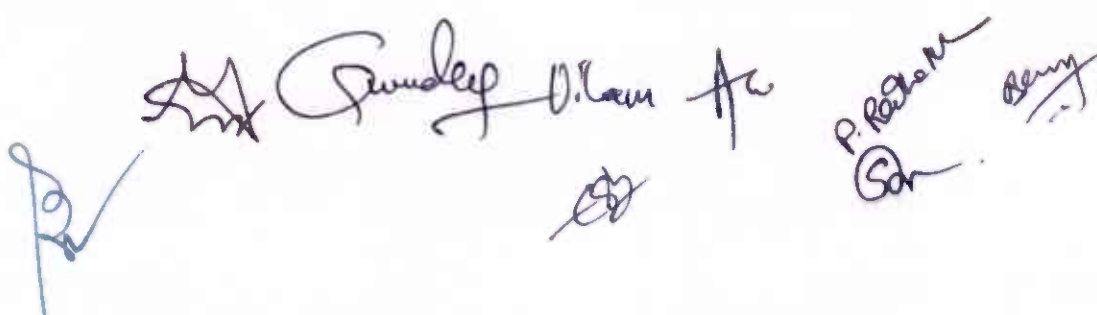
COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
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Textbooks

1. *Software Engineering: A Practitioner's Approach* – Roger S. Pressman, 6th Edition, McGraw-Hill International Edition.
2. *Software Engineering* – Sommerville, 7th Edition, Pearson Education.
3. *The Unified Modeling Language User Guide* – Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

Reference Books

1. *Software Engineering: An Engineering Approach* – James F. Peters, Witold Pedrycz, John Wiley.
2. *Software Engineering: Principles and Practice* – Waman S. Jawadekar, McGraw-Hill.
3. *Fundamentals of Object-Oriented Design Using UML* – Meiler Page-Jones, Pearson Education.
4. *Fundamentals of Software Engineering* – Rajib Mall, PHI.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CM304PC/ CS404PC: SOFTWARE ENGINEERING
(Common to CSD, CSE, and CSM)

B.Tech.II Year I Sem.**L T P C**
3 0 0 3**Course Objectives**

- The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing, and quality management of large software development projects.
- Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management, and UML diagrams.

Course Outcomes

- Ability to translate end-user requirements into system and software requirements, using UML, and structure the requirements in a Software Requirements Document (SRD).
- Identify and apply appropriate software architectures and patterns to carry out high-level design of a system and be able to critically compare alternative choices.
- Gain experience and/or awareness of testing problems and be able to develop a simple testing report.

UNIT - I

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.

A Generic View of Process: Software engineering – a layered technology, a process framework, the Capability Maturity Model Integration (CMMI).

Process Models: The waterfall model, spiral model, incremental process models, concurrent models, component-based development, and agile development.

UNIT - II

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

Requirements Engineering Process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

UNIT - III

Design Engineering: Design process and design quality, design concepts, the design model.

Creating an Architectural Design: Software architecture, data design, architectural styles and patterns, architectural design.

UML Diagrams: Conceptual model of UML, basic structural modeling, use case diagrams, class diagrams, sequence diagrams, collaboration diagrams, activity diagrams, and component diagrams.

UNIT - IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

Metrics for Process and Products: Software measurement, metrics for software quality.

UNIT - V

Risk Management: Reactive vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM.

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

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Event Handling: Events, event sources, event classes, event listeners. Delegation event model. Handling mouse and keyboard events. Adapter classes. Graphics, layout manager – border, grid, flow, card, and grid bag layouts.

UNIT – V**Swing Programming**

Introduction, limitations of AWT, MVC architecture. Components and containers. Exploring Swing components: JFrame, JComponent, JLabel, ImageIcon, JTextField, JButton, JCheckBox, JRadioButton, JList, JComboBox, JTabbedPane, JScrollPane, JTree, JTable.

Menu basics: JMenuBar, JMenu, JMenuItem, JCheckBoxMenuItem, JRadioButtonMenuItem, JSeparator. Creating popup menus.

