ACADEMIC REGULATIONS (R20)

COURSE STRUCTURE AND DETAILED SYLLABUS

(CHOICE BASED CREDIT SYSTEM (CBCS))

B.Tech.

Computer Science and Engineering (Data Science)

(B.Tech. Regular: Applicable for the batches admitted from 2020 - 2021)

&

(B.Tech. LES: Applicable for the batches admitted from 2021 - 2022)

CMR GROUP OF INSTITUTIONS
EXPLORE TO INVENT

Department of Computer Science and Engineering

CMR INSTITUTE OF TECHNOLOGY

(UGC - Autonomous)

Approved by AICTE, Permanently Affiliated to JNTUH, Accredited by NBA and NAAC with A Grade

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FOREWORD

CMR Institute of Technology, established in the year 2005, Approved by AICTE, New Delhi, Permanently Affiliated to JNTUH, thrice Accredited by NBA, Achieved UGC Autonomous Status and has been bestowed with NAAC 'A' Grade in July 2018 for its remarkable academic accomplishments accompanied by its unflinching spirit and dedication to impart quality technical education to the deserving aspirants. The institution has commenced functioning independently within the set norms prescribed by UGC and AICTE. The performance of the institution manifests the confidence that the prestigious monitoring body, the UGC has on it, in terms of upholding its spirit and sustenance of the expected standards of functioning on its own consequently facilitating the award of degrees for its students. Thus, an autonomous institution is provided with the necessary freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

CMR Institute of Technology takes pride for having won the confidence of such distinguished academic bodies meant for monitoring the quality in technology education. Besides, the institution is delighted to sustain the same spirit of discharging the responsibilities that it has been conveying since a decade to attain the current academic excellence, if not improving upon the standards and ethics. Consequently, statutory bodies such as the Academic Council and the Boards of Studies have been constituted under the supervision of the Governing Body of the College and with the recommendations of the JNTU Hyderabad, to frame the regulations, course structure and syllabi for autonomous status.

The autonomous regulations, course structure and syllabi have been framed in accordance with the vision and mission of the institution along with certain valuable suggestions from professionals of various ancillary fields such as the academics, the industry and the research, all with a noble vision to impart quality technical education and contribute in catering full-fledged engineering and management graduates to the society.

All the faculty members, the parents and the students are requested to study all the rules and regulations carefully and approach the Principal to seek any clarifications, if needed, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the institution and for brightening the career prospects of engineering and management graduates.

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CMR INSTITUTE OF TECHNOLOGY

Vision: To create world class technocrats for societal needs.

Mission: Achieve global quality technical education by assessing learning environment through

- Innovative Research & Development
- Eco-system for better Industry institute interaction
- Capacity building among stakeholders

Quality Policy: Strive for global professional excellence in pursuit of key-stakeholders.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

Vision: Develop competent software professionals, researchers and entrepreneurs to serve global society.

Mission: The department of **Computer Science and Engineering (Data Science)** is committed to

- create technocrats with proficiency in design and code for software development
- adapt contemporary technologies by lifelong learning and face challenges in IT and ITES sectors
- quench the thirst of knowledge in higher education, employment, R&D and entrepreneurship

I. Programme Educational Objectives (PEOs): Engineering Graduates will

1. Pursue successful professional career in IT and IT-enabled sectors.
2. Pursue lifelong learning skills to solve complex problems through multidisciplinary-research.
3. Exhibits professionalism, ethics and inter-personal skills to develop leadership qualities.

II. Programme Outcomes (POs): Engineering Graduates will be able to

1. Apply mathematics, science, engineering fundamentals to solve complex engineering problems.
2. Identify, formulate and analyze complex engineering problems to reach substantiated conclusions.
3. Design and develop a component/system/process to solve complex societal engineering problems.
4. Design and conduct experiments to analyze, interpret and synthesize data for valid conclusions.
5. Create, select and apply modern tools, skills, resources to solve complex engineering problems.
6. Apply contextual engineering knowledge to solve societal issues.
7. Adapt modern engineering practices with environmental safety and sustainable development.
8. Apply professional code of ethics, responsibilities and norms in engineering practices.
9. Compete as an individual and/or as a leader in collaborative cross cultural teams.
10. Communicate effectively through technical reports, designs, documentations and presentations.
11. Endorse cognitive management skills to prepare project report using modern tools and finance.
12. Engage in independent and life-long learning in the broad context of technological changes.

III. Programme Specific Outcomes (PSOs): Engineering Graduates will be able to

1. Design and develop Computer-Based-Systems using Algorithms, Networks, Security, Gaming, Full Stack, Golang, IoT, Cloud, Data Science and AI&ML.
2. Apply data analytics to solve real world problems.

Academic Regulations (R20)
B.Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2020 - 21)
&
B.Tech. - Lateral Entry Scheme
(For batches admitted from the academic year 2021 - 22)

PREAMBLE

For pursuing four year under graduate Bachelor Degree Programme in Engineering (B.Tech.) offered by **CMR Institute of Technology** under Autonomous status will herein be referred to as CMRIT (Autonomous).

All the specified rules are herein approved by the Academic Council. These rules will be in force and are applicable to students admitted from the Academic Year 2020-21 onwards. Any reference to "Institute" or "College" in these rules and regulations stand for CMRIT (Autonomous).

Choice Based Credit System (CBCS) has been adopted since 2017-18 under Autonomous status.

All the rules and regulations specified shall hereafter 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, CMRIT (Autonomous) shall be The Chairman, Academic Council.

1. UNDERGRADUATE PROGRAMS OFFERED (E&T)

CMRIT (Autonomous), affiliated to JNTUH, offers 4 Year (8 Semesters) **B.Tech.** Degree Programme in the following Branches of Engineering:

S. No.	Branch
1	Civil Engineering (CE)
2	Mechanical Engineering (ME)
3	Electronics and Communication Engineering (ECE)
4	Computer Science and Engineering (CSE)
5	Computer Science and Engineering (AI & ML)
6	Computer Science and Engineering (Data Science)

2. ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION

2.1. Admission into first year of four year B.Tech. (Regular) Degree Programme:

2.1.1. Eligibility: A candidate seeking admission into the first year of four year B. Tech. Degree Programme should have:

(i) Passed either Intermediate Public Examination (IPE) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.

(ii) Secured a rank in the TSEAMCET examination conducted by TSCHE for allotment of a seat by the Convenor, TSEAMCET.

2.1.2. Admission Procedure: Admissions are made into the first year of four year B.Tech. Degree Programme as per the stipulations of the TSCHE.

(a) Category A: 70% of the seats are filled through TSEAMCET counseling.
(b) Category B: 30% of the seats are filled by the Management.

2.2. Admission into the second year of four year B. Tech. (Regular) Degree Programme Under Lateral Entry Scheme.

2.2.1 Eligibility: A candidate seeking admission into the II year I Semester B. Tech. Regular Degree Programme under Lateral Entry Scheme (LES) should have passed the qualifying examination (B.Sc. Mathematics or Diploma in concerned course) and have secured a rank at Engineering Common Entrance Test TSECET (FDH). Admissions are made in accordance with the instructions received from the Convenor, TSECET and Government of Telangana State.

2.2.2 Admission Procedure: Admissions are made into the II year of four year B.Tech. (Regular) Degree Programme through Convenor, TSECET (FDH) against the sanctioned intake in each Programme of study as lateral entry student.

2.3. Branch Transfers: There shall be no Branch transfers after the completion of Admission Process.

2.4. Medium of Instruction: The Medium of Instruction and Examinations for the entire B.Tech. programme will be in **English** only.

3. B.Tech. PROGRAMME STRUCTURE

3.1 Admitted under Four year B. Tech. (Regular) degree Programme:

3.1.1 A student after securing admission shall pursue the under graduate programme in B.Tech. for a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which, students shall forfeit their seat in B.Tech course.

3.1.2 As per AICTE guidelines, a 3-week 'Mandatory **Induction Programme'** shall be offered to I-B.Tech. students to acquaint the newly admitted students with the professional environment and prepare them for the academic schedules ahead.

3.1.3 The entire B.Tech. programme is structured for a total of 160 credits. Distribution of credits Semester-wise is available in the respective course structure.

3.1.4 Each student shall register and secure 160 credits (with CGPA $\geq$ 5) for the completion of the under graduate programme and award of the B.Tech. degree.

3.2 Admitted under Lateral Entry Scheme (LES) into B. Tech. degree Programme:

3.2.1 After securing admission into II year B.Tech. I Semester, the LES students shall pursue a course of study for not less than three academic years (6 Semesters) and not more than six academic years (12 Semesters), failing which students shall forfeit their seat in B.Tech. programme.

3.2.2 The student shall register and secure 122 credits (with CGPA $\geq$ 5) from II year to IV year B.Tech. programme (LES) for the award of B.Tech. degree.

3.3 The Course Structure is designed based on the AICTE Model Curriculum (Jan-2018) for Under-Graduate Degree Courses in Engineering & Technology. **UGC / AICTE** specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations / Norms, which are listed below:

3.3.1 **Semester Scheme:** Each B.Tech. (Regular) Programme is of 4 Academic Years (8 Semesters) and B.Tech. (LES) Programme is of 3 Academic Years (6 Semesters)), with the academic year being divided into two semesters of 22 weeks (≥ 90 Instructional days per semester) each, each Semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)', Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and Curriculum / Course Structure as suggested by AICTE are followed.

3.3.2 **Credit Courses:**

a) All Subjects / Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject / Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods : Credits) Structure based on the following pattern:

Theory		Practical	
1 Hr. Lecture (L) per week	1 credit	1 Hr. Practical (P) per week	0.5 credit
1 Hr. Tutorial (T) per week	1 credit	2 Hrs Practical (Lab) per week	1.0 credit

All Mandatory Courses, Study Tour, Guest Lecture, etc., will not carry any Credits.

b) **Contact Hours:** Weekly contact hours – maximum of 30 hours per week (i.e. 1 hour = 60 Minutes) including credit and non-credit courses.

3.3.3 **Subject / Course Classification and Nomenclature:**

CMRIT has followed the guidelines specified by AICTE / UGC / JNTUH. The subjects / courses offered in B.Tech. programme are broadly classified as mentioned below.

S. No.	Category	Breakup of Credits	
		(AICTE)	(CMRIT)
1	Humanities and Social Sciences including Management courses (HSMC)	12*	10
2	Basic Science Courses (BSC)	25*	25
3	Engineering Science courses including workshop, drawing, basics of Electrical / Mechanical / Computer etc. (ESC)	24*	24
4	Professional core courses (PCC)	48*	60
5	Professional Elective courses relevant to chosen specialization / branch (PEC)	18*	18
6	Open subjects – Electives from other technical and /or emerging subjects (OEC)	18*	09
7	Project work, seminar and internship in industry or appropriate work place / academic and research institutions in India / abroad (PRJ)	15*	14
8	Mandatory Courses: (Environmental Sciences, Induction program, Indian Constitution, Essence of Indian Traditional Knowledge, etc) (MC)	(non-credit)	(non-credit)
Total Credits		**160***	**160**

**Minor variation is allowed as per need of the respective disciplines.*

4. COURSE REGISTRATION

4.1 A '**faculty advisor or counselor**' shall be assigned to each student to advise the student about the B.Tech. programme, course structure and curriculum, choice / option for subjects / courses, based on his/her competence, progress, pre-requisites and interest.

4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through online submission, ensuring '**date** and **time stamping**'.

The online registration requests for any 'current semester' shall be completed **before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.

4.3 A student can apply for **online** registration, **only after** obtaining the '**written approval**' from his faculty advisor or counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor and the student.

4.4 A student has to register for all subjects/courses in a semester as specified in the course structure and may be permitted to register one additional theory subject / course limited to 3 credits, based on the student's **progress** and SGPA / CGPA, and completion of the '**pre-requisites'** as indicated for various subjects/courses, in the department course structure and syllabus contents.

4.5 If the student submits ambiguous choices or multiple options or erroneous (incorrect) entries during **online** registration for the subject(s) / course(s) under a given / specified course group / category as listed in the course structure, only the first mentioned subject / course in that category will be taken into consideration.

4.6 Subject / course options exercised through **online** registration are final and **cannot** be changed or inter- changed; further, alternate choices will not be considered. However, if the subject / course that has already been listed for registration by Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice - either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by Head of the Department, with due notification and time-framed schedule, within the **first week** from the commencement of class-work for that semester.

4.7 Dropping of additional registered subject / course (refer 4.4) may be permitted only after obtaining prior approval from the faculty advisor / counselor, '**within a period of 15 days**' from the commencement of that semester.

4.8 **Open electives**: Students have to choose one open elective wherever offered from the list of open electives given for their stream. Students should opt for open electives offered by other departments / branches only.

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

4.10 **Mandatory Courses (Non-Credit):** All mandatory courses wherever offered require prior registration.

5. SUBJECTS / COURSES TO BE OFFERED

5.1 A typical Section (or Class) Strength for each Semester shall be 60. A subject / course may be offered to the students, **if only** a minimum 1/3 of students register to the course. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

i) More than **one faculty member** may offer the **same subject** (lab / practical's may be included with the corresponding theory subject in the same semester) in any semester. However, selection choice for students will be based on '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

ii) If more entries for registration of a subject come into picture, then the concerned Head of the Department shall take necessary decision, whether or not to offer such a subject / course for **two (or multiple) sections**.

6. ATTENDANCE REQUIREMENTS

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum 75% of attendance in aggregate (excluding the days of midterm examinations) for all the subjects / courses, excluding attendance in mandatory courses in that semester.

6.2 Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be granted by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in **no** case be condoned.

6.5 **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 their registration for that semester shall stand cancelled. They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and / or open electives, the same may also be re-registered, if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7. ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. 6.

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course, if student secures not less than 35% marks (25 out of 70 marks) in the semester end examination (SEE), and a minimum of 40% of marks in the sum total of the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) taken together; in terms of letter grades, this implies securing **C** grade or above in that subject / course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to summer internship and project courses, if student secures not less than 40% of the total marks in each of them. The student would be treated as failed, if student does not submit a report on his project(s), or does not make a presentation of the same before the evaluation committee as per the schedule. Student may reappear once for each of the above evaluations, when they are scheduled again; if he fails in such 'one re-appearance' evaluation also, student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	I Semester to II Semester	Regular course of study of I semester.
2	II Semester to III Semester	**(i)** Regular course of study of II semester. **(ii)** Must have secured at least 19 credits out of 38 credits i.e., 50% credits up to second semester from all the relevant regular and supplementary examinations whether the student takes those examinations or not.
3	III Semester to IV Semester	Regular course of study of III semester.

4	IV Semester to V Semester	**(i)** Regular course of study of IV semester. **(ii)** Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to fourth semester (21 credits out of 42 credits in case of LES) from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	V Semester to VI Semester	Regular course of study of V semester.
6	VI Semester to VII Semester	**(i)** Regular course of study of sixth semester. **(ii)** Must have secured at least 72 credits out of 120 credits (49 credits out of 82 credits in case of LES) i.e., 60% credits up to sixth semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	VII Semester to VIII semester	Regular course of study of VII semester.

7.4 A student has to register for all subjects covering 160 credits (122 credits in case of LES) as specified and listed (with the relevant course / subject classifications as mentioned) in the course structure, fulfill all the attendance and academic requirements for 160 credits (122 credits in case of LES) securing a minimum of **'C'** grade or above in each subject, and 'earn all 160 credits (122 credits in case of LES) securing SGPA ≥ 5.0 (in each semester), and CGPA (at the end of each successive semester) ≥ 5.0, to successfully complete the under graduate programme.

7.5 If a student registers for '**additional subjects'** (in the parent department or other departments / branches of engineering) other than those listed subjects totaling to 160 credits (122 credits in case of LES) as specified in the course structure of parent department, the performances in those '**additional subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits (122 credits in case of LES)) will not be taken into account while calculating the SGPA and CGPA. For such '**additional subjects'** registered, % of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1 to 7.4 above.

7.6 A student eligible to appear in the semester end examination for any subject / course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for that subject / course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject / course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.7 A student **detained in a semester due to shortage of attendance may be re-admitted when the same semester is offered in the next academic year for fulfillment of academic requirements**. The academic regulations under which student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which student has been detained.

7.8 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which student has been readmitted shall be applicable.

8. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

8.1 The performance of a student in each semester shall be evaluated subject-wise / course-wise (irrespective of credits assigned) with a maximum of 100 marks. These evaluations shall be based on 30 marks allotted for CIE (Continuous Internal Evaluation) and 70 marks for SEE (Semester End Examination), and a letter grade corresponding to the percentage of marks obtained shall be given.

8.2 Evaluation of Theory Subjects / Courses

A) Continuous Internal Evaluation: For each theory subject, during the semester, there shall be 2 mid-term examinations of 30 marks each. Each mid-term examination consists of subjective paper for 25 marks & assignment for 5 marks and the final CIE marks (for total of 30) are calculated by taking 80% weightage from best of the two mid examinations and 20% weightage from the least scored mid examination marks in each subject.

- The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.
- The subjective paper shall be conducted for duration of 90 minutes. Each subjective paper shall contain 2 parts (Part-A and Part-B). Part-A consists of one compulsory question with five sub questions carrying two marks each. Part-B consists of 3 essay questions carrying five marks each with internal choice; the student has to answer all 3 questions.
- First assignment should be submitted before the commencement of the first mid-term examinations, and the second assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified / given by the concerned subject teacher.

B) Semester End Examinations: The duration of SEE is 3 hours. The details of the question paper pattern are as follows:

- The end semester examinations will be conducted for 70 marks consisting of two parts viz. i) **Part- A** for 20 marks, ii) **Part - B** for 50 marks.
- Part-A is compulsory, which consists of ten questions (two from each unit) carrying 2 marks each.
- Part-B consists of five questions (numbered from 11 to 15) carrying 10 marks each. One question from each unit (may contain sub-questions) with internal choice.

8.3 Evaluation of Practical / Design / Drawing Subjects /Courses: In any semester, a student has to complete a minimum of 10 experiments / exercises in each laboratory course and get the record certified by the concerned Head of the Department to be eligible for Semester End Examination. For practical subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks and 70 marks for Semester End Examination (SEE).

A) Continuous Internal Evaluation (CIE): For each practical subject, during the semester, there shall be 2 mid-term examinations of 30 marks each. Each mid-term examination consists of day-to-day work evaluation for 20 marks and internal test for 10 marks conducted by the concerned laboratory teacher for duration of 90 minutes. The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus. The final CIE marks (for total of 30) are calculated by taking 80% weightage from best of the two mid examinations and 20% weightage from the least scored mid examination marks in each practical subject.

B) Semester End Examination (SEE): The SEE for practical subject / course shall be conducted at the end of the semester with duration of 3 hours by one internal and one external examiner appointed by the Head of the Institution as per the recommendation of the concerned Head of the Department.

8.4 Evaluation of Summer Internship: The summer internship shall be registered by the students immediately after their IV semester course work in consultation with course coordinator and carried out in Industry/R&D organizations with a minimum duration of 4

weeks. The completed internship report will be assessed as SEE for 100 marks in V semester by a committee consisting of an external examiner; Head of the Department, supervisor of the Summer Internship and a senior faculty member of the department. There shall be no internal marks for Summer Internship.

8.5 **Evaluation of Industry Oriented Mini-Project:** The industry-oriented mini-project shall be registered by the students immediately after their VI semester course work in consultation with course coordinator and carried out in any Industry or R&D organization during the summer vacation for four weeks duration. The industry oriented mini-project shall be submitted in a report form and presented before the committee in VII semester. It shall be evaluated as SEE for 100 marks by the committee consisting of Head of the Department, concerned supervisor and two senior faculty members of the department. There shall be no internal marks for industry-oriented mini- project.

8.6 **Evaluation of Major Project:** The student shall enroll for the main project 15 days before commencement of VIII semester and should submit before II mid-test as per the guidelines issued by the respective Head of the Department. The main project will be evaluated for a total of 100 marks, of which 30 marks shall be for continuous internal evaluation and 70 marks for the end semester viva-voce examination. Out of 30 marks allocated for CIE, 15 marks shall be awarded by the project supervisor (based on the continuous evaluation of student's performance throughout the project work period), and the other 15 marks shall be awarded by a Departmental Committee consisting of Head of the Department and Project Supervisor, and two senior faculty members, based on the work carried out and the presentation made by the student during internal reviews (at least two internal reviews shall be conducted). The project viva-voce shall be conducted by a committee comprising an external examiner, Head of the Department and Project Supervisor.

8.7 **Evaluation of Mandatory Non-Credit Courses:** A student has to fulfill minimum attendance requirement for successful completion of all mandatory (non-credit) courses. Instead of letter grades, **'Satisfactory'** or "**Unsatisfactory'** shall be indicated and will not be counted for SGPA / CGPA computations for the award of the degree. Any student who fails to obtain the required attendance has to reregister and repeat the course as and when offered for award of the degree as per guidelines.

9. GRADING PROCEDURE

9.1 Marks will be awarded to indicate the performance of the student in each theory subject, lab /practical's/design/drawing practice, Summer Internship, Industry oriented Mini-Project and Major Project based on the percentage of marks obtained in Continuous Internal Evaluation plus Semester End Examination, both taken together, as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following letter grades (UGC Guidelines) and corresponding percentage of marks shall be followed...

% of Marks Secured (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above (≥ 90% , ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ (Excellent)	9
Below 80% but not less than 70% (≥ 70% , < 80%)	A (Very Good)	8
Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ (Good)	7
Below 60% but not less than 50% (≥ 50% , < 60%)	B (Average)	6
Below 50% but not less than 40% (≥ 40% , < 50%)	C (Pass)	5
Below 40% (< 40%)	F (Fail)	0
Absent	Ab	0

9.3 A student obtaining '**F**' grade in any subject shall be considered **'failed**' and will be required to reappear as '**Supplementary Student**' in the Semester End Examination (SEE),

as and when offered. In such cases, Continuous Internal Examination (CIE) in those subject(s) will remain same as those obtained earlier.

9.4 A letter grade does not imply any specific % of marks.

9.5 In general, a student shall not be permitted to repeat any subject/course (s) only for the sake of '**grade improvement**' or 'SGPA / CGPA improvement'. However, student has to repeat all the subjects / courses pertaining to that semester, if detained.

9.6 A student earns grade point (GP) in each subject / course, on the basis of the letter grade obtained in that subject/course (excluding mandatory non-credit courses). Then the corresponding '**credit points**' (CP) are computed by multiplying the grade point with credits for that particular subject/course.

Credit Points (CP) = Grade Point (GP) x Credits

9.7 The student passes the subject / course only when GP ≥ 5 (C grade or above).

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects / courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\mathbf{SGPA\ (S_i) = \sum (C_i\ X\ G_i) / \sum C_i}$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

9.9 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 in **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 from the I year second semester onwards, at the end of each semester, as per the formula:

$$\mathbf{CGPA = \sum (C_i\ X\ S_i) / \sum C_i}$$

where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

Illustration of calculation of SGPA					**Illustration of calculation of CGPA**			
Course /Subject	**Credits**	**Letter Grade**	**Grade Points**	**Credit Points**	**Sem.**	**Credits**	**SGPA**	**Credits x SGPA**
Course 1	4	A	8	4 x 8 = 32	Sem I	19	7	19 x 7= 133
Course 2	3	O	10	3 x 10 = 30	Sem II	19	6	19 x 6= 114
Course 3	3	C	5	3 x 5 = 15	Sem III	21	6.5	21 x 6.5 =136.5
Course 4	3	B	6	3 x 6 = 18	Sem IV	21	6	21 x 6 = 126
Course 5	1.5	A^+	9	1.5x9 = 13.5	Sem V	20	7.5	20 x 7.5 =150
Course 6	1.5	A	8	1.5x8 = 12	Sem VI	20	8	20 x 8 = 160
Course 7	1.5	B^+	7	1.5x7 = 10.5	Sem VII	20	8.5	20 x 8.5 =170
Course 8	1.5	A^+	9	1.5x9 = 13.5	Sem VIII	20	8	20 x 8 = 160
Total	**19**		**62**	**144.5**	**Total**	**160**		**1149.5**
SGPA = 144.5/19 = 7.60					**CGPA = 1149.5/160 = 7.18**			

9.10 For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.

9.11 For calculations listed in Item 9.6–9.10, performance in failed subjects/courses (securing **F** grade) will also be taken into account, and the credits of such subjects/courses will also be included in the multiplications and summations. However, mandatory courses will not be taken into consideration.

10 PASSING STANDARDS

10.1 A student shall be declared '**successful'** or '**passed**' in a semester, if student secures a GP ≥ 5 ('C' grade or above) in every subject/course in that semester (i.e. when student gets an SGPA ≥ 5.00 at the end of that particular semester); and a student shall be declared '**successful**' or '**passed**' in the entire under graduate programme, only when a student gets a CGPA ≥ 5.00 for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. it will show the details of the courses registered (course code, title, no. of credits, grade earned etc.), credits earned, SGPA, and CGPA.

11. DECLARATION OF RESULTS

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 – 9.9.

11.2 The conversion formula from CGPA to percentage of Marks:

Percentage of Marks = (final CGPA – 0.5) x 10

12 AWARD OF DEGREE

12.1 After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. degree the student shall be placed in one of the following four classes based on CGPA:

Class Awarded	Grade to be Secured	Remarks
First Class with Distinction	≥ 8 CGPA	From the aggregate marks secured from 160 Credits for Regular Students and 122 Credits for Lateral Entry Students.
First Class	≥ 6.5 to < 8 CGPA	
Second Class	≥ 5.5 to < 6.5 CGPA	
Pass Class	≥ 5.00 to < 5.5 CGPA	
FAIL	CGPA < 5	

12.2 First class with distinction will be awarded to those students who clear all the subjects in single attempt during their regular course of study by fulfilling the following conditions:

i. Should have passed all the subjects/courses in '**first appearance'** within the first 4 academic years (or 8 sequential semesters) for B.Tech. (Regular) and first 3 academic years (or 6 sequential semesters) for B.Tech. (LES) from the date of commencement of first year first semester for B.Tech. (Regular) and II year I semester for B.Tech. (LES).

ii. Should have secured a CGPA ≥ 8.00, at the end of each of the 8 sequential semesters (6 sequential semesters for LES), starting from I year I semester (starting from II year I semester for LES) onwards.

iii. Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason, shall be placed in '**first class with distinction'**.

12.3 **Award of Medals:** Students fulfilling the conditions listed under item 12.2 alone will be eligible for award of '**College Ranks**' and '**Medals**'.

12.4 **Graduation Day:** The College shall have its own Annual Graduation Day for the award of Degrees issued by the University.

12.5 **Transcripts:** After successful completion of prerequisite credits for the award of degree a transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

13 WITH HOLDING OF RESULTS

If the student has not paid the fees to the Institute 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.

14 SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for odd semester subjects will be conducted along with even semester regular examinations and vice versa.

15. TRANSITORY REGULATIONS

a) A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the degree programme, may be considered eligible for readmission to the same subjects / courses (or equivalent subjects/ courses, as the case may be), and same professional electives / open electives (or from set / category of electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the date of commencement of student's first year first semester).

b) A student who has failed in any subject under any regulation has to pass those subjects in the respective regulations.

c) The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R20 Regulations. The performance evaluation of the student will be done as per the rules and regulations applicable at the time of admission(s) regarding award of grade and/or class as the case may be.

d) If a student readmitted to R20 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R20 Regulations will be substituted by another subject to be suggested by the CMRIT Academic Council.

e) **Promotion Rule:** Where the credits allotted to a semester/year under the regulations studied in are different from that under R20 regulations for the corresponding semester/year, the promotion rules of R20 vide section 7.3 shall be applied after normalization. Normalization is done by scaling down or up the number of credits of a semester/year under the previous regulations to equal the number of credits of the corresponding semester/year under R20 regulations and revising the secured credits also in the same proportion.

16 STUDENT TRANSFERS

There shall be no transfers from other colleges / streams.

17 RULES OF DISCIPLINE

17.1 Any attempt by any student to influence the teachers, examiners, faculty members and staff of Controller of Examination office for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice case and the student can be debarred from the college.

17.2 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, student is awarded zero marks in that subject(s).

17.3 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Malpractice Prevention Committee is final.

18. MALPRACTICE

18.1 Malpractice Prevention Committee: The committee shall examine the student's malpractice and indiscipline cases occurred, while conducting the examinations and recommend appropriate punishment to the Academic Council after taking explanation from the student and concerned invigilator as per the malpractice rules mentioned below. The committee consists of

a) Controller of Examinations - Chairman
b) Addl. Controller of Examinations.- Convener
c) Subject Expert - Member
d) Head of the Department of which the student belongs to - Member
e) The Invigilator concerned - Member

18.2 Malpractice Rules: Disciplinary Action for Improper Conduct in Examinations

S. No.	Nature of Malpractices / Improper Conduct	Punishment
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 he is appearing but has not made use of (material shall include any marks on the body of the candidate 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.
1(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate 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 candidates 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 candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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. The Hall Ticket of the candidate is to be cancelled and sent to the Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate 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 candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate 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 candidate 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 candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate 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 Addl. Controller of examinations / 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 addl. Controller of examinations 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 addl. Controller of examinations, 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 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.	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 candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates 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.
7	Leaves the exam hall taking away answer script or intentionally tears of 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 candidate 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 candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic

		regulations in connection with forfeiture of seat.
8	Possess 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 candidate 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 candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate 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.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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 candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to 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 candidate 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.
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 candidate has appeared 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 principal for further action to award suitable punishment.	

19. SCOPE

i) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

ii) The above mentioned rules and regulations are applicable in general to both B.Tech. (Regular) and B.Tech. (LES), unless and otherwise specific.

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

20. REVISION AND AMENDMENTS TO REGULATIONS

The Academic Council may revise 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 Academic Council.

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COURSE STRUCTURE

B.Tech. (CSE (DS)) – R20 COURSE STRUCTURE

(Applicable from the batch admitted during 2020-21 and onwards)

I – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-BSC-101	Linear Algebra & Calculus	1,2,12		3	1	-	4
2	20-BSC-105	Engineering Chemistry	1,2,12		3	-	-	3
3	20-ESC-101	Basic Electrical & Electronics Engineering	1,2,3,12		3	-	-	3
4	20-ESC-103	Problem Solving with C Programming	1,2,3,12		3	-	-	3
5	20-BSC-106	Engineering Chemistry Lab	4		-	-	3	1.5
6	20-ESC-102	Basic Electrical & Electronics Engineering Lab	4		-	-	3	1.5
7	20-ESC-104	Problem Solving with C Programming Lab	4		-	-	3	1.5
8	20-ESC-108	IT & Engineering Workshop Practice	1,5,9,10		-	-	3	1.5
9	20-MC-101	NSS / Physical Education / Yoga	3,6,8,9,12		-	-	2	-
TOTAL					**12**	**01**	**14**	**19**

II – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-BSC-102	Advanced Calculus	1,2,12		3	1	-	4
2	20-BSC-103	Applied Physics	1,2,12		3	1	-	4
3	20-HSMC-101	English for Engineers	10,12		2	-	-	2
4	20-ESC-105	Data Structures through C	1,2,3,12		3	-	-	3
5	20-ESC-107	Computer Aided Engineering Graphics	1,5,10		-	-	3	1.5
6	20-BSC-104	Applied Physics Lab	4		-	-	3	1.5
7	20-HSMC-102	English Language and Communication Skills Lab	5,10		-	-	3	1.5
8	20-ESC-106	Data Structures through C Lab	4		-	-	3	1.5
9	20-MC-102	Environmental Science	1,6,7,12		2	-	-	-
TOTAL					**13**	**02**	**12**	**19**

III – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-BSC-201	Statistical Foundations for Computer Science	1,2,12		3	1	-	4
2	20-ESC-208	Discrete Mathematics & Graph Theory	1,2,12		3	-	-	3
3	20-ESC-209	Digital Logic Design and Computer Organization	1,2,3,6,12		3	-	-	3
4	20-CS-PC-211	Database Management Systems	1,2,3,12		3	-	-	3
5	20-CS-PC-212	Python Programming	1,2,3,12		3	-	-	3
6	20-ESC-210	Digital Logic Design and Computer Organization Lab	4,5		-	-	3	1.5
7	20-CS-PC-213	Database Management Systems Lab	4,5		-	-	2	1
8	20-CS-PC-214	Python Programming Lab	4,5		-	-	2	1
9	20-HSMC-201	Business Communication Skills Lab	9,10		-	-	3	1.5
10	20-MC-201	Gender Sensitization Lab	9,12		-	-	2	-
TOTAL					**15**	**01**	**12**	**21**

IV – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-CS-PC-221	Automata and Compiler Design	1,2,3,12		3	-	-	3
2	20-CS-PC-222	Design & Analysis of Algorithms	2,3,12,13		3	-	-	3
3	20-CS-PC-223	OOP through Java	1,2,3,12		3	-	-	3
4	20-CS-PC-224	Computer Networks	1,2,12	1	3	-	-	3
5	20-CS-PC-225	Operating Systems	1,2,12		3	-	-	3
6	20-CS-PC-226	OOP through Java Lab	4,5		-	-	3	1.5
7	20-CS-PC-227	Operating Systems (Linux) Lab	3,5	2	-	-	3	1.5
8	20-BSC-204	Aptitude and critical thinking skills Lab	9,10		-	-	3	1.5
9	20-BSC-205	Social Innovation Lab	1 to 12	1,2	-	-	3	1.5
10	20-MC-202	Indian Culture and Constitution	8,12		2	-	-	-
TOTAL					**17**	**00**	**12**	**21**

Note: Summer Internship carried out during Summer Vacation between IV semester & V semester and evaluated in V semester.

V – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-CS-PC-311	Software Design and Engineering	2,3,8,11,12	1	3	-	-	3
2	20-CS-PC-312	Data Mining and Data Analytics	1,2,3,12	1	3	-	-	3
3	20-CS-PC-313	Information and Cyber Security	2,3,6,8,12	1	3	-	-	3
4	20-CS-PC-314	Artificial Intelligence	1,2,3,6,12	1	3	-	-	3
5	**Professional Elective – I**				3	-	-	3
	20-CS-PE-311	Soft Computing	2,3,5,7,12	1				
	20-CS-PE-312	Gamification	2,3,5,6,8,12	1				
	20-CS-PE-313	Digital marketing	2,3,5,6,8,12					
6	20-CS-PC-315	Data Mining and Data Analytics Lab	4,5	2	-	-	2	1
7	20-CS-PC-316	Information and Cyber Security Lab	4,5	2	-	-	2	1
8	20-CS-PC-317	Artificial Intelligence Lab	4,5	2	-	-	2	1
9	20-CS-PC-318	Automated Testing Tools (Selenium) Lab	2,3,4,5,8	2	1	-	2	2
10	20-CS-PR-311	Summer Internship	1 to 12	1,2	-	-	-	1
11	20-MC-301	Coding Skills	2,3,4,5,12		1	-	2	-
TOTAL					**17**	**-**	**10**	**21**

VI – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-CS-PC-321	IoT with Cloud Computing	2,3,6,7,12	1	3	-	-	3
2	20-CS-PC-322	Machine Learning and Data Science	2,3,6,12	1	3	-	-	3
3	20-CS-PC-323	Full Stack Web Development	2,3,6,12	1	3	-	-	3
4	**Professional Elective – II**				3	-	-	3
	20-CS-PE-321	Computer Vision	2,3,5,6,12	1				
	20-CS-PE-322	Blockchain and Cryptocurrency	2,3,5,6,12	1				
	20-CS-PE-323	Augmented and Virtual Reality	2,3,5,8,12	1				
5	**Open Elective – I**				3	-	-	3
	20-OEC-321	CE: Disaster Management	2,7,8,12					
	20-OEC-322	ME: Robotics	1,2,5,12					
	20-OEC-323	ECE: Electronic Measurements and Instrumentation	1,2,12					
	20-OEC-324	CSE: Java Programming	1,2,3,5,12					
6	20-CS-PC-324	IoT with Cloud Computing Lab	4,5	2	-	-	3	1.5
7	20-CS-PC-325	Machine Learning and Data Science Lab	4,5	2	-	-	2	1
8	20-CS-PC-326	Full Stack Web Development Lab	4,5	2	-	-	3	1.5
9	20-HSMC-301	Advanced English Communication Skills Lab	5,10		1	-	2	2
10	20-MC-302	Human Values and Professional Ethics	6,7,8,12		2	-	-	-
TOTAL					**18**	**-**	**10**	**21**

Note: Industry Oriented Mini-Project carried out during Summer Vacation between VI semester & VII semester and evaluated in VII semester.

VII – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-HSMC-411	Business Economics	11,12		3	-	-	3
2	20-CS-PC-411	Go Programming	2,3,6,12	1	3	-	-	3
3	**Professional Elective – III**				3	-	-	3
	20-CD-PE-411	Data Visualization Techniques	2,3,5,6,12	1				
	20-CD-PE-412	Robotic Process Automation	2,3,5,6,12	1				
	20-CD-PE-413	Web and Social Media Analytics	2,3,5,8,12	1				
4	**Professional Elective – IV**				3	-	-	3
	20-CD-PE-414	Data Optimization Techniques	2,3,5,6,12	1				
	20-CD-PE-415	Quantum Computing	2,3,5,7,12	1				
	20-CD-PE-416	Software Process & Project Management	2,3,6,8,12	1				
5	**Open Elective – II**				3	-	-	3
	20-OEC-411	CE: Green Building Technologies	1,2,7,12					
	20-OEC-412	ME: Drones	1,2,3,5,7,12					
	20-OEC-413	ECE: 5G Technologies	1,2,3,5,7,12					
	20-OEC-414	CSE: Database Management Systems	1,2,3,5,12					
6	20-CS-PC-412	Go Programming Lab	4,5	2	-	-	2	1
7	20-CA-PR-411	Industry Oriented Mini-Project	1 to 12	1,2	-	-	-	3
TOTAL					**15**	**-**	**02**	**19**

VIII – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	**Professional Elective – V**				3	-	-	3
	20-CD-PE-421	Predictive Analytics	2,3,5,6,12	1				
	20-CD-PE-422	Data Streaming Techniques	2,3,5,6,12	1				
	20-CD-PE-423	Healthcare Data Analytics	2,3,5,6,12	1				
2	**Professional Elective – VI**				3	-	-	3
	20-CD-PE-424	Mining Massive Datasets	2,3,5,6,12	1				
	20-CD-PE-425	Information Storage and Retrieval	2,3,5,6,12	1				
	20-CD-PE-426	Time Series Analysis and Forecasting	2,3,5,6,12	1				
3	**Open Elective – III**				3	-	-	3
	20-OEC-421	CE: Intellectual Property Rights	1,6,8,12					
	20-OEC-422	ME: Principles of Entrepreneurship	7,8,9,11,12					
	20-OEC-423	ECE: Precision Agriculture	1,2,3,5,6,12					
	20-OEC-424	CSE: Web Technologies	2,3,5,6,12					
4	20-CD-PR-421	Major Project	1 to 12	1,2	-	-	20	10
TOTAL					**09**	**-**	**20**	**19**

B.TECH.-I-SEMESTER SYLLABUS

LINEAR ALGEBRA & CALCULUS

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-BSC-101	3	1	-	4

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	solve system of linear equations by using matrices	3	2	1
CO2	find Eigen values and Eigen vectors	3	2	1
CO3	analyze the nature of sequences and series	3	2	1
CO4	verify mean value theorems and evaluate improper integrals by using Beta and Gamma functions	3	2	1
CO5	find the extreme values of functions of two variables	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Matrices**	9
Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew-Hermitian; orthogonal matrices; Unitary Matrices; 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 elimination method; Gauss Seidel Iteration Method.		
II	**Eigen values and Eigen vectors**	11
Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors and their properties: Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); finding inverse and power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and Nature of the Quadratic Forms; Reduction of Quadratic form to canonical forms by Orthogonal Transformation.		
III	**Sequences and Series**	4+6=10
Part A: Sequence: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences. Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert's ratio test; Raabe's test.		
Part B: Cauchy's Integral test; Cauchy's root test Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence.		
IV	**Calculus**	9
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 and Maclaurin's series (without proof). Definition of Improper Integral: Beta and Gamma functions and their applications.		
V	**Multivariable calculus (Partial Differentiation and applications)**	9
Definitions of Limit and continuity, Partial Differentiation; Euler's Theorem; Total derivative; Jacobian; Functional dependence & independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.		
Textbooks:		
1. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers, 36th Edition, 2010. 2. Advanced Engineering Mathematics by Erwin kreyszig, 9th Edition, John Wiley & Sons, 2006. 3. Calculus and Analytic Geometry by G.B.Thoms and R.L.Finney, 9th Edition, Pearson, Reprint, 2002.		
References:		
1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008. 2. Higher Engineering Mathematics, Ramana B.V., TMH, 11th Reprint.		

ENGINEERING CHEMISTRY

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-BSC-105	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	determine the hardness of water and various treatment methods	3	2	1
CO2	apply the concepts of electrochemistry and corrosion control	3	2	1
CO3	explain the principles of spectroscopy and its applications	3	2	1
CO4	illustrate the various fuels, synthesis of polymers and drugs	3	2	1
CO5	analyze the properties of engineering materials	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Water and its treatment**	9
Introduction - hardness of water - causes of hardness - types of hardness: temporary and permanent - expression and units of hardness - Estimation of hardness of water by complexometric method. Numerical problems. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning - Softening of water by ion exchange processes. Potable water and its specifications - Steps involved in the treatment of potable water - Desalination of water - Reverse osmosis.		
II	**Electrochemistry and Corrosion**	10
Electrochemistry: Introduction, conductance - specific, equivalent and molar conductance, Electrode-Types of electrodes - Construction and functioning of calomel electrode and glass electrode, Nernst equation - electrochemical series and its applications. Batteries: Primary (Lithium cell) and secondary batteries (Lead - acid storage battery and Lithium ion battery). **Corrosion**: Causes and effects of corrosion - Theories of chemical and electrochemical corrosion - mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Corrosion control methods - Cathodic protection - Sacrificial anode and impressed current cathodic methods.		
III	**Spectroscopic techniques and applications**	5+4=9
Part A: Introduction - Absorbance, Extinction coefficient - Principles of spectroscopy - UV - Visible spectroscopy: Beer's-Lamberts law - applications, IR spectroscopy.		
Part B: Basic concepts of nuclear magnetic resonance Spectroscopy- Spin-spin coupling, chemical shift. Introduction to Magnetic resonance imaging.		
IV	**Fuels, Polymers and Synthesis of drug molecules**	11
Fuels: Classification- solid fuels: coal – analysis of coal - proximate and ultimate analysis and their significance. Liquid fuels - Petroleum and its refining, Gaseous fuels - composition and uses of natural gas, LPG and CNG. **Polymers:** Definition - Classification of polymers with examples - Types of polymerization - addition and condensation polymerization with examples. Preparation, Properties, and engineering applications of PVC, Teflon and Nylon. **Synthesis of drug molecules**: Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.		
V	**Engineering Materials**	9
Cement: Portland cement, its composition, setting and hardening of Portland cement. **Refractories:** Classification and characteristics of refractories, properties and applications of Refractories. **Lubricants:** Classification of lubricants with examples - characteristics of a good lubricants - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. **Nano materials:** Introduction to nanomaterials, preparation of CNT'S by CVD method, properties of CNT'S. General applications of nanomaterials.		
Textbooks:		
1. Engineering Chemistry by P.C. Jain and M.Jain, Dhanpatrai Publishing Company, New Delhi 2010. 2. Engineering Chemistry by Rama Devi, Ch. V. Ramana Reddy and Rath, Cengage learning, New Delhi 2016.		
References:		
1. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company Pvt. Ltd., New Delhi 2011.		

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-ESC-101	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	solve electrical circuits using circuit laws	3	3	2	1
CO2	elaborate the concepts of network theorems & single phase AC circuits	3	3	2	1
CO3	explain three phase AC circuits and P-N Junction Diode	3	3	2	1
CO4	evaluate the functioning of electronic devices and their applications	3	3	2	1
CO5	illustrate the configurations and biasing techniques of BJT	3	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Electrical Circuits**	11
Electrical circuit elements (R, L and C), Types of sources, Source Transformation, ohm's law Kirchhoff's Laws, Network reduction techniques - series, parallel, series-parallel, star-to-delta, delta-to-star transformation, Mesh and Nodal Analysis.		
II	**DC Theorems and Single Phase AC Circuits**	8
DC Theorems: Superposition, Reciprocity, Thevenin's, Norton's and Maximum power transfer Theorems for DC excitation. Simple problems. **Single Phase AC Circuits:** Introduction, Sinusoidal alternating quantities, RMS values, Average values, form factor and peak factor, AC through Series RL, RC & RLC circuits.		
III	**Three Phase AC circuits & P-N Junction Diode**	5+5=10
Part-A: Three Phase AC circuits: Introduction, line voltage, line current relations power equation in star and delta connections in Three Phase systems, Advantages of Three Phase systems.		
Part-B: P-N Junction Diode: PN Junction diode- V-I Characteristics, Ideal versus Practical, Temperature dependence.		
IV	**Rectifiers and Special Purpose Devices**	9
Rectifiers: Diode as a Rectifier - Half Wave Rectifier, Full Wave rectifier with centre tapped transformer, Bridge Rectifier. **Special Purpose Devices:** Breakdown Mechanisms in Semi-Conductor Diodes, Zener diode characteristics, Use of Zener diode as voltage regulator.		
V	**Bipolar Junction Transistor (BJT)**	10
Construction, Principle of Operation, Symbol, CE, CB, CC configurations. DC & AC load line, stability factor, Need for biasing & biasing techniques.		
Textbooks:		
1. Circuit Theory (Analysis and synthesis) - A. Chakrabarti, Dhanpat Rai & Co Pvt Ltd. 7th Edition, 2015. 2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Edition, 2006. 3. Electrical Technology- vol-II B L Theraja, S. Chand publications.		
References:		
1. Introduction to Electronic Devices and Circuits-Rober T. Paynter, Pearson Education. 2. Network Theory by Sudhakar, Shyam Mohan Palli, TMH. 3. Electronic Devices and Circuits – 2nd Edition by Muhammad H.Rashid, Cengage Learning.		

PROBLEM SOLVING WITH C PROGRAMMING

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-ESC-103	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	write simple programs using C language	3	3	2	2
CO2	design structured programs using functions	3	3	2	2
CO3	develop programs using arrays, strings and pointers	3	3	2	2
CO4	construct programs for heterogeneous data	3	3	2	2
CO5	implement various file operations in C programming	3	3	2	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Programming**	11
Introduction to components of a computer system: primary and secondary memory, processor, Input/output devices, operating system, compilers, creating, compiling and executing a program. **Introduction to Algorithms:** Representation of Algorithm/Pseudo code, Flowchart, Structure chart with examples, Program development steps. **Introduction to C Programming Language:** identifiers, data types, variables, constants, Operators, Expression evaluation, precedence, Preprocessor commands, Conditional Branching and Loops: Writing and evaluation of conditions and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do-while loops.		
II	**Arrays and Functions**	8
Arrays: Concepts, using arrays in C, One dimensional, two dimensional arrays, multidimensional arrays, array applications- linear search, binary search and bubble sort, C program examples. **Functions:** Designing Structured Programs, Functions, user defined functions, Standard functions, Parameter passing in functions, Storage classes-auto, register, static, extern, recursion- recursive functions, differences between recursion and iteration, Simple programs, such as Finding Factorial, GCD, Fibonacci series etc., Limitations of recursion, example C programs.		
III	**Pointers and Strings**	5+5=10
Part A: Pointers: Defining pointers, pointers to pointers, Pointer Arithmetic, accessing arrays using pointers, void pointer, Null pointer, Dangling Pointer, dynamic memory allocation functions.		
Part B: Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strcmp, strstr, etc.), arrays of strings.		
IV	**Structures and Unions**	10
Structures - Defining structures, initializing structures, accessing structures, operations on structures, Nested structures, structures containing arrays, arrays of structures, structures and functions, self-referential structures, enum, typedef, bit fields; **Unions** - Defining unions, initializing unions, accessing unions, differences between Structures and unions, C programming examples.		
V	**File handling in C**	9
Files - Concept of a file ,Text and Binary files, Differences between text and binary files, File opening modes , Opening and Closing files, file input / output functions, file status functions (error handling), Random access using fseek, ftell and rewind functions, C programming examples.		
Textbooks:		
1. Computer Science: A Structured Programming Approach Using C, B. A. Forouzan and R. F. Gilberg, 3rd Edition, Cengage Learning. 2. Programming in ANSI C, E. Balaguruswamy, TMH.		
References:		
1. The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, 2nd Edition, Pearson. 2. C: The Complete Reference, Herbert Schildt, TMH, 4th Edition.		

ENGINEERING CHEMISTRY LAB

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-BSC-106	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	determine the hardness in water samples to solve societal problems	3
CO2	estimate the strength of the given solutions	3
CO3	analyze adsorption and viscosity of various fluids	3
CO4	synthesize the various organic compounds used in medical industry	3
CO5	verify and understand the distribution coefficient	3

List of Experiments: (Perform any 10 Experiments)

Week	Title/Experiment
	Volumetric Analysis
1	Determination of total hardness of water by complexometric method using EDTA.
2	Estimation of ferrous ion by dichrometry.
	Instrumentation
3	Estimation of HCl by Conductometric titrations.
4	Estimation of Acetic acid by Conductometric titrations.
5	Estimation of HCl by Potentiometric titrations.
6	Estimation of Fe^{2+} by Potentiometer using $KMnO_4$.
7	Estimation of copper by colorimetric method.
8	Estimation of amount of ferrous ion in Cement by colorimetric method.
	Preparations
9	Synthesis of Aspirin and paracetamol.
	Physical properties
10	Determination of viscosity of a liquid by using Ostwald's viscometer.
11	Verification of Freundlich adsorption isotherm-adsorption of acetic acid on charcoal.
12	Determination of partition coefficient of acetic acid between n-butanol and water.

References

1. Engineering Chemistry Lab manual - Department of FED - CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Assessment of ground water quality of specified area.
2. Determination of Viscosity of castor oil and groundnut oil.
3. Preparation of petroleum jelly.
4. Preparation of soaps and liquid hand wash.
5. Recycling of waste water.
6. Drinking water purification.
7. Estimation of manganese in pyrolusite.
8. Preparation of hand sanitizer.
9. Determination of P^H values of various soft drinks.
10. Studies on the effect of metal coupling on corrosion.

BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-ESC-102	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	design electrical circuits to verify circuit laws	3
CO2	evaluate network theorems	3
CO3	verify the V-I characteristics of various electronic devices	3
CO4	determine the efficiency of various rectifiers	3
CO5	illustrate the configurations of Bi-polar junction transistor	3

List of Experiments

Week	Title/Experiment
	Part-A: Electrical lab
1	Verification of KVL & KCL.
2	Verification of Superposition theorem.
3	Verification of reciprocity theorem.
4	Verification of maximum power transfer theorem.
5	Experimental determination of Thevenin's Theorem equivalent circuits.
6	Experimental determination of Norton's Theorem equivalent circuits.
	Part-B: Electronics Lab
1	Forward and reverse bias characteristics of PN-Junction Diode.
2	Zener diode V-I characteristics and Zener diode as voltage regulator.
3	Efficiency of Half wave rectifier.
4	Efficiency of Full wave rectifier.
5	Input & output characteristics of Transistor in CB configuration.
6	Input & output characteristics of Transistor in CE configuration.

References

1. Basic Electrical & Electronics Engineering Lab manual, FED, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design a regulated power supply.
2. Design a voltmeter.
3. Design a voltage doubler circuit.
4. Design a line follower using DC motor.
5. Design an automatic fan controller.
6. Design a burglar alarm.
7. Design an automatic irrigation system using soil moisture sensor.
8. Design a Water level indicator using transistor.
9. Design a brake failure indicator.
10. Design an IR transmitter and receiver.

PROBLEM SOLVING WITH C PROGRAMMING LAB

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-ESC-104	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	execute simple programs using C compiler	3
CO2	apply control statements in designing programs	3
CO3	design programs using functions, arrays, strings and pointers	3
CO4	construct programs for heterogeneous data	3
CO5	implement various file operations in C programming	3

List of Experiments

Week	Title/Experiment
I	**Familiarization with programming environment**
1. Write a program to print sample strings like “hello world”, “Welcome to C Programming” with different formats using escape sequences. 2. Write a Program to print different data types in C and their ranges. 3. Write a Program to initialize, assign & print variables of different data types.	
II	**Operators**
1. Write a Program to demonstrate arithmetic operators. (+,-,*,/,%) 2. Write a Program to demonstrate relational operators.(<,>,<=,>=,==,!=) 3. Write a program to check equivalence of two numbers using conditional operator. 4. Write a Program to demonstrate pre increment and post increment. (++a, a++ where a is a value to be initialized)	
III	**Simple C programs**
1. Write a Program to read radius value from the keyboard and calculate the area of circle 2. Write a Program to calculate simple interest. 3. Write a Program to convert temperature. (Fahrenheit –Centigrade and vice-versa) 4. Write a program for computing the volume of sphere, cone and cylinder assume that dimensions are integers use type casting where ever necessary.	
IV	**Decision Statements**
1. Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = distinction. Read percentage from standard input. 2. Write a Program to calculate roots of quadratic equation (using if-else). 3. Write a Program to perform arithmetic operations using switch case. 4. Write a Program to display colors using switch case (VIBGYOR).	
V	**Loops**
1. Write a program to calculate sum of individual digits of a given number. 2. Write a program to print prime numbers in the given range. 3. Write a program to read 2 numbers x and n then compute the sum of the Geometric Progression. $1+x+x^2+x^3+ - - - - - - - +x^n$ 4. Write a C program to construct a pyramid of numbers as follows: . 1 / 1 2 / 1 2 3	* / * * / * * *	1 / 2 3 / 4 5 6	1 / 2 2 / 3 3 3 / 4 4 4 4	* / * * / * * * / * * / *
VI	**1-D arrays**
1. Write a program to store 10 elements in the 1-D array and print sum of the array. 2. Write a program to print minimum and maximum elements in the 1-D array. 3. Write a program to search the given element by using linear search and binary search. 4. Write a program to sort the given elements using bubble sort technique.	

VII	2-D arrays
1. Write a program to perform matrix addition. 2. Write a program to perform matrix multiplication. 3. Write a program to print the transpose of a matrix.	
VIII	**Functions**
1. Write a program to find product of two numbers using functions without arguments, without return type. 2. Write a program to find difference of two numbers using functions without arguments, with return type. 3. Write a program to find sum of two numbers using functions with arguments &without return type. 4. Write a program to find product of two numbers using functions with arguments, with return type.	
IX	**Functions and Recursion**
1. Write a program to swap two numbers using a) Call by Value b) Call by Reference. (Using pointers) 2. Write a program to calculate factorial, GCD and Fibonacci series of n terms using recursion and non-recursion functions. 3. Write C program that reads two integers x and n and calls a recursive function to compute x^n 4. Write a C program that reads two integers and calls a recursive function to compute ${}^nC_r$	
X	**Strings**
1. Write a program to demonstrate various string manipulations using built-in functions. 2. Write a program to print the given strings in ascending order. 3. Write a program to verify the given string is palindrome or not (without using built-in functions and with using built-in functions). 4. Write a program to concatenate two strings using arrays without using strcat.	
XI	**Structures**
1. Write a program to find total marks of individual student and average marks for 10 students using structures. 2. Write a program to illustrate passing an entire structure to a function. 3. Write a C Program to perform addition and multiplication of two complex numbers using structures.	
XII	**File operations**
1. Write a C program to display the contents of a file to standard output device. 2. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents. 3. 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). 4. Write a C program to count the number of times a character occurs in a text file.	
References	
1. Problem Solving with C Programming Lab Manual, FED, CMRIT, Hyd.	
Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.	
1. Pay roll management system. 2. Fee collection system. 3. Employee's Management System. 4. Library management. 5. Department store system. 6. Personal Dairy Management System. 7. Telecom Billing Management System. 8. Bank Management System. 9. Contacts Management. 10. Medical Store Management System.	

IT & ENGINEERING WORKSHOP PRACTICE

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-ESC-108	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO5	PO9	PO10
CO1	execute simple programs using Sci Lab	3	3	2	2
CO2	design programs using conditional statements and loops	3	3	2	2
CO3	apply safety norms while handling the workshop equipment	3	1	3	2
CO4	prepare required models using various engineering trades	3	1	3	2
CO5	make use of various power tools	3	1	3	2

List of Experiments

Week	Title/Experiment
	Part-A: IT Workshop (Sci Lab)
1	**Introduction:** Why Sci Lab?, History, Its strengths, Competitors, Starting Sci Lab, Using Sci Lab as a calculator, Quitting Sci Lab.
2	**Basics:** Familiar with Sci Lab windows, Basic Operations, Sci Lab - Data types, Rules about variable names, Predefined variables.
3	**Programming-I:** Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept.
4	**Programming-II:** Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file.
5	**Conditional statements and Loop:** Relational and Logical Operators, If-else statements, Switch-case statements, For loop, While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database.
6	**Plotting-I:** In-built functions for plotting, Multiple plotting with special graphics.
7	**Plotting-II:** Curve fitting, Interpolation, Basic fitting interface.
	Part-B: Engineering Workshop
8	**House Wiring:** Power point, light fitting and switches.
9	**Carpentry:** Study of tools and joints; Practice in planning, chiseling, marking and sawing.
10	**Carpentry:** Joints: Cross joint, T joint, Dove tail joint.
11	**Fitting:** Study of tools, practice in filing, cutting, drilling and tapping.
12	**Fitting:** Male and female joints, stepped joints**.**
13	**Tin Smithy:** Preparation of Open scoop, Cylinder, square/rectangular tray.
14	**Demonstration of Power Tools:** Bench drilling machine, hand drilling machine, power hacksaw, grinding machine, lathe machine, wood cutting machine and welding machine.

References

1. IT & Engineering Workshop Practice Manual, FED, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design a mathematical model to explain the functioning of Global positioning system (GPS)
2. Design a mathematical model for the construction of flyover.
3. Model any art craft using mathematical calculations (electrical / non-electrical).
4. 2-D plotting using SCI-lab.
5. 3-D plotting using SCI-lab.
6. Make Round tee pipe.
7. Design electrical wiring plan for a house.
8. Prepare decorative series lights / dim & bright lighting.
9. Preparation of door stoppers / hinges.
10. Preparation of tool handles.

NATIONAL SERVICE SCHEME (NSS)/PHYSICAL EDUCATION/YOGA MANDATORY COURSE (NON-CRIDIT)

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-MC-101	-	-	2	-

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO3	PO6	PO8	PO9	PO12
CO1	harness physical literacy and lifelong engagement	3	3	3	3	3
CO2	use aesthetic appreciation	2	1	2	3	3
CO3	build competence and confidence to face challenges	1	2	1	3	3
CO4	develop Sports related values and attitudes	3	3	2	2	3
CO5	follow appropriate etiquette and sports	1	1	2	3	3

List of Activities/Events

NATIONAL SERVICE SCHEME (N.S.S.)

The programme aims to inculcate social welfare in students, and to provide service to society without bias. NSS volunteers work to ensure that everyone who is needy gets help to enhance their standard of living and lead a life of dignity. In doing so, volunteers learn from people in villages how to lead a good life despite a scarcity of resources. It also provides help in natural and man-made disasters by providing food, clothing and first aid to the disaster victims.

S. No.	Name of the Activity	S. No.	Name of the Activity
1	First-aid	9	Anti-Ragging Awareness
2	Blood donation camp	10	Social Activities Awareness
3	Traffic awareness program	11	Cyber Crime
4	Environmental Awareness	12	Digital India
5	Swachh Bharat Abhiyan	13	Substance Abuse Awareness Program (SAAP)
6	Health awareness program	14	Fire Safety Awareness
7	Garments / Essential Education Material Collection and distribution	15	Telanganaku Haritha Haram (Sapling Plantation)
8	Non-formal education		

PHYSICAL EDUCATION / YOGA

The aim of course is to make Physical Education as an integral part of Educational System. Students studying in the colleges should have the benefit of Physical Education to improve their health during the course of college education. It is designed to ensure that on completion of this training they would attain the minimum prescribed standard.

Name of the Individual Event		Name of the Team Event	
S. No.	Event	S. No.	Event
1	Badminton	1	Basketball
2	Gymnastics	2	Football
3	Judo	3	Hockey
4	Swimming	4	Kabaddi
5	Table Tennis	5	Kho –Kho
6	Tennis	6	Volleyball
7	Weight Lifting and Power Lifting	7	Cricket
8	Wrestling	8	Hand ball
9	**Yoga**	9	Throw ball
10	Archery	10	Badminton
11	Body Building	11	Table Tennis
12	Carroms	12	Tennis
13	Chess	13	Swimming
14	Boxing	14	Carroms
15	Taekwondo	15	Taekwondo
16	Fencing	16	Fencing
17	Athletics	17	Athletics

B.TECH.-II-SEMESTER SYLLABUS

ADVANCED CALCULUS

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-BSC-102	3	1	-	4

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	solve linear and non-linear ordinary differential equations	3	2	1
CO2	solve linear and non-linear partial differential equations	3	2	1
CO3	evaluate the line, surface and volume integrals and convert them from one to another by using multiple integrals	3	2	1
CO4	determine vector field, scalar field, gradient, divergence and curl by using vector differentiation	3	2	1
CO5	solve the line, surface and volume integrals by using vector integration	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Differential Equations**	11
Exact & Reducible to exact, Linear and Bernoulie's Differential Equations. Applications; Newton's law of cooling, law of natural growth and decay. Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, $e^{ax}V(x)$, $xV(x)$,method of Variation of parameters.		
II	**Partial Differential Equations**	8
Formation of partial differential equations-by elimination of arbitrary constants and arbitrary functions–solutions of first order linear (Lagrange) equations and nonlinear equations (Four standard types) – Method of Separation of Variables.		
III	**Multiple Integration**	5+5=10
Part A: Double integrals (Cartesian &polar), change of order of integration in double integrals, Change of variables (Cartesian to polar).		
Part B: Applications: areas and volumes (Cartesian), Triple integrals (Cartesian).		
IV	**Vector Differentiation**	9
Vector Differentiation: Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Scalar potential functions. Solenoidal and Irrational vectors, Vector Identities.		
V	**Vector Integration**	10
Vector Integration: Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and related Problems.		
Textbooks:		
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010 2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006 3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.		
References:		
1. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes. 2. S. L. Ross, Differential Equations, 3rd Edition, Wiley.		

APPLIED PHYSICS

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-BSC-103	3	1	-	4

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	explain the principles of Quantum Mechanics	3	2	1
CO2	analyze various electron theories of conduction in solids	3	2	1
CO3	classify semiconductors and relate functioning of semiconductor devices	3	2	1
CO4	illustrate principles and applications of lasers and optical fibers	3	2	1
CO5	outline dielectric and magnetic properties of materials	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Principles of Quantum Mechanics**	9
Waves and particles, de-Broglie hypothesis, matter waves, Davisson and Germer's experiment, Heisenberg's uncertainty principle, physical significance of the wave function , Schrödinger's time independent wave equation, particle in 1-dimensional potential box.		
II	**Introduction to Solids**	9
Quantum free electron theory, estimation of Fermi energy, dependence of Fermi level on temperature, density of states. Bloch's theorem, Kronig - Penny model, origin of energy bands, classification of materials on the basis of energy bands, effective mass of electron.		
III	**Semiconductor Physics and Devices**	6+5=11
Part-A: Introduction, types of semiconductors, calculation of carrier concentration in intrinsic semiconductor, Fermi level in intrinsic semiconductor, direct and indirect band gaps, Hall effect.		
Part-B: Formation of PN junction, open circuit PN junction, I-V characteristics of PN junction diode, solar cell, LED.		
IV	**Lasers and Fiber Optics**	9
Characteristics of Lasers, absorption, spontaneous and stimulated emission of radiation, Einstein's coefficients and relation between them, population inversion, lasing action, Ruby laser, Helium-Neon laser, applications of lasers. Principle of optical fiber, construction of fiber, acceptance angle and acceptance cone, numerical aperture, types of optical fibers: step index and graded index fibers, applications.		
V	**Dielectric and Magnetic Properties**	10
Introduction to dielectric properties, electronic, ionic and orientation polarizations and calculation of polarizabilities: ionic and electronic - internal fields in solids, Clausius - Mossotti equation. Introduction to magnetic properties, origin of magnetic moment, Bohr magneton, classification of Dia, Para and Ferro magnetic materials on the basis of magnetic moment, applications.		
Textbooks:		
1. Applied Physics by P.K.Mittal, I K International Publishers. 2. Engineering Physics by P.K.Palanisamy, Scitech Publishers.		
References:		
1. Principles of physics by Halliday, Resnick, Walker, Wiley India Pvt. Ltd, 9th Edition. 2. Introduction to solid state physics by Charles Kittel, Wiley India Pvt. Ltd, 7th Edition.		

ENGLISH FOR ENGINEERS

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-HSMC-101	2	-	-	2

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO10	PO12
CO1	acquire proficiency in RAWLS skills	3	1
CO2	demonstrate the acquired language in written and spoken contexts	3	1
CO3	express, restate and respond appropriately by comprehending the given data	3	1
CO4	develop proficiency to succeed in academic activities, research and career	3	1
CO5	excel in professional and social etiquette	3	1

Syllabus

Unit	Title/Topics	Hours
I	**The Raman Effect**	7
Vocabulary Building: The Concept of Word Formation -The Use of Prefixes and Suffixes. **Grammar:** Identifying Common Errors in Writing with Reference to Articles and Prepositions. **Reading:** Reading and Its Importance - Techniques for Effective Reading. **Basic Writing Skills:** Sentence Structures - Use of Phrases and Clauses in Sentences-Importance of Proper Punctuation-Techniques for writing precisely - **Paragraph writing** - Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.		
II	**Ancient Architecture in India**	11
Vocabulary: Synonyms and Antonyms. **Grammar:** Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement. **Reading:** Improving Comprehension Skills – Techniques for Good Comprehension. **Writing:** Format of a Formal Letter-**Writing Formal Letters** E.g.., Letter of Complaint, Letter of Requisition, Job Application with Resume.		
III	**Blue Jeans**	4+6=10
Part A: Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-Words from Foreign Languages and their Use in English. **Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.		
Part B: Reading: Sub-skills of Reading- Skimming and Scanning. **Writing**: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places and Events - **Classifying**- Providing Examples or Evidence.		
IV	**What Should You Be Eating**	9
Vocabulary: Standard Abbreviations in English. **Grammar:** Redundancies and Clichés in Oral and Written Communication. **Reading**: Comprehension- Intensive Reading and Extensive Reading. **Writing: Writing Practices** - Writing Introduction and Conclusion - Information Transfer - Essay Writing-Précis Writing.		
V	**How a Chinese Billionaire Built Her Fortune**	9
Vocabulary: Technical Vocabulary and their usage. **Grammar:** Common Errors in English. **Reading:** Reading Comprehension-Exercises for Practice. **Writing: Technical Reports** - Introduction – Characteristics of a Report – Categories of Reports; **Formats**- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.		
Textbooks:		
1. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.		
References:		
1. Swan, M. (2016). Practical English Usage. Oxford University Press. 2. Zinsser, William. (2001). On Writing Well. Harper Resource Book. 3. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.		

DATA STRUCTURES THROUGH C

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-ESC-105	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	classify different data structures to design efficient programs	3	3	2	2
CO2	identify appropriate sorting and searching techniques	3	2	2	2
CO3	illustrate operations and applications of linear data structures	3	3	2	2
CO4	explain various concepts of non-linear data structures	3	3	2	2
CO5	choose an appropriate hashing technique for a given problem	3	3	2	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Data Structures, Searching and Sorting**	11
Basic concepts - Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms, different approaches to design an algorithm, recursive algorithms. **Searching and Sorting techniques -** Linear search and binary search, Bubble sort, selection sort, insertion sort, quick sort, merge sort, and comparison of sorting algorithms.		
II	**Linear Data Structures**	8
Stack - Primitive operations, implementation of stacks using Arrays, applications of stacks: arithmetic expression conversion and evaluation. **Queue -** Primitive operations; Implementation of queues using Array, Types of Queue: Simple queue, circular queue and priority queue, applications of linear queue.		
III	**Linked Lists**	5+5=10
Part A: Linked lists -Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list: Traversing, searching, insertion, deletion. Applications of linked lists: Polynomial representation and sparse matrix manipulation.		
Part B: Types of linked lists - Doubly linked lists, Circular linked lists, linked list representation and operations of Stack, linked list representation and operations of queue.		
IV	**Non Linear Data Structures**	10
Trees - Basic Tree Terminologies, binary tree, binary tree representation, array and linked representations, binary tree traversal, Binary Search Tree: properties and operations, Balanced search trees: AVL tree, application of trees.		
V	**Graphs and Hashing**	9
Graphs- Basic terminologies and representations, graph implementation, graph search and traversal algorithms, Application of graphs. **Hashing and Collision-** Introduction, hash tables, hash functions, collisions, applications of hashing.		
Textbooks:		
1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson, 2nd Edition, 1996. 2. Ellis Horowitz, SatrajSahni, Susan Anderson Freed, "Fundamentals of Data Structures in C", Universities Press, 2nd Edition 2008.		
References:		
1. ReemaThareja, "Data Structures using C", Oxford University Press, 2nd Edition, 2014. 2. S. Lipschutz, "Data Structures", Tata McGraw Hill Education, 1st Edition, 2008. 3. Tanenbaum, Langsam, Augenstein, "Data Structures Using C", Pearson, 1st Edition, 2003.		

COMPUTER AIDED ENGINEERING GRAPHICS

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-ESC-107	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO5	PO10
CO1	apply engineering drawing concepts in technical graphic communication	3	3	2
CO2	construct conic sections using various methods	3	3	2
CO3	draw orthographic projections of points, lines, planes and solids	3	3	2
CO4	draw development of solid surfaces	3	3	2
CO5	draw the conversions of orthographic to isometric projections & vice versa	3	3	2

List of Experiments

Week	Title/Experiment
1	Introduction to engineering drawing and AutoCAD software, Lettering, dimensioning practice and Geometrical Constructions.
2	Conic sections: General method, Construction of Ellipse, Parabola.
3	Construction of Hyperbola, Epicycloid.
4	Construction of hypocycloid, involutes.
5	Orthographic Projections: Principles of Orthographic projections, Projections of Points.
6	Projections of lines simple position, inclined to one plane.
7	Projections of Lines inclined to both the planes.
8	Projections of planes inclined to one plane and both the planes.
9	Projections of Solids simple position.
10	Projections of Solids inclined to one plane.
11	Projections of Solids inclined to both the planes.
12	Development of surfaces: Development of Prisms and Cylinders, Pyramids and Cones.
13	Isometric projections: isometric views of lines, planes and solid figures; Conversion of Isometric to Orthographic views (3D to 2D).
14	Conversion of Orthographic to Isometric views (2D to 3D).

Textbooks

1. Engineering Drawing N.D. Bhatt, Charotar.
2. A Text Book of Engineering Drawing, Basant Agarwal.

References

1. A Text Book of Engineering Drawing, Dhawan R K, S. Chand.
2. Engineering Graphics with Auto CAD, James D Bethune, Pearson Education.

Micro-Projects: Student must submit a report on one of the following Micro–Projects using AutoCAD before commencement of second internal examination.

1. Draw the orthographic projections of knuckle joint.
2. Draw the orthographic projections of Socket and spigot cotter joint.
3. Draw the orthographic projections of glass bottle.
4. Draw the orthographic Projections of Connecting rod of IC Engine.
5. Draw the isometric projections of Horse chess coin.
6. Draw the Pipe truss design.
7. Draw a 3-D bolt and nut with Threads.
8. Draw a 3-D Cross head pattern.
9. Draw the pipe vice.
10. Draw the satellite dish and Antenna.

APPLIED PHYSICS LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-BSC-104	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	demonstrate the electrical properties of a semiconductor	3
CO2	compare practical results with theoretical calculations in electrical circuits	3
CO3	demonstrate the properties of lasers and optical fibers	3
CO4	find the energy gap of a semiconductor and identify its band structure	3
CO5	examine electrical resonance in LCR circuits	3

List of Experiments

(Minimum 10 experiments to be conducted)

Week	Title/Experiment
1	Determination of frequency of an Electronic Vibrator – Melde's Experiment.
2	Calculation of the rigidity modulus of a given wire - Torsional pendulum.
3	Newton's Rings-Radius of curvature of Plano convex lens.
4	Determination of Energy Gap of a Semiconductor.
5	Time constant of an R-C Circuit.
6	Stewart and Gee's method - Magnetic field along the axis of current carrying coil.
7	Bending Losses of Fibers & Evaluation of numerical aperture of given fiber.
8	Determination of Resonance frequency of an LCR circuit.
9	Determination of the characteristics of a Solar Cell.
10	Diffraction Grating-Determination of wavelengths of a LASER source.
11	Determination of the characteristics of a Light Emitting Diode.
12	Calculation of Hall Voltage across a semiconductor sample.

Reference

1. Applied Physics Lab Manual, FED, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design rechargeable torch.
2. Design temperature sensor.
3. Design radio receiver set employing LCR tank circuit.
4. Design a counter using photo cell.
5. Design smoke detector.
6. Design mechanical energy to light energy converter.
7. Design a mobile phone detector.
8. Design IR based obstacle detector.
9. Design security alarm.
10. Design a circuit to detect breakage in a conducting wire.

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-HSMC-102	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO5	PO10
CO1	identify the nuances of the language through multimedia experience	3	3
CO2	express clearly with right accent, intonation to overcome MTI	3	3
CO3	demonstrate formal and informal English in real life scenarios	3	3
CO4	develop speaking and listening skills	3	3
CO5	appraise communication and correspond effectively	3	3

List of Experiments

Week	Title/Experiment
PART – A: COMPUTER ASSISTED LANGUAGE LEARNING (CALL) LAB	
1 2	Introduction to Phonetics -Speech Sounds -Vowels and Consonants
5	Pronunciation I: Syllable Division, Accent & Stress, Stress Shift
8	Pronunciation II: Intonation and Rhythm – Situational Dialogue
11	Errors in pronunciation – the Interference of Mother Tongue (MTI)
14	Listening Comprehension (Specific & General)
PART – B: INTERACTIVE COMMUNICATION SKILLS (ICS) LAB	
3 4	JAMs
6 7	Role Play: Situational Dialogues
9	Introduction to a Structured Talk
10	Descriptions & Formal Presentations
12 13	Communication at Workplace and Interview Skills
References	
1. English Language and Communication Skills Lab Manual, FED, CMRIT, Hyd.	
Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.	
1. Common Errors in English 2. Listening Skills 3. Phonetics 4. Writing Skills 5. Reading Skills 6. Letter Writing 7. Report Writing 8. Vocabulary 9. Body Language 10. Functional English	

DATA STRUCTURES THROUGH C LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-ESC-106	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	implement various searching and sorting techniques	3
CO2	demonstrate basic operations of stack and queues using arrays and linked lists	3
CO3	apply stack data structure to solve various computing problems	3
CO4	demonstrate and apply different methods for traversing graphs	3
CO5	construct binary search tree	3

List of Experiments

Week	Title/Experiment
I	**Searching Techniques**
Write C programs for implementing the following searching techniques. a. Linear search. b. Binary search.	
II	**Sorting Techniques**
Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Bubble sort. b. Insertion sort. c. Selection sort.	
III	**Sorting Techniques**
Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Quick sort. b. Merge sort	
IV	**Implementation of Stack and Queue**
a. Write C programs to design and implement Stack and its operations using Arrays. b. Write C programs to design and implement Queue and its operations using Arrays.	
V	**Applications of Stack**
a. Write C program by using Stack operations to convert infix expression into postfix expression. b. Write C program by using Stack operations for evaluating the postfix expression.	
VI	**Implementation of Single Linked List**
Write a C program that uses functions to perform the following operations on single linked list. a. Creation b. insertion c. deletion d. traversal	
VII	**Implementation of Circular Single Linked List**
Write a C program that uses functions to perform the following operations on Circular linked list. a. Creation b. insertion c. deletion d. traversal	
VIII	**Implementation of Double Linked List**
Write a C program that uses functions to perform the following operations on double linked list. a. Creation b. insertion c. deletion d. traversal in both ways.	
IX	**Implementation of Stack Using Linked List**
Write a C program to implement stack using linked list.	
X	**Implementation of Queue Using Linked List**
Write a C program to implement queue using linked list.	
XI	**Graph Traversal Techniques**
Write C programs to implement the following graph traversal algorithms: a. Depth first search. b. Breadth first search.	
XII	**Implementation of Binary Search Tree**
Write a C program that uses functions to perform the following: a. Create a binary search tree. b. Traverse the above binary search tree recursively in pre-order, post-order and in-order.	
References	
1. Data Structures through C Lab Manual, FED, CMRIT, Hyd.	