Textbooks

1. Herbert Schildt & Dr. Denny Coward, *Java: The Complete Reference*, 13th Edition, McGraw Hill.
2. T. Budd, *Understanding OOP with Java*, Updated Edition, Pearson Education.
3. P. Radha Krishna, *Object Oriented Programming through Java*, CRC Press/University Press, 2006, ISBN No.: 9781420047929. (<https://www.crcpress.com/Object-Oriented-Programming-Through-Java/Krishna/p/book/9781420047929>)

Reference Books

1. J. Nino & F. A. Hosch, *An Introduction to Programming and OO Design using Java*, John Wiley & Sons.
2. T. Budd, *An Introduction to OOP*, 3rd Edition, Pearson Education.
3. Y. Daniel Liang, *Introduction to Java Programming*, Pearson Education.
4. R. A. Johnson-Thomson, *An Introduction to Java Programming and Object-Oriented Application Development*.
5. Cay S. Horstmann & Gary Cornell, *Core Java 2, Vol. 1: Fundamentals*, 8th Edition, Pearson Education.
6. Cay S. Horstmann & Gary Cornell, *Core Java 2, Vol. 2: Advanced Features*, 8th Edition, Pearson Education.
7. R. Buyya, S. T. Selvi, X. Chu, *Object-Oriented Programming with Java*, TMH.
8. John Hunt, *Java and Object Orientation: An Introduction*, 2nd Edition, Springer.
9. Maurach, *Beginning Java 2 JDK 5*, SPD.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS303PC: OBJECT-ORIENTED PROGRAMMING THROUGH JAVA
(Common to CSD, CSE, and CSM)

B.Tech. II Year I Sem.**L T P C**
3 0 0 3**Course Objectives**

The course aims to:

1. Understand the basic object-oriented programming concepts and apply them in problem solving.
2. Illustrate inheritance concepts for reusing the program.
3. Demonstrate multitasking using multiple threads and event handling.
4. Develop data-centric applications using JDBC.
5. Understand the basics of Java console and GUI-based programming.

Course Outcomes

Upon successful completion of this course, students will be able to:

1. Demonstrate the behavior of programs involving the basic programming constructs like control structures, constructors, string handling, and garbage collection.
2. Implement inheritance (multilevel, hierarchical, and multiple) using extends and implements keywords.
3. Use multithreading concepts to develop inter-process communication.
4. Understand the process of Graphical User Interface (GUI) design and implementation using AWT or Swing.
5. Develop applets that interact abundantly with the client environment and deploy them on the server.

UNIT - I**Object-Oriented Thinking and Java Basics**

Need for OOP paradigm, summary of OOP concepts, coping with complexity, abstraction mechanisms. History of Java, Java buzzwords. Data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and casting. Writing simple Java programs. Concepts of classes, objects, constructors, methods, access control, *this* keyword, garbage collection. Overloading methods and constructors, parameter passing, recursion, nested and inner classes, exploring String class.

UNIT - II**Inheritance, Packages, and Interfaces**

Hierarchical abstractions, base class object, subclass, subtype, substitutability. Forms of inheritance: specialization, specification, construction, extension, limitation, combination. Benefits and costs of inheritance. Member access rules, *super* keyword uses, using *final* keyword with inheritance. Polymorphism - method overriding, abstract classes, the Object class. Defining, creating and accessing a package, understanding CLASSPATH, importing packages. Differences between classes and interfaces, defining an interface, implementing an interface, applying interfaces, variables in interface and extending interfaces.

UNIT - III**Exception Handling and Multithreading**

Concepts of exception handling, benefits of exception handling, termination or resumptive models, exception hierarchy. Usage of *try*, *catch*, *throw*, *throws*, and *finally*. Built-in exceptions, creating user-defined exception subclasses. Differences between multithreading and multitasking. Thread lifecycle, creating threads, thread priorities, synchronizing threads, inter-thread communication, thread groups, daemon threads.

UNIT - IV**Packages, I/O, and Event Handling**

Exploring String class, Object class. Exploring *java.util* package, *java.io* package.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
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UNIT-IV

Microprogrammed Control: Control memory, Address sequencing, Microprogram example, Design of control unit.

Central Processing Unit (CPU): General Register Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control.

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms. Floating-point Arithmetic Operations. Decimal Arithmetic Unit, Decimal Arithmetic Operations.

UNIT-V**Input-Output Organization:**

Input-Output Interface, Asynchronous data transfer.

Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).

Memory Organization:

- Memory Hierarchy, Main Memory, Auxiliary Memory.
- Associative Memory, Cache Memory.

Textbooks

1. M. Morris Mano, *Digital Design*, 3rd Edition, Pearson/PHI.
2. M. Morris Mano, *Computer System Architecture*, 3rd Edition, Pearson/PHI.