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Write a program to create a one dimensional array at run time using a user defined function with user given number of elements into it. Also write separate functions that would allow you to insert and delete elements into/from this array at any arbitrary location.
2. WAP to add and subtract following polynomials $5x^2 – 3xy + y – 2x^2 – y^2+5xy – x + y$ using array.
3. Write a program to create one dimensional - two dimensional and three dimensional arrays in memory and then verify the various address calculation formulae for any arbitrary element of these arrays.
4. Write a program to implement a sparse matrix for the given matrix A.
5. Write a program to implement a queue using stack operations.
6. WAP to convert the following expression to its postfix equivalent using stack ((A+B)* D) ^ (E – F)
7. II. A+ (B * C – (D / E ^ F) * G) * H Where ^: raise to the power
8. Implement a program to evaluate any given postfix expression. Test your program for the evaluation of the equivalent postfix form of the expression (- (A*B)/D) ↑ C+E – F * H * I for A = 1 - B = 2 - D = 3 - C = 14 - E = 110 - F = 220 - H = 16.78 - I = 364.621.
9. WAP to declare a priority queue using two-dimensional array - store elements and priority. Display the elements according to priority from higher to lower.
10. Let $X = (x_1 - x_2 - \dots x_n)$ -$Y = (y_1 - y_2 - \dots y_n)$ be two lists with a sorted sequence of elements. Write a program to merge the two lists together as a single list Z with m + n elements. Implement the lists using array and singly linked list.
11. Write a menu driven program which will maintain a list of mobile phone models - their price - name of the manufacturer – storage capacity etc. - as a doubly linked list. The menu should make provisions for inserting information pertaining to new mobile phone models - delete obsolete models - and update data such as price besides answering queries such as listing all mobile phone models within a price range specified by the user and listing all details given a mobile phone model.

ENVIRONMENTAL SCIENCE
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-MC-102	2	-	-	-

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO6	PO7	PO12
CO1	identify the role of ecosystem for livelihood	3	3	3	2
CO2	interpret methods to sustain environmental resources	3	3	3	2
CO3	outline bio-diversity and its relevance to ecological balance	3	3	3	2
CO4	explain laws and legislations on environmental protection	3	3	3	3
CO5	evaluate technologies for achieving sustainable development	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Ecosystem**	6
Introduction to ecosystem: Definition, Scope and Importance; Classification of ecosystem; Structure and functions of ecosystem food chain food web, ecological energetic, eco-pyramids, carrying capacity; Biogeochemical cycles (Carbon and Nitrogen Cycles), flow of energy.		
II	**Natural Resources**	7
Renewable and Non–renewable resources–Importance, uses, classification of natural resources (i) forest: deforestation, timber extraction & conservation (ii) water: conflicts over water, dams – benefits &effects; use and over exploitation of water resources, (iii) mineral :use and exploitation, effects on mining, (iv) energy resources: growing needs, renewable and non renewable energy sources, use of alternative energy (v) land resources: land degradation, landslides, soil erosion and desertification; role of an individual in conservation of natural resources and equitable use.		
III	**Biodiversity**	3+2=5
Part A: Definition and levels of biodiversity, Values of biodiversity Bio– geographical classification of India; hot spots of biodiversity; India as a mega diversity nation; Threats to biodiversity; Endangered and endemic species of India.		
Part B: Conservation of biodiversity: In–situ and Ex–situ conservation; Case studies.		
IV	**Environmental Pollution & Control Technologies**	8
Types of environmental pollution; **Air pollution**: major air pollutants, sources, effects, control measures, National Air Quality Standards. Water pollution: sources, impacts & control technologies- ETP, watershed management, rain water harvesting, Water Quality standards. Soil pollution: sources, causes & impacts on modern agriculture. Noise pollution. Solid waste Management- causes, effects and control measures; E-waste. **Global Environmental Issues and Treaties**: Global warming, ozone layer depletion. International protocol, Kyoto and Montreal protocol. Population Explosion.		
V	**Environmental Acts, EIA & Sustainable Development**	6
Environment Protection Acts: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act and Forest Conservation Act, Environment (Protection) Act, 1986. EIA: conceptual facts, base line data acquisition, EIS, EMP. **Sustainable development**-causes & threats, strategies for achieving sustainable development; CDM and concept of green building, life cycle assessment(LCA); Ecological foot print. **Role of Information Technology** in Environment - Remote Sensing, GIS.		
Textbooks:		
1. Environmental Science by Y. Anjaneyulu, B S Publications (2004). 2. Environmental studies by Rajagopalan R (2009), Oxford University Press, New Delhi.		
References:		
1. Environmental Science and Technology by M. Anji Reddy (2007), B.S Publications. 2. Environmental Studies by Anubha Kaushik (2006), 4thedn, New age International Publications		

B.TECH.-III-SEMESTER SYLLABUS

STATISTICAL FOUNDATIONS FOR COMPUTER SCIENCE

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-BSC-201	3	1	-	4

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	explain the concepts of probability and random variables	3	2	1
CO2	illustrate the importance of discrete, continuous and sampling distributions	3	2	1
CO3	use various estimation methods and test hypothesis for large samples	3	2	1
CO4	test hypothesis for small samples and find correlation/regression analysis	3	2	1
CO5	apply the theory of stochastic processes to analyze classification of states	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Probability and Random variables**	8
Introduction, Sample space and events-The axioms of probability-some elementary theorems-conditional probability-Baye's theorem. Random variables, Mathematical Expectations-Discrete Random Variables and continuous Random variables. ***Task:*** *Write a program to find mathematical expectations.*		
II	**Distributions**	10
Basic Definitions, Discrete probability distributions - Binomial distribution, Poisson distribution Continuous probability Distributions-Normal distribution, Applications of Normal distributions Normal approximation to the binomial distribution, Chebyshev's theorem. Sampling distribution of means (σ Known and unknown). ***Task:*** *Write a program to find Binomial and Poisson distributions for a given data.*		
III	**Estimation and Testing of Hypothesis-I (large sample)**	6+6=12
PART-A: Introduction, Point Estimation-inferences concerning means, Interval Estimation-Confidence interval for the mean (σ known and unknown), Bayesian Estimation. ***Task:*** *Write a program to find point and interval estimations.*		
PART-B: Tests of Hypothesis, Large samples, Null hypothesis-Alternate hypothesis, type-I & Type-II errors-critical region confidence interval for mean testing of single variance, Difference between the means, confidence interval for the proportions. Tests of hypothesis for the single and difference between the proportions. ***Task:*** *Write a program to test the hypothesis for large samples.*		
IV	**Testing of Hypothesis-II (Small samples)**	10
Test concerning small samples- t-Test, F-Test and Chi-Square (χ^2) - Test for independence of attribute. Correlation and regression-Rank Correlation-coefficient of correlation-Regression coefficient-The lines of regression-The rank correlation. ***Task:*** *Write a program to test the hypothesis for small samples.*		
V	**Stochastic Processes and Markov Chains**	8
Introduction to Stochastic processes- Markov process classification of states-Examples of Markov Chains, Stochastic Matrix, limiting probabilities. ***Task:*** *Write a program for classification of states of Markov chain.*		
Textbooks:		
1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 9th extensively revised edition, Sultan Chand & Sons, 1999. 2. Johnson. R. A., "Miller & Freund's Probability and Statistics for Engineers" 6th Edition, Pearson Education, Delhi, 2000. 3. Probability and statistics by Dr. T. K. V. Iyengar, Dr. B. Krishna Gandhi, S. Ranganatham, Dr. M. V. S. S. N. Prasad. A division of S. Chand & Company Ltd.		
References:		
1. Mathematics for engineers and scientists by Alan Jeffrey, 6th Edition, CRC press.		

DISCRETE MATHEMATICS & GRAPH THEORY

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ESC-208	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	verify logical statements using connectives	3	3	2
CO2	validate arguments using predicate calculus	3	3	2
CO3	perform various operations with relational algebra	3	3	2
CO4	solve problems using combinatorics	3	3	2
CO5	simplify real-life situations using graph theory	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Mathematical logic**	10
Introduction, Statements and Notation, Connectives, Well-formed formulas, tautologies, equivalence of formulas, duality law, functionally complete set of connectives, other connectives. ***Task:*** *Write a program to implement connectives: AND, NAND, OR, NOT, XOR, NOR.*		
II	**Predicate Calculus**	9
Normal Forms, Rules of Inference, Automatic theorem proving, Predicate Calculus, Mathematical induction. ***Task:*** *Write a program to implement principle normal forms.*		
III	**Set theory, Relations and Functions**	5+5=10
Part-A: Set theory: Basic Concepts, Representation of sets, operations on sets, Principles of inclusion and exclusion. ***Task:*** *Write a program to implement various set operations*.		
Part-B: Relations and Functions: Relations and ordering, properties of binary relation, functions, partial ordered set, lattice. ***Task:*** *Write a program for following operation: a) reflexive b) symmetric c) Transitive*.		
IV	**Elementary Combinatory**	10
Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Pigeon hole principle ***Task:*** *Write a program to implement Fibonacci sequence.*		
V	**Graph Theory**	9
Basic Concepts, Isomorphism and Sub-graphs, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem. ***Task:*** *Write a program to implement Chromatic Number for a given graph.*		
Textbooks:		
1. Discrete Mathematical Structures with Applications to Computer Science: J. P. Tremblay, R. Manohar, TMH, 1st Edition. 2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel, Teodore P. Baker, PHI, 2nd Edition.		
References:		
1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph. P. Grimald, Pearson education, 5th Edition. 2. Discrete Mathematical Structures: Thomas Kosy, TMH.		

DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ESC-209	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO6	PO12
CO1	interpret number systems and logical functions using K-Maps	3	3	2	2	2
CO2	design various combinational and sequential circuits	3	3	2	2	3
CO3	illustrate computer components and function of 8086 processor	3	3	2	2	2
CO4	analyze arithmetic operations and I/O operations	3	3	2	2	3
CO5	distinguish various memories and pipelining operations	3	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Binary Systems, Boolean algebra and logic gates**	10
Binary Systems: Digital Systems, Binary Numbers, Number base conversions, Octal, Hexadecimal numbers, signed binary numbers, complements, floating point representation, binary codes. **Boolean algebra and logic gates**: Basic Definitions, Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, Digital Logic Gates, The K-Map Method, Three-Variable Map, Four-Variable Map, sum of products, product of sums simplification, Don't care conditions, NAND and NOR implementation.		
II	**Combinational and Sequential Circuits**	10
Combinational Circuits: Design Procedure, Combinational circuit for different code converters, Binary Adder – Subtractor, Decoders, Encoders, Multiplexers and De-Multiplexers. **Sequential circuits:** Synchronous sequential Circuits, Latches, Flip-flops, Registers, ripple counters, synchronous counters, ring counter, Johnson counter.		
III	**Basic Computer Organization & Design and CPU**	4+5=9
Part-A: Basic Computer Organization and Design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, micro program example.		
Part-B: Central Processing Unit: The 8086 processor architecture, register organization, physical memory organization, general bus operation, instruction formats, addressing modes, 8086 instruction set and assembler directives, Assembly Language Programming (ALP).		
IV	**Computer Arithmetic and Input-Output Organization**	10
Computer Arithmetic: Introduction, addition and subtraction, multiplication algorithms, division algorithms. **Input-Output Organization:** Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access, input - output processor.		
V	**Memory and Pipeline Processing**	9
Memory: Memory hierarchy, RAM, ROM, associative memory, and cache memory. **Pipeline Processing:** Parallel processing, pipelining, arithmetic pipeline, instruction pipeline.		
Textbooks:		
1. Digital Design, M. Morris Mano, M.D.Ciletti, 5th Edition, Pearson. 2. Computer System Architecture, M.Morris Mano, 3rd Edition, Pearson. 3. Advanced Microprocessors and Peripherals, K. M. Bhurchandi, A.K Ray, 3rd Edition, TMH.		
References:		
1. Fundamentals of Logic Design, C. H. Roth, L. L. Kinney, 7th Edn., Cengage Learning. 2. Microprocessors and Interfacing, D V Hall, SSSP Rao, 3rd Edition, TMH. 3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edn., TMH, 2002.		

DATABASE MANAGEMENT SYSTEMS

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-CS-PC-211	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	design simple databases using basic concepts of database architectures	3	3	3	2
CO2	construct databases using ER Modeling	3	3	3	2
CO3	formulate SQL queries to interact with database	3	3	3	2
CO4	apply normalization on database to eliminate redundancy	3	3	3	2
CO5	illustrate the mechanisms of transaction management, concurrency control and recovery system	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Database Systems**	10
Introduction: Introduction and applications of DBMS, Purpose of data base, Database architecture and structure - Abstraction Levels, Data Independence, Database Languages, Database users and DBA. **Introduction to Database Design:** Database Design Process, Data Models, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, Generalization, Specialization, Aggregation, Conceptual design with the E-R model for large Enterprise.		
II	**Relational Model, Algebra and Calculus**	9
The Relational Model: Introduction to the relational model, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design: E-R to relational, Introduction to views, Destroying/altering tables and views. **Relational Algebra and Calculus:** Relational algebra operators, relational calculus - Tuple and domain relational calculus.		
III	**SQL**	5+5=10
Part-A: Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, in operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations.		
Part-B: Sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. Transaction control commands – Commit, Rollback, save point, cursors, stored procedures, Triggers.		
IV	**Schema Refinement and Normal Forms**	10
Schema Refinement and Normal Forms: Introduction to schema refinement, functional dependencies, reasoning about FDs. Normalization, Normal forms: 1NF, 2NF, 3NF, BCNF, Multi valued dependency-forth normal form-Join dependency-fifth normal form, Properties of decomposition, dependency preservation.		
V	**Transactions Management, Concurrency Control and Recovery System**	9
Transactions Management: Transaction concept and ACID properties, transaction state, implementation of atomicity and durability, concurrent executions, Serializability, testing for Serializability, recoverability, implementation of isolation. **Concurrency Control and Recovery System:** Concurrency control, lock based protocols, time-stamp protocols, validation protocols, Crash Recovery, Remote backup system.		
Textbooks:		
1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, TMH. 2. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, 5th Edition, TMH.		

PYTHON PROGRAMMING

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-CS-PC-212	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	perceive the fundamentals of python programming	3	3	2	2
CO2	develop programs using control statements	3	3	2	2
CO3	analyze the programming performances using functions	3	3	2	2
CO4	make use of collections in python programming	3	3	3	2
CO5	design classes and build error-free codes	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Introduction to Python, Installing Python. How a Program Works, Using Python, Program Development Cycle, Input and Output, Comments, Variables, Data types, Reading Input from the Keyboard, Displaying Output with the Print Function, Performing Calculations, Operators, Type conversions, Expressions.		
II	**Control Flow, Functions and Modules**	10
Control Flow Statements: Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Repetition Structures: Introduction, while loop, for loop, Input Validation Loops, Nested Loops, control statements-break, continue, pass. **Functions and Modules:** Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions-Generating Random Numbers, The math Module, Storing Functions in Modules.		
III	**Strings and Collections**	4+5=9
Part-A: Strings: Accessing Characters and Substrings in a String, String Methods, Basic String Operations, String Slicing, Testing, Searching, Comparing and Manipulating Strings.		
Part-B: Collections: Lists, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples, Tuple methods. Sets, Operations on Sets, Dictionaries and its methods.		
IV	**Classes and Exceptions**	10
Design with Classes: Classes and Objects, Classes and Functions, Classes and Methods, Working with Instances, Inheritance and Polymorphism. Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, techniques for Designing Classes. **Exceptions:** Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.		
V	**GUI Programming**	9
Graphical User Interfaces: Behavior of terminal based programs and GUI-based programs, Coding simple GUI-based programs, other useful GUI resources. GUI Programming: Graphical User Interfaces, Using the Tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.		
Textbooks:		
1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning. 2. Think Python First Edition, by Allen B. Downey, Orielly publishing.		
References:		
1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press. 2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing.		

DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ESC-210	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5
CO1	design logic gates using NAND and NOR gates	3	3
CO2	construct the combinational and sequential logic circuits	3	3
CO3	solve simple problems using ALP	3	3
CO4	implement string handling operations using ALP	3	3
CO5	develop programs using procedures and macros	3	3

List of Experiments

Week	Title/Experiment
	PART-A: Exercises in Digital Logic Design
1	Implement Logic gates using NAND and NOR gates
2	Design and implement Full adder using gates
3	Design and implement 4:1 MUX, 8:1MUX using gates/ICs.
4	Design and implement 3 to 8 decoder using gates
5	Design and implement 4 bit comparator using gates/IC
6	Design and implement 4bit shift register using Flip flops
	PART-B: Exercises in 8086 Assembly Language Programming (ALP)
	Write an Assembly Language Programs (ALP) for the following using GNU Assembler / Microsoft Assembler.
1	Write an ALP to evaluate the expressions: i) a = b +c– d*e ii) z= x * y+ w – v + u / k
2	Write an ALP to take N numbers as input. And do the following operations on them. a. Arrange in ascending order b. Arrange in descending order
3	Write an ALP to take N numbers as input and find maximum, minimum and average.
4	Write an ALP to take a string of as input and do the following operations on it. a. Find the length b. Check is it Palindrome or not
5	Write an ALP to take a string as input and do the following Operations on it a. Find the Armstrong number b. Find the Fibonacci series for n numbers
6	Write an ALP to implement the following operations as procedures and call from the Main Procedure. a. Find the Armstrong number b. Find the Fibonacci series for n numbers
	References
	1. Digital Logic Design and Computer Organization Lab Manual, Dept. of CSE, CMRIT, Hyd.
	Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.
	1. Implement 4 x 1 multiplexer using PLA. 2. Implement full Subtractor (hint: use half Subtractor). 3. Design a logic circuit that has three inputs A, B and C whose output will be HIGH only when a majority of the inputs are HIGH. 4. Design a circuit for detecting equality of two bit binary numbers. 5. Write an ALP to evaluate the following expressions: i) a = b * c / d - e ii) z= x / y + w * u - v a. Considering 8 and 16 bit binary numbers. b. Considering 2 and 4 digit BCD numbers. 6. Write an ALP to convert given lower case letter to upper case letter (using AND Logic). 7. Write an ALP to create a table consisting of roll number, name. Input a roll number and then display the corresponding name. Display appropriate message, if roll number does not exists. 8. Write an ALP to compare two strings. (Use subroutine) 9. Write an ALP to read date & time and display the corresponding day & month. 10. Write an ALP to count the number of 1's and 0's in given binary number.

DATABASE MANAGEMENT SYSTEMS LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-CS-PC-213	-	-	2	1

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5
CO1	construct databases using SQL commands	3	3
CO2	apply normalization techniques to eliminate redundancy	3	3
CO3	design a database schema for a given domain	3	3
CO4	solve queries based on joins, nested queries and aggregate functions	3	3
CO5	execute PL / SQL programs for a given application	3	3

List of Experiments

Note: Take any database application and conduct experiments to get expertise on various case studies

Week	Title/Experiment
1	Student should decide on a case study, analyze and then formulate the problem Statement by populating objects (entities) and their role.
2	**Conceptual Designing using ER Diagrams** (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) **Note:** Student is required to submit a document by drawing ER Diagram.
3	**Converting ER Model to Relational Model** (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys) **Note:** Student is required to submit a document showing the database tables created from ER Model.
4	**Normalization -**To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form.
5	**Creation of Tables using SQL** - Overview of using SQL tool, Data types in SQL, **Practicing DDL Commands-**Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables.
6	**Practicing DML commands** - Insert, Select, Update, Delete of Tables.
7	**Practicing Queries** using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, EXCEPT, CONSTRAINTS etc.
8	**Practicing Sub queries** (Nested, Correlated) and Joins (Inner, Outer and Equi).
9	**Practice Queries** using Aggregate Operators - COUNT, SUM, AVG, MAX, MIN. GROUP BY, HAVING, VIEWS Creation and Dropping.
10	**Practicing on** Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger
11	**Procedures**- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure.
12	**Cursors** - Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.

References

1. Database Management Systems Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design and implement University Database for External examination schedule.
2. Construct an E-R diagram for a motor-vehicle sales company.
3. Design and implement relational database for University Registrar's office.
4. Take any schema and convert in to 1st Normal Form and 2nd Normal Form.
5. Design and implement a schema for Life Insurance Company.
6. Design an E-R diagram for the Library Management system.
7. Demonstrate various built-in functions of SQL with suitable examples.
8. Demonstrate various operators in SQL with suitable examples.
9. Perform sub-queries, nested Queries and join concepts in SQL with suitable examples.
10. Analyze tuple relational calculus and domain relational calculus for suitable queries.

PYTHON PROGRAMMING LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-CS-PC-214	-	-	2	1

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5
CO1	write simple programs using python	3	3
CO2	develop programs using control statements	3	3
CO3	implement functions and file I/O operations	3	3
CO4	make use of lists and tuples in python	3	3
CO5	design simple GUI programs	3	3

List of Experiments

Week	Title/Experiment
1	a) Write a Python program to compute the GCD of two numbers. b) Write a Python program to find the maximum among a list of numbers. c) Write a Python program to display first "N" Fibonacci sequence.
2	a) Write a Python program to display first "N" prime numbers. b) Write a Python program to find the factorial value of a given number. c) Write a Python program to check whether the given string is palindrome or not.
3	a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem) b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum. c) Write a Python program to read filename as command line argument and displays the character count, word count and line count.
4	a) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, ..., 1/10. b) Write a Python program to simulate simple Calculator. c) Write a Python program to copy contents from one file to another file.
5	a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure. b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.
6	a) Write a Python program to compute the matrix multiplication. b) Write a Python program to find the most frequent words in a text read from a file. c) Write a program to print each line of a file in reverse order.
7	a) Write a Python program to perform Linear Search. b) Write a Python program to perform Binary Search.
8	a) Write a Python program to implement Insertion sort. b) Write a Python program to implement Merge Sort.
9	a) Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b. b) Find mean, median, mode for the given set of numbers in a list. c) Write two functions **dups** to find all duplicates in the list and **unique** to find all the unique elements of a list.
10	a) Write a Python function to compute "N"/0 and use try/except to catch the exceptions. b) Write a Python program to define a custom exception class which takes a string message as attribute.
11	a) Write a Python program which accepts a sequence of comma-separated numbers from user and generate a list and a tuple with those numbers. b) Write a function cumulative product to compute cumulative product of a list of numbers. c) Write a function reverse to reverse a list without using the reverse function.

12	a) Write a python program to design the login form using Tkinter module. b) Write a python program to design student application form for admission.

References

1. Python Programming Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Install packages requests, flask and explore them using pip.
2. Write a python script to fetch the content(s) from the web pages. (Hint: use Wiki).
3. Write a python script that serves HTTP Response and HTML Page on request.
4. Create a class for ATM and implement its functions.
5. Create several modules and imports these modules in a new program.
6. Create a class for Library and implement its functions.
7. Write a python script for reading and writing data from local files. (.txt,.csv,.xls, .json, etc)
8. Write a python script for reading data from remote files.
9. Demonstrate the working of pandas data structures: Series and Data Frames.
10. Develop an application to access database with DB-API2.

BUSINESS COMMUNICATION SKILLS LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-HSMC-201	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO9	PO10
CO1	demonstrate verbal and written skills effectively	3	3
CO2	develop professional correspondence skills	3	3
CO3	make use of soft skills to become a professional team member	3	3
CO4	apply knowledge of decision making, leadership, motivation	3	3
CO5	exhibit confidence in facing the interview process	3	3

List of Experiments

Week	Title/Experiment
1	Introduction to Business English - Functional English.
2	Fundamentals of Grammar - Sentence Structure - Parts of Speech - Articles - Prepositions - Subject - Verb Agreement, Question Tags, Speeches, Voices, Tenses etc.
3	Synonyms and Antonyms. Homonyms and Homophones, Word Formation, Idioms and Phrases, Analogy, One-word Substitutes.
4	Spotting errors, Sentence Corrections using Grammar concept knowledge.
5	Verbal logics - Para jumbles.
6	Paragraph writing, Picture description, Text Completion, Essay writing.
7	Verbal Reasoning - Reading Comprehensions, Cloze passages etc.
8	Critical Reasoning: Statements - Arguments, Assumptions, Conclusions, Assertions & Reasons.
9	**Importance of soft skills in personal and professional spheres:** Introduction to Soft Skills**,** Self awareness and Self esteem, Discipline, Integrity, Attitude, Change and Adaptability.
10	**People Skills:** Relationships - Personal & Professional Relationships - Rapport Building - Personal Space; Definition of Motivation - Motivation - Self-motivation; Time Management - Stephen Covey's time management.
11	**Teamwork:** Definition of Team, Team Dynamics - Specialization and Teamwork - Rewards of Teamwork.
12	**Leadership:** Definition of Leadership, Leading a Team, Leadership Qualities - Leader vs Manager - Leadership Styles.
13	**Problem Solving and Decision Making:** Definitions - Problem Solving and Decision Making - Hurdles in Decision Making - Case studies.
14	**Preparation for Interviews:** Body Language - Posture - Dressing and Grooming - Researching the Industry and the Organization- Types of Interviews - First Impressions - Dos and Don'ts of an Interview.

Activities

1. Regular practice tests.
2. Quiz, crossword, word-search and related activities.
3. Picture description including description of photos/images/posters/advertisement analysis etc.
4. Five-minute presentations about concepts learnt
5. JAM and picture narration.
6. Mock interviews.

References

1. Business Communication Skills Lab Manual, FED, CMRIT, Hyd.

GENDER SENSITIZATION LAB
(MANDATORY COURSE- NON- CREDIT)

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-MC-201	-	-	2	-

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO9	PO12
CO1	identify gender issues in contemporary India	2	3
CO2	explain gender roles, spectrum, relationships etc	3	2
CO3	analyze gender issues related to sexual harassment and violence	3	3
CO4	assess gender and human rights	3	3
CO5	adapt to the societal need to end prejudices and achieve gender equality	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Understanding Gender**	6
Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.		
II	**Gender Roles and Relations**	6
Two or Many? - Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary.		
III	**Gender and Labour**	4+4=8
Part-A: Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics.		
Part-B: Fact and Fiction. Unrecognized and Unaccounted work. Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.		
IV	**Gender - Based Violence**	6
The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".* Domestic Violence: Speaking Out: Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life".		
V	**Gender and Culture**	6
Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues - Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals. Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks - The Brave Heart.		
Textbooks:		
1. Towards a world of equals, A bilingual textbook on gender, Telugu Akademi, Hyderabad.		
Note: Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".		

B.TECH.-IV-SEMESTER SYLLABUS

AUTOMATA AND COMPILER DESIGN

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-CS-PC-221	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	design various finite automata	3	3	3	2
CO2	write a context free grammar for a given language	3	3	3	2
CO3	construct various parsers, semantics and intermediate code forms	3	3	3	2
CO4	implement code optimization techniques	3	3	3	2
CO5	apply generic code generation algorithm to generate target code	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Formal Languages**	10
Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata. Chomsky hierarchy of languages and recognizers. ***Task:*** *Write a C program to recognize strings under 'a*', 'a*b+', 'abb'*		
II	**Introduction to Compiler Design**	9
Introduction: Phases of a Compiler, symbol Table management **Context Free grammars and parsing:** Context free grammars, derivation, parse trees, ambiguity **Parsing Techniques:** Top-Down parsing, BFT, Left-Recursion, Left-Factoring, Predictive parsing, LL(1) parsing. ***Task:*** *Design Predictive Parser for the given language.*		
III	**Parsing, Semantic and Intermediate Code Generations**	5+5=10
Part-A: Bottom up parsing: Shift-Reduce parsing, LR Grammar Parsing. ***Task:*** *Design a LALR bottom up parser for the given language.*		
Part-B: Semantics: Syntax directed translation, S-attributed and L-attributed grammars. **Intermediate code**: Intermediate Code Forms, abstract syntax tree, DAG, translation of simple statements and control flow statements, type checking. ***Task:*** *Design Three address code for the given Language.*		
IV	**Code Optimization Techniques**	10
Code optimization: Principal sources of optimization, optimization of basic blocks, peephole optimization. **Data Flow Analysis**: Flow graphs, Data flow Equation, Redundant Sub-Expression, Elimination of Dead-code, Live variable analysis, Copy propagation. ***Task:*** *A program to generate machine code from the abstract syntax tree generated by the parser.*		
V	**Code Generation**	9
Code Generation: Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Blocks. ***Task:*** *Simulate DAG representation for a given expression.*		
Textbooks:		
1. Introduction to Theory of computation. Sipser, 2nd Edition, Thomson. 2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.		
References:		
1. Introduction to Automata Theory Languages and Computation, Hopcroft H.E. and Ullman J. D. Pearson Education. 2. Theory of Computer Science automata, languages and computations, K.L.P. Mishra, N. Chandrashekaran, PHI Publications. 3. Modern Compiler Design - Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.		

DESIGN & ANALYSIS OF ALGORITHMS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-CS-PC-222	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PSO1
CO1	measure time and space complexity of algorithms	3	3	3	3
CO2	solve problems using disjoint sets and divide-and-conquer techniques	3	3	2	2
CO3	apply greedy method and dynamic programming paradigm to solve the problems	3	3	2	2
CO4	adapt back-tracking and branch-bound methods to solve problems	3	3	2	2
CO5	interpret NP-hard and NP-complete problems	3	3	2	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Introduction: Algorithm, pseudo code for expressing algorithms, performance analysis-space complexity, time complexity, asymptotic Notation: big-oh notation, omega notation, theta notation and little oh notation. ***Task:*** *Program to perform operation count for a given pseudo code.*		
II	**Disjoint Sets, Divide and Conquer**	12
Disjoint Sets: Disjoint set operations, UNION and FIND algorithms, spanning trees, connected components and biconnected components. **Divide and Conquer:** General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication. ***Task:*** *Write a Binary Search Program for a given list of values recursively and non-recursively.*		
III	**Greedy method and Dynamic Programming**	4+6=10
Part-A: Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem. ***Task:*** *Program to implement knapsack problem using greedy method.*		
Part-B: Dynamic Programming: General method, applications- Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design. ***Task:*** *Program for finding shortest path for multistage graph using dynamic programming.*		
IV	**Backtracking**	10
Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles. **Branch and Bound:** General method, applications - Travelling sales person problem, 0/1 knapsack problem, LC Branch and Bound solution, FIFO Branch and Bound solution. ***Task:*** *Write a program to find the optimal profit of a Knapsack using Branch and Bound Technique.*		
V	**NP-Hard and NP-Complete problems**	8
NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Cook's theorem statement. ***Task:*** *Write a program to color the nodes in a given graph such that no two adjacent can have the same color using backtracking.*		
Textbooks:		
1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia Publications pvt. Ltd. 2. Introduction to Algorithms, 2nd Edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest,and C.Stein, PHI Pvt. Ltd., Pearson Education.		
References:		
1. Data structures and Algorithm Analysis in C++, Allen Weiss, 2nd Edition, Pearson education. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.		

OOP THROUGH JAVA

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-CS-PC-223	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	write simple java programs using OOP concepts	3	3	2	2
CO2	interpret programs using the concepts of inheritance, polymorphism, packages and interfaces	3	3	2	2
CO3	build efficient and error free codes using the concepts of multithreading and exception handling	3	3	3	3
CO4	design GUI programs using the concepts of AWT and event handling	3	3	3	2
CO5	develop real-time applications using applets and swings	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Java Basics**	10
Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java programs, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods, parameter passing, recursion, exploring String class.		
II	**Inheritance, Polymorphism, Packages and Interfaces**	9
Inheritance and Polymorphism: Types of inheritance, member access rules, super uses, using final with inheritance, the object class and its methods, Method overriding, dynamic binding, abstract classes and methods. **Packages and Interfaces**: Defining, Creating and Accessing a Package, understanding CLASSPATH, importing packages, Differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.		
III	**Exception handling and Multithreading**	5+5=10
Part-A: Exception handling: Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.		
Part-B: Multithreading: Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.		
IV	**Event handling and AWT**	9
Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. **AWT:** class hierarchy, user interface components- labels, buttons, scrollbars, text components, checkbox, checkbox groups, choices, lists panels – scroll pane, dialogs, menu bar, Layout Managers- Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.		
V	**Applets and Swings**	10
Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. **Swings:** Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, ImageIcon, JLabel, JTextfield, JButton, JCheckbox, JList, JRadiobutton, JComboBox, JTabbedPane, JScrollPane.		
Textbooks:		
3. Java the complete reference, 8th Edition, Herbert Schildt, TMH.		
References:		
1. Java How to Program, H. M. Dietel and P. J. Dietel, 6th Edition, Pearson Education/PHI. 2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.		

COMPUTER NETWORKS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-CS-PC-224	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12	PSO1
CO1	outline the basics of computer networks and various layers	3	3	2	3
CO2	demonstrate multiple access protocols	3	3	2	3
CO3	interpret network layer and routing algorithms	3	3	3	3
CO4	illustrate internetworking and various transport protocols	3	3	3	3
CO5	make use of various protocols of application layer	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Overview of the Internet, Physical layer and Data link layer**	10
Overview of the Internet: Protocols and standards, Layering scenario, TCP/IP Protocol Suite, The OSI model, Internet history and administration, Comparison of the OSI and TCP/IP reference model. **Physical layer:** Transmission Media, Guided Media, wireless transmission Media. **Data link layer**: Design issues, CRC Codes, Elementary Data Link layer Protocols, sliding Window Protocol. ***Task:*** *Write a program to compute CRC code for the polynomials.*		
II	**Multiple Access protocols**	9
Multiple Access protocols-Aloha, CSMA, Collision free protocols, Ethernet –Physical layer, Ethernet Mac sub layer, Data link layer switching and use of bridges, learning bridges ,Spanning tree bridges, repeaters, hubs, bridges, switches ,routers and gateways. ***Task:*** *Write a program for 1 bit collision free protocol.*		
III	**Network layer and Routing Algorithms**	5+5=10
Part-A: Network layer: Network layer Design issues, store and forward packet switching connection less and connection oriented networks. ***Task:*** *Write a program to implement i) Character stuffing ii) Bit stuffing.*		
Part-B: Routing Algorithms: Optimality principle, shortest path, flooding, distance vector routing, count to infinity problem, hierarchical routing, congestion control algorithms and admission control. ***Task:*** *Implement distance vector routing algorithm for obtaining routing tables at each node.*		
IV	**Internetworking and Transport Layer**	9
Internetworking: Tunneling, internetwork Routing, Packet fragmentation, IPV4, IPV6 Protocol, IP addresses, CIDR, ICMP, ARP, RARP, DHCP. **Transport Layer**: Services provided to the upper layers elements of transport protocol-addressing connection establishment, connection release. ***Task:*** *Write a program to demonstrate ARP.*		
V	**TCP/IP and Application Layer**	10
TCP/IP: The internet Transport protocols UD-RPC, Real time Transport protocols, The internet Transport protocols-Introduction to TCP, The TCP services model ,The TCP segment Header, The connection Establishment, The TCP Connection release, The TCP Connection management modeling, The TCP Sliding Window, The TCP Congestion Control. **Application Layer**: Introduction, Providing services, Applications layer paradigms, HTTP, FTP, electronic mail, DNS, SSH. ***Task:*** *Write a program to implement RPC.*		
Textbooks:		
1. Data Communications and Networking – Behrouz A Forouzan, Fourth Edition, TMH. 2. Computer Networks - Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI		
References:		
1. Introduction to Data communication and Networking, Tamasi, Pearson Education		

OPERATING SYSTEMS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-CS-PC-225	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	outline various concepts operating systems and Linux utilities	3	3	2
CO2	solve synchronization problems by using process management and API s	3	3	2
CO3	adapt various deadlock handling and memory management mechanism	3	3	2
CO4	analyze various file management system	3	3	2
CO5	make use of I/O Management and security mechanisms	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Operating Systems Overview and Operating Systems Structures**	9
Operating Systems Overview: Introduction, Operating System Objectives and functions, Evolution of operating System, operating system structure and services. **Basic Linux utilities and system calls:** File handling, Process utilities, Disk, Networking, Filters, Backup utilities, system calls-open, read, write, close.		
II	**Process Management, Concurrency and Synchronization**	10
Process Management: Process concepts creating process using fork, vfork system calls process state, process control block, scheduling queues, process scheduling, Threads Overview, Threading issues. **Concurrency and Synchronization:** Cooperating Processes, Inter-process Communication using pipes and fifo, Principles of Concurrency, Mutual Exclusion, Software and hardware approaches, Semaphores, Monitors, Message Passing, and Classic problems of synchronization.		
III	**Deadlocks and Memory Management**	5+5=10
Part-A: Deadlocks: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm.		
Part-B: Memory Management: Basic concepts, swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, thrashing.		
IV	**File Management System**	10
File Management System: Concept of a file, access methods, directory structure, file system mounting, file sharing, protection. File system implementation: file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance.		
V	**I/O Management System, Protection and Security**	9
I/O Management System: Mass storage structure - overview of mass storage structure, disk structure, disk attachment, disk scheduling algorithms, swap space management, stable storage implementation, tertiary storage structure. **Protection & Security:** Protection mechanisms, OS Security issues, threats, Intruders, Viruses.		
Textbooks:		
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 10th Edition, 2018, Wiley India Private Limited, New Delhi. 2. Internal and Design Principles, Stallings, 5th Edition, 2005, Pearson education, PHI. 3. Unix Concepts and Applications, 4th edition, Sumitabha Das, TMH.		
References:		
1. Andrew S. Tanenbaum, Modern Operating Systems, 2nd Edition, 2007, PHI, India. 2. Unix System Programming using C++, T.Chan , PHI 3. Operating Systems – A concept based approach – DM Dhamdhere, 2nd Edition, TMH.		

OOP THROUGH JAVA LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-CS-PC-226	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5
CO1	write, compile and execute simple java programs	3	3
CO2	develop programs using inheritance, polymorphism, packages and Interfaces	3	3
CO3	demonstrate multithreading and exception handling mechanisms	3	3
CO4	design GUI using the concepts of AWT and event handling	3	3
CO5	build real-time applications using applets and swings	3	3

List of Experiments

Note: Use Eclipse or Netbeans platform and get acquainted with the various menus. Create a test project, add a test class and run it. See how you can use auto suggestions and auto fills. Try code formatter and code refactoring like renaming variables, methods and classes. Try debugging step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.

Week	Title/Experiment
1	a) Write a Java program that prints all real solutions to the quadratic equation $ax^2 + bx + c = 0$. Read in a, b, c and use the quadratic formula. If the discriminate b^2-4ac is negative, display a message stating that there are no real solutions. b) Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer. (use Scanner class to read input)
2	a) Write a Java program to create a Student class with following fields i. Hall ticket number ii. Student Name iii. Department iv. Create 'n' number of Student objects where 'n' value is passed as input to constructor. b) Write a Java program to demonstrate string comparison using == and equals method.
3	a) Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome. b) Write a Java program for sorting list of names. Read input from command line. c) Write a Java program to make frequency count of words in a given text.
4	a) Write a java program to demonstrate static member, static method and static block. b) Write a java program todemonstrate method overloading and method overriding. c) Write a java program to demonstrate finals, blank finals, final methods, and final classes d) Write a java program to demonstrate synchronized keyword.
5	a) Write a java program to implement multiple inheritance. b) Write a program to demonstrate packages. c) Java program to demonstrate abstract usage d) Write a Java program that creates a user interface to perform integer divisions.
6	a) Write a java program to crate user defined exception class and test this class. b) Java program that implements a multi-thread application
7	Java program to demonstrate MouseListener, MouseMotionListener and KeyListener
8	a) Applet that displays a simple message b) Applet to compute factorial value
9	a) Java program that simulates a traffic light b) Java program to demonstrate Hashtable usage
10	a) Java program to display the table using Labels in Grid Layout b) Java program that works as a simple calculator
11	Develop Swing application which uses JList, JTree, JTable, JTabbedPane and JScrollPane.

References
1. OOP through JAVA Lab Manual, Department of CSE, CMRIT, Hyd.
Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.
1. Design job application form using swing / applet 2. Develop attendance management system 3. Implement social media System 4. Implement Library management System. 5. Design New Patient Registry Management System 6. Develop Scientific Calculator 7. Demonstrate login validation using rich GUIcomponents 8. Create a package which has classes and methods to read Student Admission details. 9. Event handler to display cut/copy/paste events using swings 10. Demonstrate Graphics class

OPERATING SYSTEMS (LINUX) LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-CS-PC-227	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO3	PO5	PSO2
CO1	illustrate Linux shell environment	3	3	3
CO2	create process using APIs	3	3	3
CO3	interpret various CPU scheduling algorithms and file allocation methods	3	3	3
CO4	experiment with page replacement and memory management	3	3	3
CO5	distinguish deadlock avoidance and deadlock prevention	3	3	3

List of Experiments

Week	Title/Experiment
1	Study of Linux general purpose utilities (File handling, Process utilities, Disk utilities, Networking, Filters)
2	c) Write a shell script to find factorial of a given integer. d) Write a Shell Script to wish 'Good Morning' and 'Good Evening' depending on the system time.
3	Implement Linux cat command using File API s.
4	Implement the Linux commands (a) cp (b) mv using Linux system calls
5	Write a C program to create a child process and allow the parent to display 'parent' and the child to display 'child' on the screen.
6	Write a C program in which a parent writes a message to a pipe and the child reads the message.
7	Write C programs to simulate the following CPU scheduling algorithms a) FCFS b) Priority
8	Write C programs to simulate the following CPU scheduling algorithms a) SJF b) RR
9	Write C programs to simulate the following file allocation strategies a) Sequential b) Linked c) Indexed
10	Write C programs to simulate the following memory management techniques a) Paging b) Segmentation
11	Write a C program to simulate bankers algorithm for deadlock detection and avoidance
12	Write C programs to simulate the following page replacement techniques: a) FIFO b) LRU c) Optimal

References

1. Operating Systems (Linux) Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Producer-consumer problem using semaphore
2. Dining- Philosopher problem using semaphore
3. Multithreading using pthread library
4. DAG (Directed Acyclic Graph) file organization technique
5. Virtual Memory Simulation
6. Multi-level queue CPU scheduling algorithm
7. Process/thread synchronization
8. A slower file system mechanism
9. Demand paging technique of memory management
10. Threaded Matrix Multiply

APTITUDE AND CRITICAL THINKING SKILLS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-BSC-204	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO9	PO10
CO1	build proficiency in quantitative reasoning	3	3
CO2	improve critical thinking skills	3	3
CO3	enhance analytical skills	3	3
CO4	demonstrate quantitative aptitude concepts	3	3
CO5	adapt principles of quantitative aptitude to achieve qualitative results	3	3

List of Experiments

Week	Title/Experiment
1	Basic concepts, combined mean, average principles, wrong values taken, number added or deleted, average speed.
2	**Percentages** - Basic Concepts, conversions, finding percentages from given numbers, quantity increases or decreases by given percentage, population increase by given percentage, comparisons, consumption when a commodity price increase or decrease and applications.
3	**Data Interpretation -** Introduction to Data Interpretation, quantitative and qualitative data, Tabular Data, Line Graphs, Bar Chart, Pie Charts, X-Y Charts. **Gamification** - Deductive Logical Thinking.
4	Number Series, Letter Series, Series completion and correction, Coding and Decoding. Word analogy-Applied analogy, Classifications, verbal classification. **Gamification -** Inductive Logical Thinking.
5	**Reasoning Logical Diagrams -** Simple diagrammatic relationship, Multi diagrammatic relationship, Venn-diagrams, Analytical reasoning. **Gamification** - Grid Motion, Motion Challenge, Colour The Grid. **Reasoning Ability -** Blood Relations, Seating arrangements, Directions, Decision making.
6	**Number Systems:** Basic Concepts, Number Systems: Natural numbers, whole numbers, integers, fractions, Rational Numbers, Irrational Numbers, Real Numbers, Divisibility Rules, Logic Equations, Remainder theorem, Unit digit calculation. **Gamification** – Switch Challenge **Progressions & Inequalities:** Basic Concepts, Types: arithmetic, geometric, harmonic progression and applications.
7	**Profit and Loss:** Basic Concepts, discounts, marked price and list price, dishonest shopkeeper with manipulated weights, successive discounts etc. **Interest (Simple and Compound):** Basic Concepts, Yearly, Half-yearly, and quarterly calculations, multiples, differences between simple and compound interest. **Gamification** – Digit Challenge.
8	**Ratio and Proportion:** Basic Concepts of ratio and proportion, continued or equal proportions, mean proportions, invest proportion, alternative proportion, division proportion, compound proportion, duplication of ratio, finding values, coins and currencies, etc. **Gamification** – The Same Rule.
9	**Speed, Time and Distance:** Basic Concepts, Single train problems, two train problems: some point same side, some point opposite sides, relative speed, different points meeting at common points, different points same side (different timings vs. same timings), ratios, number of stoppages, average speed, etc.
10	**Time and Work:** Basic Concepts, comparative work, mixed work, alternative work, middle leave and middle join, ratio efficiency.
11	**Permutations and combinations:** Basic Concepts, differences between permutations and combinations, always together-never together, alternative arrangement, fixed positions,
12	

	double fixations, items drawing from a single group, items drawing from a multiple group, total ways of arrangement with repetitions and without repetitions, dictionary, handshakes or line joining between two points or number of matches , sides and diagonals, etc.
13	**Clocks and Calendars:** Basic Concepts, Angle between minute hand and hour hand, reflex angle, hours hand angle, time gap between minute hand and hour hand, relative time: coincide, opposite sides and right angle, mirror images, faulty clock (slow/fast), miscellaneous, calendar. **Gamification** - Overall Revision.
14	**Geometry and Mensuration:** Basic concepts, types of angles. **Plane figures:** rectangles, squares, triangles, quadrilateral, areas, perimeters, etc. **Solid figures:** cubes, cuboids, cylinders-area (total surface area and lateral surface area), volumes, perimeters. **Others:** Parallelogram, Rhombus, Trapezium, Circle, Sector, Segment, Cone, Sphere, Hemisphere, etc.
References	
1. Aptitude and critical thinking skills Lab Manual, FED, CMRIT, Hyd.	

SOCIAL INNOVATION LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-BSC-205	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PSO2
CO1	illustrate social innovation	3
CO2	identify the problems	3
CO3	choose suitable design processes	3
CO4	develop a prototype using suitable platform	3
CO5	prepare a report using project management techniques and ethics	3

List of Experiments

Week	Title/Experiment
1	**Introduction to Engineering and Social Innovation**
Introduction to engineering, difference between science, engineering and technology. History of social innovation, core definitions, core elements and common features of social innovation, a topology of social innovations, fields for social innovation.	
2	**Stages and Process of social innovation**
Different sectors for social innovation and stages of social innovation. Prompts - identifying needs, Proposals - generating ideas, Prototyping - testing the idea in practice, Sustaining-developing a business model.	
3	**Social and economic change**
The shape of the economy to come, understanding social change-individuals, movements and organizations.	
4	**Analysis and Prototyping**
Basic components and applications, data acquisition, examples for prototyping.	
5	**Design and Platform based development**
Engineering design process, multidisciplinary facet of design. Introduction to PCB design. Introduction to various platform based development programming and its essentials.	
6 - 8	**Choose any one of the following or other platform for implementation**
Arduino: Introduction to sensors, transducers and actuators and its interfacing with Arduino.	
Mobile App Development using android: Installation of android studio, setup of AVD, layouts, UI components, working with Firebase, simple authentication App.	
Mobile App Development using MIT App inventor: Create an account in MIT App inventor, working with UI components and blocks, App development using MIT App inventor, authentication using firebase, AI using MIT App inventor.	
Multi-platform Application: Installation of flutter, create widgets, layers and simple authentication app using flutter.	
Web Application: Install virtual environment for FLASK, create web app using FLASK with routing.	
9	**Project Management and Ethical Dilemmas**
Significance of team work, importance of communication in engineering profession. Identify and apply moral theories and codes of conduct for resolution of ethical dilemmas.	
10	**Case Studies**
Report writing and documentation, presentation of the case studies with a focus on impact and vision on society.	
References	
1. Social Innovation Lab Manual, Department of FED, CMRIT, Hyd.	

INDIAN CULTURE AND CONSTITUTION
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-MC-202	2	-	-	-

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO8	PO12
CO1	identify paradigm shift in indian culture	3	1
CO2	explain features of languages, religions and holy books	3	2
CO3	illustrate provisions of Indian constitution	3	3
CO4	appreciate the structure of Indian administration system	3	3
CO5	appraise the role of Election Commission of India	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Indian Culture**	10
Indian Culture: Characteristics of Indian culture, significance of geography on Indian culture, society in India through ages, religions in ancient period, caste system, communalism and modes of cultural exchange.		
II	**Indian Languages, Religions and Literature**	9
Indian Languages, Religions and Literature: Evolution of script and languages in India, the Vedas and holy books of various religions. religion and philosophy in India; ancient period – Prevedic, Vedic religion, Buddhism and Jainism.		
III	**Indian Constitution and Union Administration**	5+5=10
Part A: Indian Constitution: Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Fundamental Rights and Duties.		
Part B: Union Administration: Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.		
IV	**State and District Administration**	10
State Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Structure and functions Election Commission: Role and Functioning. **District's Administration**: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.		
V	**Local Administration and Election Commission**	9
Local Administration: Introduction to local self government, Organizational Hierarchy (Different departments), ZP administration, Mandal level and Village level administration. **Election Commission:** Role, structure and Functions of Election Commission of India. Introduction to different welfare boards.		
Reference:		
1. A Hand Book on Indian Culture and Constitution, FED, CMRIT, Hyderabad.		