Reference Books

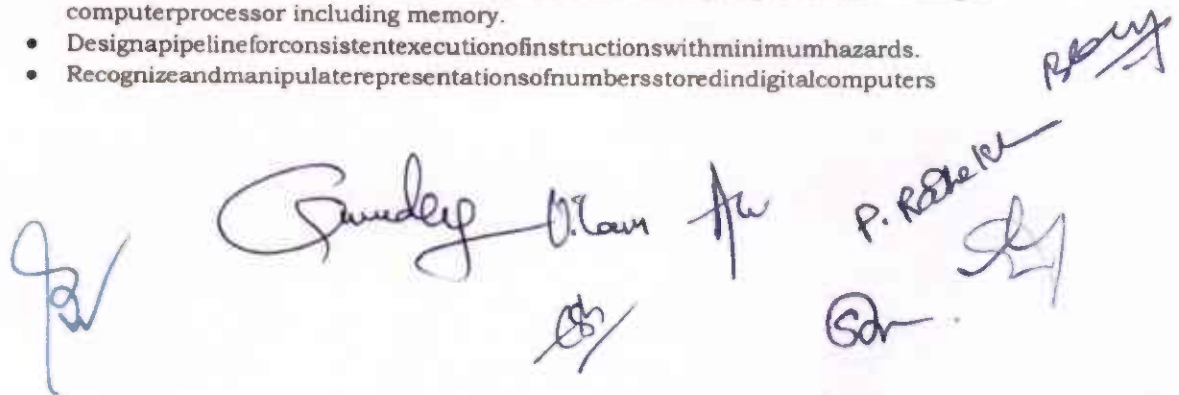
1. Zvi Kohavi, *Switching and Finite Automata Theory*, Tata McGraw Hill.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, *Computer Organization*, 5th Edition, McGraw Hill.
3. William Stallings, *Computer Organization and Architecture*, 6th Edition, Pearson/PHI.
4. Andrew S. Tanenbaum, *Structured Computer Organization*, 4th Edition, PHI/Pearson.

Course Objectives:

- The purpose of the course is to introduce principles of computer organization and the basic architectural concepts.
- It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations.
- Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors.

Course Outcomes:

- Understand the basics of instruction sets and their impact on processor design.
- Demonstrate an understanding of the design of the functional units of a digital computer system.
- Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
- Design a pipeline for consistent execution of instructions with minimum hazards.
- Recognize and manipulate representations of numbers stored in digital computers.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
CS302PC: COMPUTER ORGANIZATION AND ARCHITECTURE
(Common to CSD, CSE, and CSM)

B.Tech.II Year I Sem.

L T P C
3 0 0 3**Prerequisites:** No prerequisites.**Co-requisite:** A Course on "Digital Electronics".**Course Objectives**

1. To introduce the principles of computer organization and the basic architectural concepts.
2. To understand the basic organization, design, and programming of a simple digital computer using register transfer language.
3. To learn computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing.
4. To study memory organization, I/O systems, and multiprocessors.

Course Outcomes

After successful completion of the course, the student will be able to:

1. Understand the basics of instruction sets and their impact on processor design.
2. Demonstrate an understanding of the design of functional units of a digital computer system.
3. Evaluate cost, performance, and design trade-offs in processor and memory design.
4. Design a pipeline for consistent execution of instructions with minimum hazards.
5. Recognize and manipulate representations of numbers stored in digital computers.

UNIT-I**Boolean Algebra and Logic Gates:** Binary codes, Binary storage and registers, Binary logic, Digital logic gates.**Data Representation:** Data types, Complements, Fixed Point Representation, Floating Point Representation.**Digital Computers:** Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design, and Computer Architecture.**UNIT-II****Combinational Logic:** Combinational circuits, Analysis procedure, Design procedure.

Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator.

Decoders, Encoders, Multiplexers. HDL for Combinational Circuits.

Sequential Logic: Sequential circuits, Latches, Flip-Flops. Analysis of clocked sequential circuits, State reduction and assignment, Design procedure. Registers, Shift registers, Ripple counters, Synchronous counters, Other counters.**UNIT-III****Register Transfer Language and Micro-operations:** Register Transfer Language, Register transfer, Bus and memory transfers. Arithmetic, Logic, and Shift Micro-operations. Arithmetic Logic Shift Unit.**Basic Computer Organization and Design:** Instruction codes, Computer Registers, Computer Instructions. Timing and Control, Instruction Cycle. Memory Reference Instructions. Input-Output and Interrupt.