B.TECH.-V-SEMESTER SYLLABUS

SOFTWARE DESIGN AND ENGINEERING

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PC-311	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO8	PO11	PO12	PSO1
CO1	identify & analyze software requirements and prepare SRS	3	3	3	3	3	3
CO2	design a system, component or process to meet the needs	3	3	3	3	3	3
CO3	make use of UML diagrams in software design	3	3	3	3	3	3
CO4	analyze various testing techniques by using various metrics	3	3	3	3	3	3
CO5	adapt risk management strategies to assure software quality	3	2	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Introduction to Software Engineering: Evolving role of Software, SDLC, Software engineering- A layered technology, The Capability Maturity Model Integration (CMMI), Process Assessment. **Process Models:** The water fall model, incremental process models, evolutionary process models, the unified process. **Software Requirements:** Functional and Non functional requirements, User requirements, System requirements, the software requirements document. **Requirements Engineering Process:** Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. ***Task:*** *Develop a problem statement.*		
II	**Design**	9
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. **Modeling component-level design & performing user interface design**: Designing Class based components, conducting component level design, Golden rules, user interface analysis and design. ***Task:*** *Develop Data Flow Diagram Model.*		
III	**Modelling**	5+5=10
Part-A: Introduction to UML: Principles of modeling, conceptual model of the UML, **Class and Object Diagrams**: terms, concepts, modeling techniques. ***Task:*** *Create a Class diagram for ATM Application.*		
Part-B: Behavioral Modeling: Interaction diagrams, use case diagrams, activity diagrams**,** state chart diagram, component and deployment diagrams. ***Task:*** *Create a Use Case diagram for an ATM Application.*		
IV	**Testing**	10
Testing Strategies: A strategic approach to software testing, strategies for conventional software, Black-Box and White-Box testing, Validation Testing, System Testing, the art of Debugging. **Process and Product Metrics**: Software Quality and measurement, Metrics for software quality, analysis model, design model, source code, testing and maintenance. ***Task:*** *Develop test cases for unit testing and integration testing.*		
V	**Management**	9
Risk Analysis and Management: Risk Management, Reactive vs Proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM plan. **Software Quality Assurance:** Quality Management, Quality concepts, Software quality assurance, Software reviews, Formal technical reviews, Software reliability, ISO 9000 Quality standards. ***Task:*** *Preparation of Software Configuration and Risk Management related documents.*		
Textbooks:		

1. Roger S. Pressman, Software engineering- A practitioner's Approach, TMH (I), 7th Edn., 2019.
2. Ian Sommerville, Software Engineering, Pearson education Asia, 10th Edition, 2015.
3. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modelling Language User Guide, Pearson Education.

DATA MINING AND DATA ANALYTICS

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PC-312	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	PSO1
CO1	summarize fundamentals of data mining	3	2	2	2	2
CO2	illustrate various mining association rules	3	3	2	2	3
CO3	make use of classification and clustering techniques	3	3	3	2	3
CO4	outline various data analytics techniques	3	2	2	2	3
CO5	solve statistical problems using R programming	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Data Mining**	8
Introduction to Data Mining: Kinds of Data, Data mining Functionalities – Interesting Patterns Task Primitives, Issues in Data Mining, Data Preprocessing		
II	**Mining Frequent, Associations and Correlations**	10
Mining Frequent, Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods:, Apriori Algorithm: Finding Frequent Itemsets by Confined Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, From Association Analysis to Correlation Analysis.		
III	**Classification and Clustering**	6+6=12
Part-A: Classification: Basic Concepts, Algorithm for Decision Tree Induction, Attribute Selection Measures. Bayes Classification Methods, Bayesian Belief Networks, a Multilayer Feed-Forward Neural Network, k-Nearest-Neighbor Classifiers.		
Part-B: Clustering: Cluster Analysis, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering.		
IV	**Data Definitions and Analysis Techniques**	9
Data Definitions and Analysis Techniques: Introduction to statistical learning and R-Programming, Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing.		
V	**Basic Analysis Techniques**	9
Basic Analysis Techniques: Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Maximum likelihood test, regression, Practice and analysis with R.		
Textbooks:		
1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2nd Edition, 2006. 2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education. 3. An Introduction to Statistical Learning: with Applications in R, G James, D. Witten, T Hastie, and R. Tibshirani, Springer, 2013		
References:		
1. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing 2. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press. 3. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer.		

INFORMATION AND CYBER SECURITY

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PC-313	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO8	PO12	PSO1
CO1	explain information and cyber security terminologies	2	2	2	3	2	3
CO2	identify various cyber offences	3	3	3	3	3	3
CO3	apply cryptography for security networks	3	3	3	3	3	3
CO4	use standards and cyber laws to enhance cyber security	3	3	3	3	3	3
CO5	illustrate the importance of security policies & IT Act	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	12
Essential Terminologies: Information security – Principles, Mechanisms, Network security models, NIA, Risks, Breaches, Threats, Attacks, Exploits. Information gathering. Incident response team, Reporting crime, Operating System attacks, Application attacks, Reverse engineering, Cracking techniques, and financial frauds.		
II	**Cyber Offences**	6
Introduction, how criminals plan the attacks, social engineering, cyber stalking, cyber cafe and cybercrimes, Botnets: The fuel for cybercrime, attack vector, cloud security.		
III	**Cryptography and Cryptanalysis**	6+6=12
Part-A: Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.		
Part-B: Open Source/ Free/ Trial Tools: Implementation of Cryptographic techniques, OpenSSL, Hash Values Calculations MD5, SHA1, SHA256, SHA 512, Steganography (Stools)		
IV	**Cyber Security Audit & Standards**	9
Risk assessment and management, asset classification, crisis management plan, resources recovery strategy, security testing, international standards, analysis and logging, security certification.		
V	**Security Policy & IT ACT**	9
Security policies, WWW policies, email security policies, policy review process- corporate policies, sample security policies, publishing and notification requirement of the policies. Information Security Standards-ISO, cyber laws in India; IT Act 2000 provisions, Intellectual Property Law: Copy right law, software license, semiconductor law and patent law.		
Textbooks:		
1. William Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2006. 2. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.		
References:		
1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security", Pearson. 2. Schou, Shoemaker, "Information Assurance for the Enterprise", TMH. 3. Chander, Harish," Cyber Laws And It Protection " , PHI, New Delhi, India		

ARTIFICIAL INTELLIGENCE

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PC-314	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO6	PO12	PSO1
CO1	explain the concepts of artificial intelligence	3	3	3	3	2	3
CO2	illustrate various search algorithms	3	3	3	3	2	3
CO3	adapt various probabilistic reasoning approaches	3	3	2	3	3	3
CO4	elaborate Markov decision process	3	3	2	3	2	3
CO5	perceive various reinforcement learning approaches	3	3	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.		
II	**Search Algorithms**	10
Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.		
III	**Probabilistic Reasoning**	6+4=10
Part-A: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference.		
Part-B: Temporal Model, Hidden Markov Model.		
IV	**Markov Decision Process**	10
MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.		
V	**Reinforcement Learning**	10
Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.		
Textbooks:		
1. Elaine Rich & Kevin Knight, 'Artificial Intelligence', 3rd Edition, TMH, 2008. 2. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003.		
References:		
1. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi. 2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011. 3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.		

SOFT COMPUTING
(Professional Elective-I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PE-311	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO7	PO12	PSO1
CO1	use search techniques in AI problems	3	2	2	2	2	3
CO2	describe various supervise learning techniques	3	2	3	3	2	3
CO3	apply special networks in soft computing problems	3	3	3	3	3	3
CO4	implement fuzzy systems in engineering applications	3	2	3	3	3	3
CO5	perform various operations of genetic algorithms	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
AI Problems, The Underlying Assumption, AI Techniques, The Level of the Model, Criteria for Success. Problems, Problem spaces and Search, Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best First Search, Problem Reduction, Constant Satisfaction, Means Ends Analysis, Logic Rules. ***Task:*** *Write a Program to implement Best First Search.*		
II	**Supervised Learning Techniques**	10
Perceptron, Back Propagation Algorithm- classification. Problem Speech processing. Unsupervised learning Network - Introduction, Fixed Weight, Competitive Nets, MaxNet, Hamming Network, Kohonen self - organizing Feature Maps, Learning Vector Quantization. ***Task:*** *Write a program to implement artificial neural network with back propagation*		
III	**Special Networks**	5+5=10
Part-A: Boltzmann Machine, Gaussian Machine, Probabilistic Neural Net. ***Task:*** *Write a Program to implement Bayes Rule.*		
Part-B: Cellular Neural Network, Spatio-Temporal Connectionist Neural Network, Neuroprocessor Chips. ***Task:*** *Write a Program to implement neural network.*		
IV	**Fuzzy Logic, Classical Sets and Fuzzy Sets**	10
Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule-Based Systems ***Task:*** *Write a Program to implement various operations on fuzzy sets.*		
V	**Genetic Algorithms**	9
Basic Concepts, Basic Operators for Genetic Algorithms, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm. ***Task:*** *Write a Program to implement Simple Genetic Application.*		
Textbooks:		
1. S. N. Sivanandam & S. N. Deepa, "Principles of Soft Computing", 3rd Edn, Wiley India, 2018.		
References:		
1. Soft Computing – Advances and Applications - Jan 2015 by B.K. Tripathy and J. Anuradha – Cengage Learning. 2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw- Hill International editions, 1995.		

GAMIFICATION
(Professional Elective-I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PE-312	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO8	PO12	PSO1
CO1	outline the importance of Gamification	3	2	2	3	3	2	3
CO2	make use of game elements	3	3	3	3	3	2	3
CO3	adapt theories of Gamification	3	3	3	3	3	3	3
CO4	apply Gamification to various learning domains	3	3	3	2	3	3	3
CO5	interpret Alternate Reality Games for Corporate Learning	3	2	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Introduction to Gamification, Gamification in Action, Gamification versus Serious Games, Growth of Gamification - Users, Implications and importance to the future of learning. ***Task:*** *Write a program to give points for meeting academic objectives.*		
II	**Understanding Game Elements**	10
Introduction to Game elements, Abstractions of Concepts and Reality, Goals, Rules, Conflict, Competition, or Cooperation, Time, Reward Structures, Feedback, Levels, Storytelling, Curve of Interest, Aesthetics, Replay or Do over. ***Task:*** *Write a program to give points for meeting procedural/non-academic objectives.*		
III	**Theories of Gamification**	6+4=10
Part-A: Theories Behind Gamification of Learning and Instruction: Introduction, Motivation, The Taxonomy of Intrinsic Motivation, Self-Determination Theory, Distributed Practice, Scaffolding, Episodic Memory, Cognitive Apprenticeship, Social Learning Theory, Flow. ***Task:*** *Write a program to create playful barriers.*		
Part-B: Game Research: Introduction, Game Research, Randel's Meta-Analysis, Wolfe's Meta-Analysis, Hays' Meta-Analysis, Vogel's Meta-Analysis. ***Task:*** *Write a program to create competition within the classroom.*		
IV	**Applying Gamification to Learning Domains**	10
Introduction, Declarative Knowledge, Conceptual Knowledge, Rules-Based Knowledge, Procedural Knowledge, Soft Skills, Affective Domain, Psychomotor Domain, Gamification Design Process - Development Process: ADDIE vs. Scrum, Team, Design Document, Paper Prototyping. ***Task:*** *Write a program to Compare and reflect on performance in nuanced ways personalized for each student.*		
V	**Alternate Reality Games for Corporate Learning**	10
Introduction to ARG, Zombie Apocalypse, ARG Terminology, Design Principles and Potential. Play Games - Pick a Card, Any Card- A Game of Phones, Survival Master, The Virtue of Gamification. ***Task:*** *Write a program to use levels, checkpoints and other methods of 'progression'.*		
Textbooks:		
1. Karl M. Kapp, "The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education", Wiley, 2012. 2. Gabe Zichermann, Christopher Cunningham, "Gamification by Design"O'reilly, 2011.		
References:		
1. Gabe Zichermann and Joselin Linder, "The Gamification Revolution: How Leaders Leverage Game Mechanics to Crush the Competition", O'reilly, 2013.		

DIGITAL MARKETING
(Professional Elective-I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PE-313	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO8	PO12
CO1	outline the importance of digital marketing	2	1	2	3	3	3
CO2	use search engine optimization to achieve business goals	3	2	3	3	3	3
CO3	adapt social media for business promotion	3	3	3	3	3	3
CO4	identify link building techniques for content consideration	3	2	3	3	3	3
CO5	apply digital marketing techniques in real time applications	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Introduction: digital marketing, Digital vs. Real Marketing, Digital Marketing Channels, Creating initial digital marketing plan, Content management, SWOT analysis, Target group analysis, Web design, Optimization of Web sites. ***Task:*** *Create the Digital Webpage using CMS.*		
II	**Search Engine Optimization (SEO)**	11
Introduction, writing the SEO content – title, meta tags, image tags, html tags, content writing essentials, Google adwords, Google adsense, Google webmaster tools, on and off page optimization, web crawlers, keyword strategy; SEO friendly website design, hosting & integration. ***Task:*** *Configure a website on Google webmaster tools to check website optimization performance.*		
III	**Social media in business**	4+5=9
Part-A: Wikipedia, Facebook, Instagram, LinkedIn, Google – advertising, analytics, ads visibility, bulk emailing essentials, integration of social media buttons into business website. ***Task:*** *Create Networking admin panel and assess the performance.*		
Part-B: campaign budgeting, cost control, resource planning, strengthen your brand, Generate leads, Get more visibility online, Connect with your audience, link exchange, registering with directories, data visualization. ***Task:*** *Campaign and sponsor networking pages.*		
IV	**Link building and content consideration**	10
Precursors to link building, elements of link building, finding your competition, analyzing your competition, competitor tracking, becoming a resource, content duplication, content verticals, sitemaps. ***Task:*** *Optimizing SEO using content management.*		
V	**Applications**	9
Travel portal – Makemytrip, Yatra, IRCTC; E-commerce – Amazon, flipkart; Song portals – Wynk. ***Task:*** *Case study of travel / music / E-commerce based on website performance.*		
Textbooks:		
1. Jerkovic, John I. SEO warrior: essential techniques for increasing web visibility. "O'Reilly Media, Inc.", 2009. 2. The Art of SEO: Mastering Search Engine Optimization Eric Enge, Stephan Spencer, Rand Fishkin, Jessie C Stricchiola; O'Reilly Media.		
References:		
1. SEO: Search Engine Optimization Bible Jerri L. Ledford; Wiley India; 2nd Edition.		

DATA MINING AND DATA ANALYTICS LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PC-315	-	-	2	1

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	make use of open source data mining and analytic tools	3	3	3
CO2	examine the interesting insights of Apriori algorithm using WEKA	3	3	3
CO3	demonstrate the classification and clustering techniques	3	3	3
CO4	analyze the concepts of data analytics and statistical testing methods	3	3	3
CO5	compare various kinds of regression techniques	3	3	3

List of Experiments

Week	Title/Experiment
	Part-A: Data Mining
1	Demonstration of preprocessing on dataset student.arff
2	Demonstration of Association rule process on dataset contactlenses.arff using apriori algorithm
3	Demonstration of classification rule process on dataset employee.arff using j48 algorithm.
4	Demonstration of classification rule process on dataset employee.arff using id3 algorithm.
5	Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm.
6	Demonstration of clustering rule process on dataset iris.arff using simple k-means.
7	Demonstration of clustering rule process on dataset student.arff using hierarchical clustering.
	Part-B: Data Analytics
8	a) Write R program to find R-Mean, Median & Mode with the sample data. b) Write R program to find Analysis and Covariance with the sample data and visualize the regression graphically.
9	Write R program to find the following Regressions with the sample data and visualize the regressions graphically. a) Linear Regression b) Multiple Regression c) Logistic Regression d) Poisson Regression.
10	Write R program to find a) Time Series Analysis with the sample data and visualize the regression graphically. b) Non Linear Least Square with the sample data and visualize the regression graphically. c) Decision Tree with the sample data and visualize the regression graphically.
11	Write R program to find the following Distribution with the sample data and visualize the linear regression graphically. a) Normal Distribution b) Binomial Distribution
12	Write R program to do the following tests with the sample data and visualize the results graphically. a) χ^2-test b) t-test c) F-test
References	
1. Data Mining and Analytics Lab Manual, Department of CSE, CMRIT, Hyd.	
Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.	
1. Data Mining Techniques in Healthcare System using WEKA. 2. Credit Scoring Analysis using WEKA. 3. Crime Rate Prediction using K Means. 4. Weather Forecasting using Data Mining. 5. Smart Health Prediction using Data Mining. 6. Movie Success Prediction using Data Mining. 7. Google data analysis using R. 8. IRCTC Reservation system data analysis using R. 9. Facebook data analysis using R. 10. Banking system data analysis using R.	

INFORMATION AND CYBER SECURITY LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PC-316	-	-	2	1

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	explain concepts of cryptanalysis	3	3	3
CO2	Examine different vulnerability attacks	3	3	3
CO3	illustrate Wi-Fi security techniques	3	3	3
CO4	Able to do malware analysis.	3	3	3
CO5	Able to configure simple firewall and IT audit	3	3	3

List of Experiments

Week	Title/Experiment
1	Cryptanalysis of Caesar Cipher using frequency analysis.
2	Cryptanalysis of RSA.
3	Examination of a website to test the vulnerability of attacks. – DVWA setup & SQLi.
4	Examination of a website to test the vulnerability of attacks. – XSS & CSRF & command line injection attack.
5	Implement firewall for an organization.
6	Implement Wi-Fi security (WPA2, IP based, MAC Based).
7	Analyze and exploit the root system of CMROS.
8	Implementing and analyzing target using Metasploit and gain control over the system.
9	Implementation of IT Audit, malware analysis and vulnerability assessment and generate the report.
10	Test security of UPI applications on desktop sharing applications.

References

1. Information and Cyber Security Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Survey for accessing the cyber-attack awareness of members in an organization.
2. Study of 2 real times cybercrime cases.
3. Implement SSL in a website.
4. Securing the files of a server on root folder for unauthorized access.
5. Use rules to protect your content and prevent data leaks to unauthorized users in email server.
6. Use detectors within a rule to identify sensitive content.
7. Analyze and prepare a report from Sent and received email report in Office 365 admin.
8. Monitor top email senders and receivers in an organization using office 365 admin
9. Configure anti malware in email server (office 365).
10. Add DKIM signatures to your domains so recipients know that email messages actually came from users in your organization and weren't modified after they were sent.

ARTIFICIAL INTELLIGENCE LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PC-317	-	-	2	1

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	illustrate various search techniques	3	3	3
CO2	solve real-time problems using graph theory	3	3	3
CO3	develop various games using AI techniques	3	3	3
CO4	adapt Bayesian probability model	3	3	3
CO5	design programs based on Markov decision process	3	3	3

List of Experiments

Week	Title/Experiment
1	Write a program to implement BFS Traversal.
2	Write a program to implement DFS Traversal.
3	Write a program to implement A* Search.
4	Write a program to implement Travelling Salesman Problem.
5	Write a program to implement Graph Coloring Problem.
6	Write a program to implement Missionaries and Cannibals Problem.
7	Write a program to implement Water Jug Problem.
8	Write a program to implement Hangman game.
9	Write a program to implement Tic-Tac-Toe game.
10	Write a program to implement 8 Queens Problem
11	Write a program to implement Bayesian Network.
12	Write a program to implement Hidden Markov Model.

References

1. Artificial Intelligence Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Intelligent vehicles using Artificial Intelligence.
2. Smart ICU Predictive detection of deterioration of seriously ill patients using Artificial Intelligence.
3. Artificial Intelligence Innovation.
4. Prevention against Cyber security Threats using Artificial Intelligence.
5. Efficient, Scalable Processing of Patient Data using Artificial Intelligence.
6. Smart Bike Share Programs using Artificial Intelligence.
7. Automatic Document Classification using Bayesian theorem.
8. Automated Geophysical Feature Detection using Artificial Intelligence.
9. Artificial Intelligence for Records Management.
10. Artificial Intelligence in e-Commerce.

AUTOMATED TESTING TOOLS (SELENIUM) LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CS-PC-318	1	-	2	2

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO5	PO8	PSO2
CO1	install JAVA, Associate SWD Jars and Browser drivers	3	2	2	3	3	3
CO2	devise website issues using automation	3	3	3	3	3	3
CO3	develop programs using web drivers	3	3	3	3	3	3
CO4	design test cases for validation of data	3	2	2	3	3	3
CO5	plan automation to address real time problems	3	3	3	3	3	3

List of Experiments

Week	Title/Experiment
1	Download and Install JAVA, Associate SWD Jars and Browser drivers.
2	Launch Mercury Tour website a) Click Register link to get registration page b) Fill fields c) Click submit d) Close site
3	Write a code to search a specific month in the Facebook registration page (Birthday).
4	Write a program which pops out an alert message in frame in personal banking login page.
5	Write a test case to search result section on CMRIT Website.
6	Write a test case to perform automation on AJIO shopping website.
7	Write a program in web driver to open Google and search CMRIT.
8	Write test case to open Google and download an image from Google images of CMRIT website.
9	Write test case to get number of list items in a list.
10	Write test case for validation in Gmail registration page.
11	Write test case for Myntra sign in page.
12	Write test case to convert PDF from word.

References

1. Automated Testing Tools (Selenium) Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Perform automation testing for any hotel booking website.
2. Perform automation testing for shopping cart.
3. Perform automation testing for utility bill payment portal.
4. Perform automation testing for travel booking website.
5. Perform automation testing for finding out list of employees having salaries greater than a specific amount.
6. Perform automation testing to find out total number of objects in Google search result with a specific query.
7. Perform automation testing for EMI calculator.
8. Perform automation testing for finding out the number of flights departing from Hyderabad airport in a day.
9. Perform automation testing for finding out the least and highest cost for a specific product in any e-commerce website.
10. Perform automation testing for voice based input in Google search engine.

SUMMER INTERNSHIP

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-CD-PR-311	-	-	-	1

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PSO2
CO1	utilize the domain knowledge with modern tools to solve real world problems	3
CO2	analyze the industrial processes that results in the end product / service	3
CO3	extend global needs for professional ethics, responsibility and communication	3
CO4	function well as an individual, member or leader in diverse teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines

S. No.	Title
1	The student has to complete the internship for a period of 4 weeks during summer vacation between IV Semester and V Semester.
2	The internship can be carried out in any industry / R&D Organization / Research Institute / Premier Educational Institutes like IITs, NITs and IIITs etc.
3	The registration process of internship should be completed before the commencement of IV-semester end examinations.
4	The registration process for internship involves: a) Students have to approach respective course coordinator with name of proposed company / organization in which they wish to carry out internship. b) The Department shall nominate guide to supervise the interns. c) Student has to obtain a no objection certificate (NOC) in the prescribed format from the department and submit the same to the respective organization. d) Student has to submit acceptance letter issued by the respective organization to the course coordinator.
5	The internal guide has to visit place of internship at least once during student's internship.
6	The students shall report the progress of the internship to the guide in regular intervals and seek advice.
7	After the completion of Internship, students shall submit a final report along with internship and attendance certificates to the course coordinator with the approval of internal guide.
8	The evaluation of internship shall be done during V-Semester.
9	The student has to give a PPT presentation for duration of 10 to 15 minutes in the presence of departmental evaluation committee consists of Head of the Department, Internal Guide and Two Senior Faculty from the respective departments.
10	After the successful presentation by the student, the evaluation committee recommends the result as satisfactory for the internship. In case of students who have not registered for internship / not submitted the internship certificate and report, the V-Semester result will not be declared till completion.

CODING SKILLS
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-MC-301	1	-	2	-

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO5	PO12
CO1	solve real world problems using C & DS	3	3	3	3	3
CO2	solve real world problems using DBMS	3	3	3	3	3
CO3	solve real world problems using Python	3	3	3	3	3
CO4	solve real world problems using Java, HTML, JavaScript	3	3	3	3	3
CO5	solve real world problems using any one emerging technology	3	3	3	3	3

List of Experiments

Week	Title/Experiment
	PART-A (Mandatory)
1	**C&DS:** Loops statements, control structures, functions, arrays, structures and unions.
2	**C&DS:** Pointers, strings, linked lists, stacks and queues.
3	**C&DS:** Sorting, searching algorithms, trees and graphs.
4	**DBMS:** Database creation, normalization, transactions and triggers.
5	**Python:** OOP concepts, control statements, list, tuple, set and dictionary.
6	**Python:** Exception handling and regular expressions.
7	**Java:** OOP concepts.
8	**Java:** String manipulations, exception handling.
9	**HTML & JavaScript:** Tags, table, lists, XHTML, HTML5, form validation using JS.
10	**Node.JS:** Simple Programs using promise and async.
	ReactJS: Features, Environment setup and installation, components, Strings, State, Props and Validation, handling RestAPI's.
	PART-B (Either DevOps/.Net/Rust/Julia or any emerging technologies)
	DevOps
11	Introduction, architecture, life cycle, DevOps Vs agile.
12	Workflows, version control - GIT.
13	Continuous integration & deployment - Jenkins. Build tool - Maven.
14	Containers and virtual development - Docker and Vagrant. Configuration management tools - Ansible, Puppet, Chef.
	.Net
11	Introduction to ASP.Net, control, architecture, framework.
12	Introduction to C#, OOPs concepts, exception handling.
13	Introduction to VB.Net, multi-threading. Introduction to ADO.Net.
14	Introduction to AJAX, routing, publishing and engine creation.
	Rust
11	Introduction, environment setup, data types, variables, constant.
12	Strings, operators, decision making, loops.
13	Function, tuple, array.
14	Ownership, borrowing, slices, structure, enum, module, error handling.
	Julia
11	Introduction, initialization and installation, OOPs, object reference, variables.
12	Introduction to REPL, tab completion, seeking help from Julia.
13	Data types, type assignment.
14	Representation of different number types, mathematical functions.
Reference	
1. Coding Skills Manual, Department of CSE, CMRIT, Hyd.	

B.TECH.-VI-SEMESTER SYLLABUS

IOT WITH CLOUD COMPUTING

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PC-321	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO7	PO12	PSO1
CO1	explain the concepts of IoT	3	2	3	3	3	3
CO2	illustrate the foundations of IoT	3	2	3	3	3	3
CO3	adapt protocol and standards of IoT	3	3	3	3	3	3
CO4	outline the importance of cloud in IoT	3	3	3	3	3	3
CO5	make use of cloud in IoT enabled spaces	3	2	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Introduction to Internet of Things, IoT Kaleidoscope, Ubiquitous IoT Applications**,** A Panoramic View of IoT Applications, Telematics and Intelligent Transport Systems, Smart Grid and Electric Vehicles, Smarter Planet and Smart Buildings.		
II	**Pillars and DNA of IoT**	10
Four Pillars of IoT, M2M: The Internet of Devices, RFID: The Internet of Objects, WSN: The Internet of Transducers, SCADA: The Internet of Controllers, The DNA of IoT - DCM: Device - Things that Talk. Connect - Via Pervasive Networks, Wired Networks, Wireless Networks. Manage - To Create New Business Value.		
III	**Smart Home Scheduling and Cloud Computing**	4+5=9
Part-A: Protocol Standards for IoT: TCP and UDP, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization.		
Part-B: Architecture Standardization for WoT: Platform Middleware for WoT, Standards for M2M, Frameworks for WSN, Standards for SCADA, Extensions on RFID Standards, Unified Multitier WoT Architecture, OSGi: The Universal Middleware, WoT Framework Based on Data Standards.		
IV	**The Cloud of Things**	10
Introduction to Cloud Computing, Cloud Middleware, NIST's SPI Architecture and Cloud Standards, Cloud Providers and Systems, The Cloud of Things, The Internet of Things and Cloud Computing, Mobile Cloud Computing, MAI versus XaaS: The Long Tail and the Big Switch, The Cloud of Things Architecture, Four Deployment Models, Vertical Applications.		
V	**Cloud in IoT Enabled Spaces**	9
Medium Access, Data Caching, Smart Parking, Indecision Service Delivery, Home, Learning in Cities', Data Delivery Pricing, Planting & Farming.		
Textbooks:		
1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012. 2. Maheswaran, Muthucumaru et.al., "The Cloud in IoT-enabled Spaces", CRC Press, 2019.		
References:		
1. HwaiyuGeng, "Internet of Things and Data Analytics Handbook", Wiley, 2016. 2. Al-Turjman, Fadi, "Trends in Cloud-based IoT", Springer, 2020.		

MACHINE LEARNING AND DATA SCIENCE

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PC-322	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PSO1
CO1	demonstrate the required mathematical foundations for ML& DS	3	3	3	3	3
CO2	outline the functionalities of machine learning	3	3	3	3	3
CO3	illustrate learning algorithms & data science basics	3	3	2	2	3
CO4	build data science applications using Python based toolkits	3	3	3	3	3
CO5	use recommender systems and sentiment analysis in real time applications	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Mathematical Foundations**	10
Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation, Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem, Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference.		
II	**Machine Learning**	10
Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors.		
III	**Advanced Machine Learning and Introduction to Data Science**	4+5=9
Part-A: Advanced Machine Learning: Find-S: finding a maximally specific hypothesis, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks - Learning and Generalization, Overview of Deep Learning.		
Part-B: Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs reporting, Data Science in business.		
IV	**Programming Tools for Data Science**	9
Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.		
V	**Recommender Systems and Sentiment Analysis**	10
Recommender Systems: Introduction, Content-Based Filtering, Collaborative Filtering, Hybrid Recommenders. **Sentiment Analysis:** Introduction, Data Cleaning, Text Representation.		
Textbooks:		
1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media(unit-1) 2. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi. (unit-2&3) 3. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi. (unit2&4) 4. Introduction to data science by Igual, Laura & Seguí, Santi, Springer. (unit-5)		
References:		
1. Machine Learning – Tom M. Mitchell, TMH. 2. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.		

FULL STACK WEB DEVELOPMENT

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PC-323	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PSO1
CO1	explain the concepts of full stack web development	3	2	2	3	3
CO2	illustrate High level programming and jQuery concepts	3	2	2	3	3
CO3	make use of Node.js and MongoDB Driver for web development	3	3	3	3	3
CO4	develop app using angularJS concepts	3	3	3	3	3
CO5	establish version control in GitHub	3	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		9
Introduction: Getting Started With HTML - HTML5, Video & Audio, Canvas, SVG, Web Storage, Drag & Drop, Geo Location. Basic Styling using CSS – Basic Styling, Positioning & Background Images. Bootstrap – Setup, Templates, Navbar, Typography, Forms & Tables.		
II		10
High level programming: Variables, Arrays, Objects, Loops, Conditionals, Switches, Functions, Events, Form validating, Ajax. **jQuery**: Selectors & Mouse events, Form events, DOM Manipulation, Effects & Animation, Traversing & Filtering.		
III		5+6=11
Part-A: Node.js: Getting Started With Node, Installation and Simple Server - Project using Simple Node Server, Express Setup and Routing, Template Engines - Project using template Engine.		
Part-B: Node MongoDB Driver - Setup, Middleware & Routes - Starting the Project, Creating the UI, Form Validation and User Register, Password Encryption, Login Functionality, Access Control & Logout.		
IV	App Development using Angular	8
Getting Started With Angular, Angular App From Scratch, Angular App From The Quickstart, Components & Properties, Events & Binding with ngModel, Fetch Data From A Service, Submit Data To Service, Http Module & Observables, Routing.		
V	Git & Version Control	10
Getting Started with Git, Working with A Local Repository, Branches and Merging, Working with A Remote Repository, Test project with all test cases, finding bugs, check previous versions, deploying procedures, documentation.		
Textbooks:		
1. Northwood, Chris. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer. A press, 2018. 2. Mulder P. Full Stack Web Development with Backbone.js: Scalable Application Design with 100% JavaScript. "O'Reilly Media, Inc."; 2014 Jun 10.		
References:		
1. Ihrig CJ, Bretz A. Full stack Javascript development with MEAN. SitePoint; 2014 Dec 24.		

COMPUTER VISION
(Professional Elective - II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PE-321	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	explain the concepts of geometric camera models	3	2	2	3	2	3
CO2	demonstrate light and shading	3	3	3	3	3	3
CO3	illustrate the concepts of colour in computer vision	3	3	2	3	2	3
CO4	make use of linear filters	3	3	2	3	2	3
CO5	adapt local image features	3	2	2	3	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Geometric Camera Models**	10
Image Formation – Pinhole Perspective, Weak Perspective, Cameras with Lenses, The Human Eye, Intrinsic and Extrinsic Parameters - Rigid Transformations and Homogeneous Coordinates, Intrinsic Parameters, Extrinsic Parameters, Perspective Projection Matrices, Weak-Perspective Projection Matrices, Geometric Camera Calibration - A Linear Approach to Camera Calibration, A Nonlinear Approach to Camera Calibration. ***Task:*** *Program to calculate Windows and Plots of geometric camera model.*		
II	**Light and Shading**	10
Modelling Pixel Brightness - Reflection at Surfaces, Sources and Their Effects, The Lambertian + Specular Model, Area Sources, Inference from Shading – Radiometric Calibration and High Dynamic Range Images, The Shape of Specularities, Inferring Lightness and Illumination, Photometric Stereo: Shape from Multiple Shaded Images. ***Task:*** *Program to change the Brightness of Image.*		
III	**Colour**	4+5=9
Part-A: Human Colour Perception - Colour Matching, Colour Receptors, The Physics of Colour – The Colour of Light Sources, The Colour of Surfaces, Representing Colour – Linear Colour Spaces, Non-linear Colour Spaces. ***Task:*** *Program to find threshold of gray scale and RGB image.*		
Part-B: A Model of Image Colour – The Diffuse Term, The Specular Term, Inference from Colour – Finding Specularities Using Colour, Shadow Removal Using Colour, Colour Constancy: Surface Colour from Image Colour. ***Task:*** *Program to convert color image to gray and hsv.*		
IV	**Linear Filters and Convolution**	10
Convolution, Shift Invariant Linear Systems – Discrete Convolution, Continuous Convolution, Edge Effects in Discrete Convolutions, Spatial Frequency and Fourier Transforms, Fourier Transforms, Sampling and Aliasing – Sampling, Aliasing, Smoothing and Re-sampling. ***Task:*** *Program for Image Filtering.*		
V	**Computing the Image Gradient**	9
Derivative of Gaussian Filters, Representing the Image Gradient - Gradient-Based Edge Detectors, Orientations, Finding Corners and Building Neighbourhood – Finding Corners, Using Scale and Orientation to Build a Neighbourhood. ***Task:*** *Edge detection with gradient of an Image.*		
Textbooks:		
1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill 2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Prentice Hall.		
References:		
1. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012.		

BLOCKCHAIN AND CRYPTOCURRENCY
(Professional Elective - II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PE-322	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	explain the fundamentals of Blockchain techniques	3	2	2	3	3	3
CO2	analyze various consensus problems	3	3	3	3	2	3
CO3	adapt Blockchain technology to improve business	3	3	3	3	2	3
CO4	make use of Ethereum frameworks to write smart contract	3	3	3	3	2	3
CO5	interpret Blockchain technology in real time applications	3	3	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Introduction to Blockchain: Basics, History, Architecture, Conceptualization, Blockchain components, Creation of blocks, Merkle Tree, Gas Limit, Transactions, Bitcoin basics, characteristics of cryptocurrencies, Altcoins (Alternative cryptocurrencies), Peer-to-Peer Networks, Distributed Ledger Technology, Blockchain types: Public, Private, and Hybrid Blockchain. ***Task:*** *Blockchain architecture demo, installation, and usage of Cryptocurrency wallets.*		
II	**Mining and Consensus Protocols**	8
Miners, Bitcoin Mining, Consensus Protocols: Miners in Bitcoin network, steps in Bitcoin mining, Bitcoin – Wallet, hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin, Bitcoin scripts. Distributed Consensus. ***Task:*** *Bitcoin wallet and querying API to get real time transactions.*		
III	**Consensus in Bitcoin and Ethereum**	6+6=12
Part-A: Consensus in Bitcoin: The basics, Proof of Work (PoW), 51% attacks on Bitcoin network, Sybil attacks, Proof of Stake (PoS), PoW vs PoS and Beyond, Miners in Blockchain, Permissioned Blockchain (Basics, Consensus), Permissioned Blockchain (RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance), Proof-of-authority. ***Task:*** *Installation and mining using GETH.*		
Part-B: Ethereum Blockchain: Characteristics of Ethereum Blockchain, Ethereum Virtual Machine (EVM)-Wallets for Ethereum: Ether and MetaMask wallets, Smart Contracts, introduction to Solidity programming, key concepts in solidity: value types, arrays, functions, structs and solidity mapping, building the Blockchain based decentralized applications (Dapps). ***Task:*** *Designing and deploying solidity contracts on Ethereum Blockchain.*		
IV	**Transform Business with Blockchain**	8
Hyperledger Frameworks: Introduction to Hyperledger fabric, Indy, Aries, Quilt, Ursa, and Caliper. Hyperledger Fabric – Transaction Flow, Hyperledger Fabric Details, Fabric – Membership and Identity Management, Hyperledger Fabric Network Setup. ***Task:*** *Installation of Hyperledger Aries and Indy demo.*		
V	**Blockchain trends and use cases**	10
Non-fungible Tokens (NFTs), Decentralized Autonomous Organization (DAOs), Soulbound Tokens (SBT), Zero Knowledge proofs, layer-2 protocols: Optimism and ZK-rollups, Para chains, substrate Blockchain. Blockchain industry use cases: Market place, supply chain, decentralized identity using Blockchain, Blockchain based certificate management, Blockchain-based E-voting, Dune analytics. ***Task:*** *Building decentralized applications (DApps) using Blockchain.*		

Textbooks:

1. Narayanan, Arvind, et al. Bitcoin and Cryptocurrency technologies: A comprehensive introduction. Princeton University Press, 2016.
2. Thompsons, Josh. "Blockchain: The Blockchain For Beginners Guide To Blockchain Technology And Leveraging Blockchain Programming." (2017).

AUGMENTED AND VIRTUAL REALITY
(Professional Elective - II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PE-323	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO8	PO12	PSO1
CO1	illustrate taxonomy and features of AR systems	2	2	2	2	2	3
CO2	explain fundamentals of virtual reality	3	3	3	3	3	3
CO3	adapt geometric modeling in virtual reality environment	3	3	3	3	3	3
CO4	make use of virtual environment for animation	3	2	3	3	2	3
CO5	develop VR and AR applications	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Augmented Reality**	7
Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for AR, enhancing interactivity in AR environments, evaluating AR systems. ***Task:*** *Explore human anatomy using AR and VR.*		
II	**Introduction to Virtual Reality**	9
Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark. ***Task:*** *Developing architecture of Flight Simulation using Virtual Reality.*		
III	**Computer Graphics And Geometric Modelling**	8+6=14
Part A: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms. ***Task:*** *Perform 2D/3D based experiment using Virtual world space.*		
Part B: Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection. ***Task:*** *Perform a case study on collision detection.*		
IV	**Virtual Environment**	9
Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc.; Output: Visual/Auditory/Haptic Devices. Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems. ***Task:*** *Perform movement capture using virtual environment.*		
V	**Development Tools and Frameworks**	9
Human factors: Introduction, the eye, the ear, the somatic senses. Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML. ***Task:*** *Developing concept of Virtual class room with multiplayer.*		
Textbooks		
1. Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology, Wiley 2016. 2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.		
References		
1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.		

DISASTER MANAGEMENT
(Open Elective - I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-OEC-321	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO7	PO8	PO12
CO1	analyze impact of disasters	3	2	3	3
CO2	choose suitable disaster management mechanism	3	3	3	3
CO3	make use of appropriate measures for capacity building to reduce risks	2	2	3	2
CO4	develop strategies to cope up with disasters	3	3	3	3
CO5	build disaster management plan	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Understanding Disaster, Hazards and Vulnerabilities**	10
Understanding Disaster: Concept of Disaster - Different approaches - Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional). **Hazards and Vulnerabilities:** Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; Vulnerability and disaster risk. ***Task:*** *Identify various types of hazards in your area.*		
II	**Disaster Management Mechanism**	9
Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief. ***Task:*** *Prepare a hypothetical risk mitigation plan.*		
III	**Capacity Building**	5+5=10
Part-A: Concept - Structural and Nonstructural Measures Capacity Assessment. ***Task:*** *Prepare a capacity assessment of the disaster risk management system in your state.*		
Part-B: Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels. ***Task:*** *Prepare a case study on initiatives of NDRF and Legislative Support.*		
IV	**Coping with Disaster**	9
Coping Strategies; alternative adjustment processes – Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management. ***Task:*** *Prepare a case study on role of mass media in coping up with disaster.*		
V	**Planning for disaster management**	10
Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India Organizational structure for disaster management in India - Preparation of state and district, Disaster management plans. ***Task:*** *Prepare a case study on proactive and reactive disaster management plans.*		
Textbooks:		
1. Manual on Disaster Management, National Disaster Management, Agency Govt of India. 2. Disaster Management by Mrinalini Pandey Wiley 2014. 3. Disaster Science and Management by T. Bhattacharya, TMH, 2015		
References:		
1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BSP 2009. 2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)		

ROBOTICS
(Open Elective-I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-OEC-322	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO5	PO12
CO1	illustrate principles and functioning of the robot	3	2	2	2
CO2	perform kinematic analysis for end-effector positioning	3	3	3	2
CO3	integrate sensors for robot	3	3	3	2
CO4	design control laws for a robot	3	3	2	2
CO5	develop robot programming for various applications	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Robotics**	10
Types and components of a robot, Classification of robots, classification with respect to geometrical configuration (anatomy), closed-loop and open- loop control systems. Social issues and safety. ***Task:*** *Study components and anatomy of a real robot system.*		
II	**Robot Kinematics**	9
Kinematics systems, Definition of mechanisms and manipulators, Kinematic Modeling: Translation and Rotation Representation, Coordinate transformation, Homogeneous Coordinate representation, DH parameters. ***Task:*** *Forward kinematics and validate using sodhana software*		
III	**Sensors and Vision System**	5+5=10
Part-A: Sensors and Vision System: Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc. ***Task:*** *Positioning and orientation of robot arm.*		
Part-B: Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean / Similarity / Affine / Projective transformations Vision applications in robotics. ***Task:*** *Image Processing using open CV*		
IV	**Robot Control**	10
Basics of control: Transfer functions, Control laws: P, PD, PID. ***Task:*** *Control experiment using Robot arm for pick and place.*		
V	**Control Hardware and Interfacing**	9
Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications. ***Task:*** *Study the architecture of Robot via FLD.*		
Textbooks:		
1. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, New Delhi. 2. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill.		
References:		
1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, 2014. 2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.		

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
(Open Elective-I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-OEC-323	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	apply the fundamental concepts of measuring instruments	3	2	2
CO2	distinguish signal generators and signal analyzers	3	3	2
CO3	make use of oscilloscopes	3	2	2
CO4	identify various transducers	3	3	2
CO5	develop bridges for various measuring parameters	3	2	2

Syllabus

Unit	Title/Topics	Hours
I	**Block Schematics of Measurement**	10
Performance characteristics-static characteristics, dynamic characteristics; measuring instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC voltmeters and Current Meters, Ohmmeters, Multi-meters; meter protection; Extension of Range; True RMS Responding voltmeters; specifications of instruments. ***Task:*** *Study the effects of measuring instruments.*		
II	**Signal Analyzers**	9
AF, HF Wave Analyzers, Heterodyne wave Analyzers, Power Analyzers; capacitance-voltage Meters; oscillators; signal generators-sweep frequency generators: AF, RF, pulse and square wave, arbitrary waveform & function generators and Specifications. ***Task:*** *Design an Attenuator.*		
III	**Oscilloscopes**	5+5=10
Part-A: Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, CRO Probes. Applications-measurement of Time period and frequency specifications. ***Task:*** *Simulate Electronic Multi-meter.*		
Part-B: Special Purpose Oscilloscopes: introduction to dual trace, dual beam CROs, sampling oscilloscopes, storage oscilloscopes, digital storage CROs. ***Task:*** *Simulate DSO.*		
IV	**Transducers**	10
Classification of transducers; force and displacement transducers; resistance thermometers; hotwire anemometers; LVDT; thermocouples, Synchros, special resistance thermometers; digital temperature sensing system; Piezoelectric; variable capacitance transducers; magneto strictive transducers. ***Task:*** *Design DAC and ADC.*		
V	**Bridges**	9
Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge; measurement of physical parameters-flow, displacement, level, humidity, moisture, force, pressure, vacuum level, temperature measurements; data acquisition systems. ***Task:*** *Design Wheatstone Bridge Measurement.*		
Textbooks:		
1. Electronic Instrumentation: H.S.Kalsi-TMH 2nd Edition 2004. 2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D.Cooper: PHI 5th Edition, 2003.		
References:		
1. Electronic Instrumentation and Measurements- David A. Bell, Oxford Univ. Press, 1997. 2. Electronic Measurements and Instrumentation K. Lal Kishore, Pearson Education 2010.		

JAVA PROGRAMMING
(Open Elective-I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-OEC-324	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO12
CO1	write simple java programs using OOP concepts	3	2	2	3	2
CO2	develop programs using inheritance and polymorphism	3	2	3	3	2
CO3	create packages and interfaces	3	2	3	3	2
CO4	build efficient code using multithreading and exception handling	3	2	3	3	2
CO5	design real-time applications using applets	3	2	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Java Basics**	10
History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, OOP concepts, concepts of classes, objects, constructors, methods, this keyword, parameter passing, recursion. ***Task:*** *Write a Java program that creates a user interface to perform integer divisions.*		
II	**Inheritance and Polymorphism**	9
Types of inheritance, member access rules, super uses, using final with inheritance, the object class and its methods, method overloading and overriding, dynamic binding, abstract classes and methods. ***Task:*** *Write a Java program to implement overloading and overriding.*		
III	**Packages, Inner classes and Interfaces**	5+5=10
Part-A: Packages and Inner classes: Defining, creating and accessing a package, CLASSPATH, importing packages, inner classes – local, anonymous and static. ***Task:*** *Write a Java program to demonstrate the package.*		
Part-B: Interfaces: Defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces, differences between classes and interfaces. ***Task:*** *Write a Java program to implement interfaces.*		
IV	**Exception handling and Multithreading**	9
Exception handling: Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. **Multithreading:** Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication. ***Task:*** *Write a Java program that implements a multi-thread application that has three threads.*		
V	**Applets**	10
Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. ***Task:*** *Develop an applet in Java that displays a simple message.*		
Textbooks:		
1. Java the complete reference, 8th Edition, Herbert Schildt, TMH.		
References:		
1. Java How to Program, H. M. Dietel and P. J. Dietel, 6th Edition, Pearson Education, PHI. 2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.		

IOT WITH CLOUD COMPUTING LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PC-324	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	identify various IoT devices	3	3	3
CO2	use IoT devices in various applications	3	3	3
CO3	develop automation work-flow in IoT enabled cloud environment	3	3	3
CO4	take part in practicing and monitoring remotely	3	3	3
CO5	make use of various IoT protocols in cloud	3	3	3

List of Experiments

Week	Title/Experiment
1	Install necessary software for Arduino and Raspberry Pi.
2	Familiarization with Arduino and Raspberry Pi board.
3	Write a program to transfer sensor data to a smart phone using Bluetooth on Arduino.
4	Write a program to implement RFID using Arduino.
5	Write a Program to monitor temperature and humidity using Arduino and Raspberry Pi.
6	Write a Program to interface IR sensors with Arduino using IoT Cloud Application.
7	Write a Program to upload temperature and humidity data to the cloud using an Arduino or Raspberry Pi.
8	Write a program to retrieve temperature and humidity data from cloud using Arduino and Raspberry Pi.
9	Write a program to create TCP server on cloud using Arduino and respond with humidity data to TCP client when requested.
10	Write a program to create UDP server on cloud using Arduino and respond with humidity data to UDP client when requested.

References

1. IoT with Cloud Computing Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Air Pollution Meter.
2. Smart Garbage Collector.
3. Weather monitoring system.
4. Baggage Tracker.
5. Circuit Breakage Detection.
6. Anti-Theft Flooring System.
7. IoT Based Smart Street Light.
8. IoT based Gas Leakage Monitoring system.
9. IoT Based Smart Irrigation System.
10. IoT Based Water Level Monitoring System.

MACHINE LEARNING AND DATA SCIENCE LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PC-325	-	-	2	1

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	illustrate the implementation procedures for the ML algorithms	3	3	3
CO2	demonstrate the ID3 classification algorithms	3	3	3
CO3	analyze k-Means clustering on different datasets	3	3	3
CO4	apply predictive algorithms on live data	3	3	3
CO5	identify the regression algorithms to solve real world problems	3	3	3

List of Experiments

(Minimum **10** experiments to be conducted**)**

Week	Title/Experiment
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
4	Apply EM algorithms to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
5	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
6	Implementing Back propagation algorithm and test the same using appropriate data sets.
7	Write a program to do sentiment analysis of live tweets.
8	Write a program to predict the eligibility of a customer for loan disbursement.
9	Write a program to predict the quality of water.
10	Write a program to predict the winning team in IPL matches.

References

1. Machine Learning and Data Science Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Diagnose crop disease with Machine Learning.
2. Recurrence of prostate cancer using Machine learning for survival analysis.
3. Develop a system to find out duplicate data.
4. Develop a system to analyze buying behavior of a customer.
5. Develop a system to study sentiment of users on twitter.
6. Develop a predictive model to study the employee satisfaction in an organization.
7. Develop a predictive model to study the rainfall of your society.
8. Develop a predictive model to study Fake News on Facebook.
9. Analyze election data.
10. Do linear regression on housing prices and do a forecasting model of how much house prices would increase.

FULL STACK WEB DEVELOPMENT LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PC-326	-	-	3	1.5

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	illustrate implementation procedure of full stack web development	3	3	3
CO2	demonstrate HTML5, CSS5 scripting languages and Github	3	3	3
CO3	make use of scripting languages in web development	3	3	3
CO4	develop web applications using AJAX	3	3	3
CO5	build real time applications using full stack web development	3	3	3

List of Experiments

Week	Title/Experiment
1	Write code in HTML5 to develop simple webpage.
2	Write CSS & HTML5 Code to show Dropdown Menu.
3	Design Single Page Application with different menu items.
4	Write a program in CSS to show your city with building and moving cars.
5	Write a program to validate web form using javascript.
6	Write jquery code to show website slider.
7	Write a program in javascript to create a user login system.
8	Write a program in javascript to create a user registration system.
9	Write a program to display user details using HTML, CSS & AJAX.
10	Demonstrate version control in Git and Github.

References

1. Full Stack Web Development Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Develop Project MyNote - A HTML5 App
2. Develop a Bookstore application by using HTML5, CSS, jquery in Github
3. Develop a shopping cart application by using HTML5, CSS, jquery in Github
4. Develop an e-learning system using HTML5, CSS, jquery in Github
5. Build a personal portfolio webpage using HTML5, CSS, jquery.
6. Develop google.com Search result page using HTML5, CSS, jquery & Ajax
7. Develop a webpage to display solar system using HTML5, CSS, jquery & Ajax
8. Build Tajmahal using CSS.
9. Build a Real-Time Markdown Editor with Node.js
10. Develop an User model covering, Registration, Email verification(send an email), Login (with remember me)

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-HSMC-301	1	-	2	2

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO5	PO10
CO1	assess and utilize vocabulary in an effective way	3	3
CO2	interpret interpersonal relationships	3	3
CO3	elaborate academic reading and writing skills	3	3
CO4	formulate appropriate communication techniques in various contexts	3	3
CO5	adapt to different work-place and socio-cultural scenarios	3	3

List of Experiments

Week	Title/Experiment
1	Self-Introduction, Role Play, Simple Exercises on Personality Development, Vocabulary Test.
2	Non-verbal Communication & Personality-Development – self assessment- attitude – self-esteem.
3	Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms, Phrases, Collocations, Technical vocabulary.
4	Reading Skills - General Vs Local Comprehension - reading for facts& details - understanding pictures, figures and graphs - guessing meaning from context - Skimming, Scanning, Inferring Meaning.
5	Unseen passages on various topics for Reading Comprehension.
6	Different types of Writing - Formal Letter Writing - Cover Letter - Resume - Email - Memos - SOP.
7	Technical Reports, Research Proposals, Thesis Writing (abstract, synopsis, thesis statement, conclusion, etc.) - Editing - understanding Plagiarism and its Tools.
8	Presentations - styles (oral and written) - tools - Inforgraphics - cross-cultural communication.
9	Oral presentations (Audience-centered, JAMs, Seminars, etc.) Written presentations (Posters, PPTs, Pictures, etc.)
10	Dynamics of Group Discussion - organization of ideas - rubrics of evaluation.
11	GD sessions for practice.
12	Interview Skills – Do's & Don'ts pre, during & post interview techniques – research about job profile and Mock Interviews.