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Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Life cycle analysis (LCA), Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Resource exploitation, Crazy Consumerism, Environmental Education, Environmental Ethics, Concept of Green Building.

TEXT BOOKS:

1. Environmental Studies by Anubha Kaushik, 4th Edition, New Age International Publishers
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

REFERENCE BOOKS:

1. Text book of Environmental Science and Technology - Dr. M.Anji Reddy 2007, BS Publications
2. Environmental Science: towards a sustainable future by Richard T. Wright 2008
PHLLearning Private Ltd. New Delhi.
3. Environmental Engineering and science by Gilbert M. Masters and Wendell P.
Ela.2008PHI Learning Pvt.Ltd.
4. Environmental Science by Daniel B. Botkin& Edward A. Keller, Wiley INDIA edition
5. Introduction to Environmental Science by Y. Anjaneyulu, BS Publications
6. Environmental Studies by R. Rajagopalan, Oxford University Press

6. Environmental Studies by R. Rajagopalan, Oxford University Press

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS410SD: Skill Development Course-II:Data Visualization Using Power BI/R
(Common to CSD, CSE, and CSM)

B.Tech.IIYearIISem.

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Course Objectives:

- Effective use of Business Intelligence (BI) technology (Power BI) to apply data visualization
- To discuss patterns and relationships in the data.
- To build Dashboard applications.
- To communicate the results clearly and concisely.
- To be able to work with different formats of datasets.

Course Outcomes: At the end of the course a student should be able to

- Understand How to import data into power BI
- Understand Power BI concepts of Dimensions and Measures.
- Develop Programs and understand how to map Visual Layouts and Graphical Properties.
- Create a Dashboard that links multiple visualizations.
- Use graphical user interfaces to create Frames for providing solutions to real world problems.

Lab Problems:

- 1 Understanding Data, What is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
- 2 Getting started with Power BI Software using Data file formats, connecting your Data to Power BI, creating basic charts (line, bar charts, Tree maps), Using the Show me panel.
- 3 Power BI Calculations, Overview of SUM, AVG, and Aggregate features, Creating custom calculations and fields.
- 4 Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.
- 5 Editing and Formatting Axes, Manipulating Data in Power BI data, Pivoting Power BI data.
- 6 Structuring your data, Sorting and filtering Power BI data, Pivoting Power BI data.
- 7 Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tool tips, Formatting your data with colors.
- 8 Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
- 9 Power BI file types, publishing to Power BI Online, Sharing your visualizations, printing, and Exporting.
- 10 Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

REFERENCES:

1. Microsoft Power BI cook book, Brett Powell, 2nd edition.
2. R Programming for Data Science By Roger D. Peng (References)
3. The Art of R Programming by Norman Matloff Cengage Learning India.

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COMPUTER SCIENCE AND ENGINEERING-DATA SCIENCE 2025-26
CMR ENGINEERING COLLEGE (UGC AUOTONOMOUS), Affiliated to JNTUH, HYDERABAD

VA311HS/ VA411HS:ENVIRONMENTAL SCIENCE

(Common to CSE/CSD/CSM and ECE)

B.Tech. II Year II Sem.

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Course Objectives:

1. Understanding the importance of ecological balance for sustainable development
2. Understanding the impacts of developmental activities and mitigation measures
3. Understanding the environmental policies and regulations
4. Integrate human ecology and science of environmental problems
5. The effect of human activities on atmospheric pollution

Course Outcomes:

Based on this course, the Engineering graduate will

1. Understand the harmonious co-existence in between nature and human being
2. Recognize various problems related to environment degradation.
3. Develop relevant research questions for environmental investigation.
4. Generate ideas and solutions to solve environmental problems due to soil, air and water pollution
5. Evaluate and develop technologies based on ecological principles and environmental regulations which in turn helps in sustainable development

UNIT-I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification structure and function of an ecosystem. Food chains, food webs, and ecological pyramids. Flow of energy. Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem resources and resilience, ecosystem value, services and carrying capacity.

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, natural capital & Resources water resources: use and over utilization of surface and ground water, conflicts over water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources: use of alternate energy source, case studies.

UNIT-III

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity, consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation. Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. conservation of biodiversity. In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution. Air Pollution: Primary and secondary pollutants. Automobile and Industrial pollution. Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards. Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies. Waste water Treatment methods: Primary, secondary and Tertiary.

Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montreal Protocol. Anthropogenic activities, influence on the occurrence of COVID-19 Pandemic? How environment benefitted due to global lockdown arising out of corona outbreak.

UNIT-V

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Lead Programs:

1. Linear Discriminant Analysis is computed using the `lda()` function. Let's use the iris data set of R Studio.
2. Decision Tree for Regression in R Programming.

REFERENCES:

1. KG Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.
2. R Programming for Data Science by Roger D. Peng (References)
3. The Art of R Programming by Norman Matloff Cengage Learning India.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CD408PC: DATA SCIENCE USING R LAB
(Only for CSD)

B.TECH II Year II Sem.

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Pre-requisites: Any programming language.

Course Objectives:

1. Familiarize with R basic programming concepts, various data structures for handling datasets, various graph representations and Exploratory Data Analysis concepts

Course Outcomes:

1. Setup R programming environment.
2. Understand and use R - Data types and R - Data Structures.
3. Develop programming logic using R - Packages.
4. Analyze data sets using R - programming capabilities

List of Experiments:

1. Download and install R-Programming environment and install basic packages using install.packages() command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc.,)
3. Write R command to
 - i) Illustrate summation, subtraction, multiplication, and division operations on vectors using vectors.
 - ii) Enumerate multiplication and division operations between matrices and vectors in R console
4. Write R command to
 - i) Illustrates the usage of Vector subsetting and Matrix subsetting
 - ii) Write a program to create an array of 3x3 matrixes with 3 rows and 3 columns.
5. Write an R program to draw i) Pie chart ii) 3D Pie Chart, iii) Bar Chart along with chart legend by considering suitable CSV file
6. Create a CSV file having Speed and Distance attributes with 1000 records. Write R program to draw
 - i) Box plots
 - ii) Histogram
 - iii) Line Graph
 - iv) Multiple line graphs
 - v) Scatter plotto demonstrate the relation between the cars speed and the distance.
7. Implement different data structures in R (Vectors, Lists, Data Frames)
8. Write an R program to read a csv file and analyze the data in the file using EDA (Explorative Data Analysis) techniques.
9. Write an R program to illustrate Linear Regression and Multi linear Regression considering suitable CSV file

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

CS304PC/CM404PC: OPERATING SYSTEMS

(Common to CSD, CSE, and CSM)

B.Tech.II Year II Sem.

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Prerequisites:

1. A course on "Computer Programming and Data Structures".
2. A course on "Computer Organization and Architecture".

Course Objectives:

1. Introduce operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
2. Introduce the issues to be considered in the design and development of operating system
3. Introduce basic Unix commands, system call interface for process management, interprocess communication and I/O in Unix

Course Outcomes:

1. Will be able to control access to a computer and the files that may be shared
2. Demonstrate the knowledge of the components of computers and their respective roles in computing.
3. Ability to recognize and resolve user problems with standard operating environments.
4. Gain practical knowledge of how programming languages, operating systems, and architectures interact and how to use each effectively.

UNIT-I

Operating System - Introduction, Structures - Simple Batch, Multiprogrammed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls

Process - Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads

UNIT-II

CPU Scheduling - Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling. System call interface for process management-fork, exit, wait, waitpid, exec

Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock

UNIT-III

Process Management and Synchronization-The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors **Interprocess Communication Mechanisms**: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

UNIT-IV

Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

UNIT-V

File System Interface and Operations-Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management. Usage of open, create, read, write, close, lseek, stat, ioctl system calls.

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UNIT-V

Branch and Bound: General method, applications - Travelling salesperson problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

TEXTBOOK:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni, and Rajasekaran, University Press.

REFERENCE BOOKS:

1. Design and Analysis of Algorithms, Aho, Ullman, and Hopcroft, Pearson Education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, PHI Pvt. Ltd. / Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R. Tamassia, John Wiley and Sons.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
CD405PC: INTRODUCTION TO DATA SCIENCE

(Only for CSD)

B.Tech. II Year II Sem.

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Prerequisites:

1. Algebra, basic calculus, and statistics.
2. Basic understanding of any programming language (Python, Java, C++, etc.).

Course Objectives

1. Learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
2. Understand the basic types of data and basic statistics
3. Identify the importance of data reduction and data visualization techniques

Course Outcomes: After completion of the course, the student should be able to

1. **Understand** the fundamentals of data science, statistical inference, and the basics of R programming.
2. **Identify** different data types and **apply** statistical measures to describe and analyze data.
3. **Utilize** R for handling vectors, matrices, arrays, factors, data frames, and lists effectively.
4. **Apply** conditionals, loops, and functions in R for efficient data manipulation and analysis.
5. **Implement** data reduction techniques and use various visualization methods to interpret complex data.

UNIT - I

Introduction: Definition of Data Science Big Data and Data Science hype and getting past the hype Datafication Current landscape of perspectives Statistical Inference Populations and samples - Statistical modeling, probability distributions, fitting a model - Over fitting.

Basics of R: Introduction, R- Environment Setup, Programming with R, Basic Data Types.

UNIT - II**Data Types & Statistical Description**

Types of Data: Attributes and Measurement, What is an Attribute? The Type of an Attribute, The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, and Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes. Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Inter- quartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

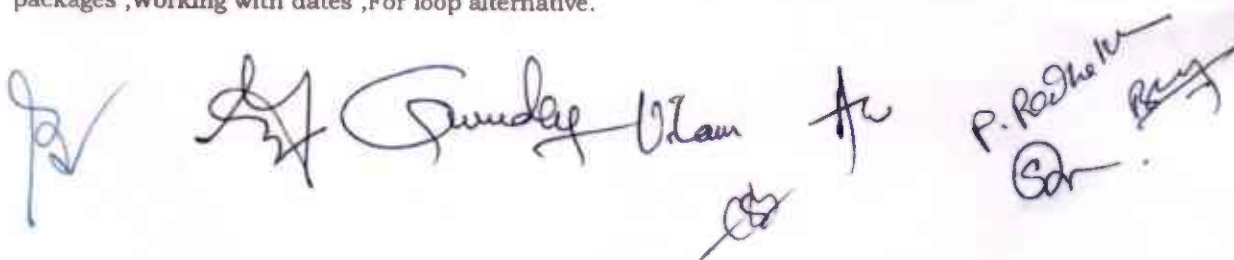
UNIT - III

Vectors: Creating and Naming Vectors, Vector Arithmetic, Vector sub setting, **Matrices:** Creating and Naming Matrices, Matrix Sub setting, Arrays, and Class. Operators, Conditional and Control Statements. **Factors and Data Frames:** Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered. Factors, Comparing Ordered Factors, Introduction to Data Frame, sub setting of Data Frames, Extending Data Frames, and Sorting Data Frames. **Lists:** Introduction, creating a List, Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors

UNIT - IV

Functions in R: Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

Data Wrangling in R: Data Wrangling Review, Importing/Exporting Data, Data reshape (library(tidyrr)), Dealing with row names (library(tibble)), Data Visualization (library(ggplot2)), Subsetting Data (library(dplyr)), Reordering rows (library(dplyr)),Joining Data frames (library(dplyr)), Transforming Variables (library(dplyr)) • Split, apply, combine (library(dplyr)) ,Other useful tidyverse packages ,Working with dates ,For loop alternative.



COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

TEXTBOOKS:

1. OperatingSystemPrinciples-AbrahamSilberchatz,PeterB.Galvin,GregGagne7thEdition, John Wiley
2. AdvancedprogrammingintheUNIXenvironment,W.R.Stevens,Pearsoneducation.

REFERENCEBOOKS:

1. OperatingSystems-InternalsandDesignPrinciples,WilliamStallings,FifthEdition-2005, Pearson Education/PHI
2. OperatingSystemADesignApproach-Crowley,TMH.
3. ModernOperatingSystems,AndrewS.Tanenbaum2ndedition,Pearson/PHI
4. UNIXprogrammingenvironment,KernighanandPike,PHI/PearsonEducation
5. UNIXInternals-TheNewFrontiers,U.Vahalia,PearsonEducation.

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Left side: A large signature that appears to be "Sundey" followed by "V. Lam". Below it is a signature that looks like "Jru".

Right side: A signature that looks like "P. Reddy" with a checkmark below it. To the right of that is a signature that looks like "San." with a checkmark below it.

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
CS307PC/ CM406PC:OPERATINGSYSTEMSLAB
(Common to CSD, CSE, and CSM)

B.Tech.IIYearIISem.

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Prerequisites:

- A course on "Programming for Problem Solving".
- A course on "Computer Organization and Architecture".

Co-requisite: A course on "Operating Systems".**Course Objectives:**

1. To provide an understanding of the design aspects of operating system concepts through simulation.
2. Introduce basic Unix commands, system call interface for process management, interprocess communication and I/O in Unix.

Course Outcomes:

1. Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.
2. Able to implement C programs using Unix system calls.

List of Experiments:

1. Write C program to simulate the following CPU Scheduling algorithms a) FCFS b) SJF c) Round Robin d) priority
2. Write programs using the I/O system calls of UNIX/LINUX operating system (open, read, write, close, lseek, stat, fork, exit)
3. Write a C program to simulate Banker's Algorithm for Deadlock Avoidance.
4. Write a C program to implement the Producer - Consumer problem using semaphores using UNIX/LINUX system calls.
5. Write C programs to illustrate the following IPC mechanisms a) Pipes b) FIFOs c) Message Queues d) Shared Memory
6. Write C program to simulate the following memory management techniques a) Paging b) Segmentation
7. Write C program to simulate Page replacement policies a) FCFS b) LRU c) Optimal

TEXTBOOKS:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Advanced programming in the Unix environment, W.R. Stevens, Pearson Education.

REFERENCE BOOKS:

1. Operating Systems - Internals and Design Principles, William Stallings, Fifth Edition-2005, Pearson Education/PHI.
2. Operating System-A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S. Tanenbaum, 2nd edition, Pearson/PHI.
4. UNIX Programming Environment, Kernighan and Pike, PHI/Pearson Education.
5. UNIX Internals: The New Frontiers, U. Vahalia, Pearson Education.

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

UNIT - V

Data Reduction: Overview of Data Reduction Strategies, Wavelet Transforms, Principal Components Analysis, Attribute Subset Selection.

Regression and Log-Linear Models: Parametric Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation.

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
3. KG Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson Education.
2. Brian S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
3. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008. Paul Teator, "R Cookbook", O'Reilly, 2011.
4. Data Wrangling with R by Alexandra L Emmons.
5. Vikram Pudi and P. Radha Krishna, Data Mining, Oxford University Press, 2009, ISBN No.: 0195686284

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COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26

CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD

- IV. To Find the Number of Packets Dropped due to Congestion
- V. To Compare Data Rate & Throughput
- VI. To Plot Congestion for Different Source/Destination
- VII. To Determine the Performance with respect to Transmission of Packets

Textbook

1. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, 5th Edition, Pearson Education/PHI

References

1. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan, 3rd Edition, TMH

P. A. Gundry *V. Ram* *A. R.* *R. R.*

COMPUTER SCIENCE AND ENGINEERING-(DATA SCIENCE) 2025-26
CMR ENGINEERING COLLEGE (UGC AUTONOMOUS), Affiliated to JNTUH, HYDERABAD
CS407PC: COMPUTER NETWORKS LAB
(Common to CSD, CSE, and CSM)

B. Tech. II Year II Sem.

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Course Objectives

1. To understand the working principle of various communication protocols.
2. To understand the network simulator environment and visualize a network topology and observe its performance.
3. To analyze the traffic flow and the contents of protocol frames.

Course Outcomes

1. Implement data link layer framing methods.
2. Analyze error detection and error correction codes.
3. Implement and analyze routing and congestion issues in network design.
4. Implement encoding and decoding techniques used in presentation layer.
5. To be able to work with different network tools.

List of Experiments

1. Implement the data link layer framing methods such as character, character-stuffing and bit-stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC-CCIP.
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4. Implement Dijkstra's algorithm to compute the shortest path through a network.
5. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
6. Implement distance vector routing algorithm for obtaining routing tables at each node.
7. Implement data encryption and data decryption.
8. Write a program for congestion control using Leaky Bucket algorithm.
9. Write a program for frame sorting techniques used in buffers.
10. **Wireshark**
 - i. Packet Capture Using Wireshark
 - ii. Starting Wireshark
 - iii. Viewing Captured Traffic
 - iv. Analysis and Statistics & Filters.
11. **Nmap**
 - i. How to run Nmap scan
 - ii. Operating System Detection using Nmap
12. **Do the following using Any Network Simulator**
 - I. Introduction
 - II. To Find the Number of Packets Dropped
 - III. To Find the Number of Packets Dropped by TCP/UDP