References

1. Advanced English Communication Skills Lab Manual, FED, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Role Play / Debate
2. Office Communication
3. Presentation Skills
4. Public Speaking
5. Interview Skills
6. Telephone Skills
7. Article Writing
8. Workplace etiquette
9. Video Resume / resume writing
10. Group Discussion

HUMAN VALUES AND PROFESSIONAL ETHICS
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-MC-302	2	-	-	-

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO6	PO7	PO8	PO12
CO1	identify values and ethics and its relation to individual excellence	3	3	3	2
CO2	outline the ten commandments and try to apply in professional career	2	2	3	2
CO3	illustrate modern percepts of ethics, CSR and Corporate Governance	3	3	3	2
CO4	analyze the purpose of professional code of ethics and whistle blowing	3	3	3	2
CO5	practice student professional/technical societies/associations activities	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Human Values**	7
Concept of Human Values - Ethics & types – Morality – Beliefs - Professional and Engineering Ethics -Ethics in Corporate Sector - Bearing of Human Values on Ethics, Morals, integrity, Equity, Caring, Sharing, Honesty, Cooperation, Commitment, Empathy, Modesty, Self-Confidence, Self-Reliance, Character, and Spirituality - Role of Yoga and meditation towards human excellence.		
II	**Concept of Virtues, Character, and Fundamental Rights**	6
List & Theories of Virtues-Values & Virtues - Moral Unity and Integrity - Honesty - Eight Ways of Misusing the Truth - Civic Virtues - Courage - Generosity in Character - Fundamental Rights.		
III	**Senses of Responsibility and Engineering Ethics**	3+3=9
Part-A: Concept of Responsibility: Spirituality, Religion, Super naturality, and Faith - The Golden Rule in Religious Ethics. Corporate Governance and Corporate Social Responsibility.		
Part-B: Concept of Engineering Ethics: Ethics in Hindu Mythology - Dharma - Development of Modern Precepts of Ethics.		
IV	**Codes of Conduct**	6
Purpose of Professional Ethical Codes and Limitations -Internal Conflicts - Professional Societies and Codes of Ethics - Corporate Codes of Ethics- Moral Issues - International Moral Code - Confidentiality – Whistle blowing, the Seven Social Sins.		
V	**Role of Professional/Technical Society/Association**	7
Attributes of a Profession - Professional Engineer & Respective Professional Associations & Technical Societies (ISTE, FIE, CSI, ACT, IETE, IEEE, SAE, ACE, Etc.) - Characteristics of a Professional. Student Professional/Technical Society Activity through institutional student chapter.		
Textbooks:		
1. D R Kiran, Professional Ethics and Human Values, MGH Publishers,		
References:		
1. R.S. Naagaraazan, Human Values & Professional Ethics, NAIP 2. Subramanian R., Professional ethics, Oxford University press		

B.TECH.-VII-SEMESTER SYLLABUS

BUSINESS ECONOMICS

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-HSMC-411	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO11	PO12
CO1	outline the concepts of business management & economics	3	2
CO2	identify demand function to predict sales using linear regression	3	2
CO3	adapt production, price, market and cost analysis functions	3	2
CO4	estimate enterprise requirements under risky economic environment	2	3
CO5	assess the operational and financial performance of an enterprise	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Fundamentals of Business Management & Economics and Demand Analysis**	10
Concept of Management, Functions, Scope and Levels of management, Concept of Business/Managerial Economics, nature, characteristics and Scope, Law of Consumption, Demand and Supply. ***Task:*** *Derive a function for Law of Consumption, demand and supply using MS-Excel.*		
II	**Demand Analysis**	10
Factors influencing Demand and Types of Demand, Types of Demand Elasticity, Methods of Demand Forecasting. ***Task:*** *Fit a trend line for sales using MS-Excel.*		
III	**Production, Price, Markets & Cost Analysis**	4+4=8
Part A: Production Analysis: Types of Production functions, Economies of Scale, Pricing objectives & methods. ***Task:*** *Derive production function using MS-Excel.*		
Part-B: Cost Analysis: Price - Output decisions under perfect and monopoly competitions, Types Costs, CVP Analysis, Computation of BEP and its applications. ***Task:*** *Find BEP for a desired profit using MS-Excel.*		
IV	**Investment Analysis & Indian Economic Environment**	10
Types of Capital Requirements, factors influencing working capital, Techniques of Capital Budgeting, Comments on Union Budgets and Flow of Credit, Steps in IPOs & trading of shares. ***Task:*** *Determine IRR for a capital budgeting project using standard notations through MS-Excel.*		
V	**Financial Statement Analysis and Type of Undertakings**	10
Types, Uses and Limitations of various ratios, Features of Sole-Trader, Partnership, Joint Stock Companies and PSUs. ***Task:*** *Forecast overall performance for a decade with ratios using MS-Excel.*		
References:		
1. Managerial Economics& Financial Analysis A.R. Aryasri. Tata McGraw Hill. 2. Financial Institutions and Markets, LM Bhole, Kindle Edition. 3. Managerial Economics, RL Varshney & KL Maheshwari, Sultan Chand & Sons. 4. Industrial Engineering and Management, O. P. Khanna, Dhanpat Rai & Sons.		

GO PROGRAMMING

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CS-PC-411	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PSO1
CO1	illustrate the concepts of Go programming	2	3	2	3	3
CO2	demonstrate the variables of Go programming	2	2	2	3	3
CO3	outline functions and packages of Go programming	3	3	3	2	2
CO4	interpret servers of Go programming	3	3	3	3	3
CO5	make use of servers and concurrency in Go programming	3	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	11
Getting started, Machine Setup - Text Editors, The Terminal, Environment, Go, Your First Program, How to Read a Go Program, Numbers - Integers, Floating-Point Numbers, Example - Strings, Booleans.		
II	**Variables**	10
How to Name a Variable, Scope, Constants, Defining Multiple Variables, Control Structures - The for Statement, the if Statement, the switch Statement, Arrays, Slices, and Maps, Arrays, Slices - append, copy, Maps.		
III	**Functions and Packages**	3+8=11
Part-A: Functions, Variadic Functions, Closure, Recursion, Defer, panic, and recover, Pointers - The * and & operators, new, Structs and Interfaces.		
Part-B: Structs - Initialization, Fields, Methods - Embedded Types.		
IV	**Servers**	8
Packages, The Core Packages - Strings, Input/Output, Files and Folders, Errors, Containers and Sort, Hashes and Cryptography, Servers - TCP, HTTP–RPC.		
V	**Servers and Concurrency**	8
Parsing Command-Line Arguments, Creating Packages, Testing, Concurrency, Goroutines, Channels - Channel Direction, Select, Buffered Channels.		
Textbooks:		
1. The Go Programming Language - Alan A. A. Donovan, Brian W. Kernighan Released October 2015, Addison-Wesley Professional, ISBN: 9780134190570. 2. Go in Action - William Kennedy with Brian Ketelsen and Erik St. Martin Foreword by Steve Francia November 2015, ISBN: 9781617291784.		
References:		
1. Mastering Go: Create Golang Production Applications using Network Libraries, Concurrency, and Advanced Go Data Structures, Mihalis Tsoukalos, Packt Publisher, 2019.		

DATA VISUALIZATION TECHNIQUES
(Professional Elective - III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CD-PE-411	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	outline the concepts of data visualization	2	3	2	3	3	3
CO2	illustrate time series analysis and mapping	3	3	2	3	3	3
CO3	make use of data processing techniques	3	3	3	3	3	3
CO4	adapt data acquiring tools for processing	3	3	3	3	3	3
CO5	implement data parsing tools and techniques	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	7
Seven Stages, Planning, Iteration and Combination, Principles, Getting Started with Processing, Sketching with Processing, Exporting and Distributing, Functions, Sketching and Scripting. ***Task:*** *Create a workbook for data processing.*		
II	**Mapping and Time Series**	10
Locations, Data, Using Your Own Data, Next Steps, Milk, Tea, and, Cleaning the Table, A Simple Plot, Labelling the Current Data Set, Drawing Axis Labels, Choosing a Proper Representation, Using Rollovers to Highlight Points (Interact), Ways to Connect Points, Text Labels As Tabbed Panes, Interpolation Between Data Sets. ***Task:*** *Create different Bar plots for variables in any dataset.*		
III	**Data Processing and Scatterplot Mapping**	7+7=14
Part-A: Connections and Correlations: Changing Data Sources, Problem Statement, Pre-processing, Using the Pre-processed Data, Displaying the Results, Returning to the Sophisticated Sorting: Using Salary As a Tiebreaker, Moving to Multiple Days, Smoothing Out the Interaction, Deployment Considerations. ***Task:*** *Create Bivariate and Multivariate charts.*		
Part-B: Scatterplot Maps: Pre-processing, Loading the Data, Drawing a Scatterplot of Zip Codes, Highlighting Points While Typing, Show the Currently Selected Point, Progressively Dimming and Brightening Points, Zooming In. ***Task:*** *Build a Scatterplot for any dataset.*		
IV	**Data Acquiring**	9
Tools for Acquiring Data, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Using open Stream as a Bridge to Java, Dealing with Byte Arrays, Dealing with a Large Number of Files. ***Task:*** *Implement data acquiring using various file techniques.*		
V	**Data Parsing**	8
Levels of Effort, Tools for Gathering Clues, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work. ***Task:*** *Perform data parsing on Markup languages.*		
Textbooks:		
1. Scott Murray, "Interactive Data Visualization for the Web - An Introduction to Designing with D3" Oreilly, 2013. 2. Ben Fry, "Visualizing Data - Exploring and Explaining Data with the Processing Environment", Oreilly, 2008.		
References:		
1. Edward Tufte "The Visual Display of Quantitative Information" 2001. 2. Colin Ware, "Visual Thinking for Design", Morgan Kaufman Series, 2008.		

ROBOTIC PROCESS AUTOMATION
(Professional Elective – III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CD-PE-412	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	outline the basics of RPA	3	3	2	3	3	3
CO2	implement RPA	3	3	3	3	3	3
CO3	demonstrate RPA tools and automation techniques	2	2	2	3	3	3
CO4	adapt RPA BOT Models	3	3	3	3	3	3
CO5	execute Orchestrator	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Automation & Robotic Process Automation**	9
Automation and History - RPA vs Automation - Business Processes & Use Cases- Scope & Limitations of RPA with Real world Industry use cases-Various Types of RPA Implementation Methodologies – RPA Centre of Excellence - Standardization of processes – Automation Life Cycle - Difference from SDLC - Robotic control flow architecture. ***Task:*** *Draw Robotic control flow architecture.*		
II	**RPA Initiation & Implementation**	10
Initiation of RPA- Limitations & factors affecting in Implementing the RPA at the enterprise level - Environments setup for RPA Implementation- Infra types to implement the RPA – Automation Life Cycle in detail- RPA Feasibility Analysis- Process Design Document/Solution Design Document - Industries best suited for RPA Implementation - Risks & Challenges with RPA - RPA and an emerging ecosystem- Leaders in RPA - Future of RPA. ***Task:*** *Perform feasibility analysis for RPA.*		
III	**RPA Tools and Automation**	5+5=10
Part-A: Introduction to RPA Tool Uipath & Basics The User Interface - Variables - Managing Variables - Selectors- Type of Selectors- Customizing the Selectors-RPA Project Maintenance –Arguments-Managing Arguments - Control Flow Activities & Importance - Data Manipulation- Data Manipulation Introduction - Scalar variables, collections and Tables - Data Manipulation - Gathering and Assembling Data. ***Task:*** *Perform a case study on Uipath tools.*		
Part-B: Advanced Automation concepts & Techniques: Recorders in Uipath - Input/Output Method-Debugging - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Keyboard based automation -Advanced Citrix Automation challenges –PDF Automation- App Integration & Excel Automation- Email Automation & Database Automation. ***Task:*** *Create and integrate PDF and Excel for Email Automation.*		
IV	**RPA BOT Models -Exception Handling**	9
RPA BOT Models: Attended Vs Unattended Bots- Monitor Events Triggers for Attended Automation. **Exception Handling:** Debugging and Exception Handling - Debugging Tools & best practices. **Deploying and Maintaining the BOT:** Publishing the Automation solution using publish utility - Creating a provision Robot from the Server - Connecting a Robot to Server – Deploy the robot to Server. ***Task:*** *Prepare a white paper on RPA BOT models.*		
V	**Orchestrator**	10
UiPath Orchestrator Introduction-Robots Configuration and Management-Connecting Robots to Orchestrator-Environment Configuration & Management -Managing Packages-Managing Processes-Managing Assets in Orchestrator and Studio -Managing Schedules & triggers -Managing Logs in Orchestrator- Practical use case scenarios. ***Task:*** *Perform a case study on Orchestrator.*		

Textbooks

1. Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant - Tom Taulli.
2. Becoming Strategic with Robotic Process Automation, L.P. Willcocks, J.Hindle, M.C. Lacity.
3. Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere - by Nandan Mullakara.
4. Learning Robotic Process Automation by Alok Mani Tripathi, Packt Publishing, 2018.

WEB AND SOCIAL MEDIA ANALYTICS
(Professional Elective – III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CD-PE-413	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO8	PO12	PSO1
CO1	illustrate the basics of web and social media data	3	2	2	3	3	3
CO2	explain the value of online data	3	3	2	3	3	3
CO3	adapt collaboration in data and business	3	3	3	3	3	3
CO4	make use of business data for prediction	3	3	3	3	3	3
CO5	outline the importance of system and data	3	3	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	7
Introduction to Social Network Data Analytics and WWW, Analytics in the Enterprise - Put employees first, Pilot, Experiment, Learn, Alstom's pillars of collaboration, Governance, How to measure success, Success is more than metrics. ***Task:*** *Perform data analytics on Facebook ad promotion platform.*		
II	**Social Business Intelligence and Valuable Data**	10
Social analytics and business intelligence integration, Four Steps - Creating and engaging social media presence, Tie social media to business goals, Decide on collaboration, Examine analytics for insights, Understanding social data types, Location/geographic data, Rich media data. ***Task:*** *Perform analysis on location and geographic data.*		
III	**Data, Business Intelligence and Collaboration**	7+8=15
Part-A: Accessing the online Data: Abstract, Acquire, Refine, Classify, Categorize, Discovery, Metricize, Challenges in data quality, Delivering the infrastructure, Delivering web access to data, How does the enterprise use this data, Social Platforms. ***Task:*** *Perform sorting, split, compute and select from any dataset.*		
Part-B: Social Business Intelligence and Collaboration: Increasing customer focus and transforming to customer-driven enterprise, An integrated approach, Enabling a better cross-sell and up-sell opportunity, Business benefits, Social media and software, Social intelligence, Solution architecture. ***Task:*** *Analyze privacy issues in Social Platforms.*		
IV	**Customer Care and Predictions**	8
New Voice of the Customer, Customer Care 2.0, Dos and Don'ts, Social Customer Care the New Commodity, Automation and Business Intelligence, Predicting the Future, Prediction of Learning, Predicting Elections, Predicting Box Offices, Predicting the Stock Market, Closing Predictions. ***Task:*** *Perform the prediction of stock market using Money control.*		
V	**Gaming the System, Right Data and Measurement**	8
Spam and Robots, Creating Reach, How to Spot Bots, Smearing Opponents, Creating Influence and Intention, Spreading Paid Opinions: Grassroots and Astroturfing, Contagiousness. ***Task:*** *Write a program for Spambot.*		
Textbooks		
1. Krish Krishnan Shawn Rogers, 'Social Data Analytics', 1st Edition, Elsevier, 2014. 2. Lutz Finger, Soumitra Dutta, "Ask, Measure, LearnUsing Social Media Analytics to Understand and Influence Customer Behavior", O'reilly, 2014		
References		
1. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN: 10:1449367615.		

DATA OPTIMIZATION TECHNIQUES
(Professional Elective - IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CD-PE-414	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	explain the concepts of optimization techniques	3	3	2	3	3	3
CO2	illustrate algorithms and complexity	3	3	2	3	3	3
CO3	demonstrate optimization techniques and algorithms	3	3	3	3	3	3
CO4	adapt optimization techniques approximation methods	3	3	3	3	3	3
CO5	make use of linear programming and evolutionary algorithms	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	11
Mathematical foundations - Functions, Continuity, Upper and lower bounds, Review of calculus - Differentiation, Taylor expansions, Partial derivatives, Lipschitz, Continuity, Integration, Vectors 16 - Vector algebra, Norms, 2D norms 19, Matrix algebra - Matrices, Determinant, Rank of a matrix, Frobenius norm, Eigen values and eigenvectors - Definiteness, Quadratic form, Optimization and optimality - Minimum and Maximum. ***Task:*** *Write a program to find rank of the matrix.*		
II	**Algorithms and Complexity**	6
Algorithm, Order notations, Convergence rate, Computational complexity - Time and Space Complexity - Class P 43, Class NP 44, NP-Completeness. ***Task:*** *Write a program on time complexity.*		
III	**Optimization Techniques and Algorithms**	7+6=13
Part-A: Regression Analysis: Unconstrained optimization - Univariate functions, Multivariate functions, Gradient-based methods - Newton's method, Convergence analysis, Steepest descent method, Line search, Conjugate gradient method, Stochastic gradient descent. ***Task:*** *Write a program on Stochastic gradient descent.*		
Part-B: Constrained Optimization: Mathematical Formulation, Lagrange Multipliers, Slack Variables, Generalized Reduced Gradient Method, KKT Conditions, Penalty Method. ***Task:*** *Write a program on Lagrange Multipliers.*		
IV	**Optimization Techniques: Approximation Methods**	12
BFGS method, Trust-region method, Sequential quadratic programming - Quadratic programming, SQP Procedure, Convex Optimization, Equality Constrained Optimization, Barrier Functions, Interior-Point Methods, Stochastic and Robust Optimization. ***Task:*** *Perform a case study on any optimization techniques.*		
V	**Linear Programming and Evolutionary Algorithms**	6
Introduction, Simplex method - Slack variables, Standard formulation, Duality, Augmented Form, Worked Example by Simplex Method, Interior-Point Method for LP, Evolutionary Computation - Basic Procedure, Choice of Parameters, Simulated Annealing, Differential Evolution. ***Task:*** *Write a program on Simplex Method.*		
Textbooks:		
1. Xin-She Yang, "Optimization Techniques and Applications with Examples", Wiley, 2018 2. Andrew Kelleher, "Machine Learning in Production: Developing and Optimizing Data Science Workflows and Applications", Addison Wesley, 2018		
References:		
1. Suvrit Sra et.al., Optimization for Machine Learning", MIT Press, 2011.		

QUANTUM COMPUTING
(Professional Elective – IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CD-PE-415	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO7	PO12	PSO1
CO1	explain the concepts of quantum computing	3	2	2	2	2	3
CO2	use mathematical foundations for quantum computing	3	3	3	2	2	3
CO3	outline the architecture and programming models	3	2	2	2	3	3
CO4	utilize basic techniques of quantum computing	3	3	3	3	2	3
CO5	elaborate major algorithms and discuss about OSS toolkits	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Quantum Computing**	6
Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing, Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement. ***Task:*** *Detect data leakage in cloud.*		
II	**Mathematical Foundations**	10
Math Foundation for Quantum Computing, Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors. ***Task:*** *Protect data leakage in cloud.*		
III	**Building Blocks**	8+5=13
Part-A: Architecture & Information Representation: Architecture of Quantum Computing platform, Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates, Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc. ***Task:*** *Implement identity and access management on Zoom.*		
Part-B: Programming Model for Quantum Computing: Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits. ***Task:*** *Perform case study on Digilocker.*		
IV	**Basic Techniques**	5
Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks. ***Task:*** *Perform comparative analysis of SecaaS platforms.*		
V	**Major Algorithms & OSS Toolkits**	14
Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch -Jozsa Algorithm, IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM). ***Task:*** *Perform comparative analysis of mobile cloud platforms - Dropbox and OneDrive.*		
Textbooks		
1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press. 2. David McMahon, "Quantum Computing Explained", Wiley.		
References		
1. Phillip Kaye Raymond Laflamme Michele Mosca, An Introduction to Quantum Computing, Oxford University Press.		

SOFTWARE PROCESS & PROJECT MANAGEMENT
(Professional Elective - IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CD-PE-416	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO8	PO12	PSO1
CO1	explain the concepts of Software process improvement	3	3	2	3	3	3
CO2	illustrate assessment phases and principles	3	3	3	3	3	3
CO3	adapt and establish software configuration management	2	2	2	3	3	3
CO4	use lifecycle phases in project maintenance	3	3	3	3	3	3
CO5	establish iterative process planning & automation	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Introduction – A Software maturity framework – Software process improvement, process maturity levels, People in the optimization process, the need of the optimizing process, The principles of software process change, Process in perspective, Six basic principles, Misconceptions, Strategy for implementing software process change. ***Task:*** *Perform a case study on a software maturity framework.*		
II	**Software process assessment**	8
Assessment overview, Assessment phases, five assessment principles, the assessment process, Assessment conduct, Implementation considerations, The initial process – The nature of the initial process, Software process entropy, The way out, Managing software organizations – Commitment discipline, The management system, Establishing a project management system. ***Task:*** *Perform a case study of a chaotic project.*		
III	**Repeatable & Define process**	8+8=16
Part-A: Managing Software Organizations and Project plan: Commitment discipline, Management system, establishing a project management system, The project plan, Principles, Contents, Size measures, Estimating, Productivity factors, Scheduling, Tracking. Development plan, Planning models, Final considerations. ***Task:*** *Perform a case study on project management system.*		
Part-B: Software configuration management: The need of configuration management, Software product nomenclature, basic configuration management functions, Baselines, Configuration management responsibilities, The need of automated tools. ***Task:*** *Make a list of Basic configuration management functions.*		
IV	**Life Cycle Phases and Artifacts**	8
Engineering and production stages, Inception phase, Elaboration phase, Construction phase, Transition phase, The artifacts sets – The management sets, The engineering sets, Artifact evolution over the life cycle, Test artifacts, artifacts – Management, Engineering, Pragmatic. ***Task:*** *Make a stat chart diagram on the life cycle phases of software development.*		
V	**Iterative Process Planning & Automation**	8
Work breakdown structures – Conventional WBS issues, Evolutionary work breakdown structures, Planning guidelines, The cost and schedule estimating process, The iteration planning process, Pragmatic planning, Tools: Automation building blocks, The project environment. ***Task:*** *Perform a case study on factors influencing project environment.*		
Textbooks		
1. Managing the Software Process, Watts S. Humphrey, Pearson Education, 2002. 2. Software Project Management, Walker Royce, Pearson Education, 1998.		
References		
1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000.		

GREEN BUILDING TECHNOLOGIES
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-OEC-411	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO7	PO12
CO1	explain the fundamentals of energy use and processes in building	3	2	2	2
CO2	identify indoor environmental requirement and its management	3	3	3	2
CO3	assess the impact of solar radiation on buildings	3	3	3	2
CO4	evaluate end-use energy utilization and requirements	3	3	2	2
CO5	adapt audit procedures for energy management	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications. ***Task:*** *Analyze the characteristics of energy use and its management of dwellings.*		
II	**Indoor environmental requirement and management**	9
Thermal comfort - Ventilation and air quality - Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement. ***Task:*** *Perform a case study on ventilation illumination and air quality in a building.*		
III	**Climate, solar radiation and their influences**	5+5=10
Part A: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation. ***Task:*** *Conduct a case study on climate changes.*		
Part B: Temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings. ***Task:*** *Conduct a case study on solar radiation.*		
IV	**End-use, energy utilization and requirements**	10
Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope. ***Task:*** *Perform a case study on energy utilization in a building.*		
V	**Energy management options**	9
Energy audit and energy targeting - Technological options for energy management. ***Task:*** *Perform a case study on energy management.*		
Textbooks:		
1. Michael Bauer, Peter Mosle and Michael Schwarz, Green Building, Guidebook for Sustainable Architecture, Springer, Heidelberg, Germany. 2. Norbert Lechner, Heating, Cooling, Lighting - Sustainable Design Methods for Architects‖, Wiley, New York.		
References:		
1. James Kachadorian, The Passive Solar House: Using Solar Design to Heat and Cool Your Home‖, Chelsea Green Publishing Co., USA.		

DRONES
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-OEC-412	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO7	PO12
CO1	explain concepts of creative industries	3	3	3	3	3	3
CO2	outline the needs of creative industries	3	3	3	3	3	3
CO3	illustrate deployment and deadly abilities of drones	3	3	3	3	3	3
CO4	adapt price based data routing in dynamic IoT	3	3	3	3	3	3
CO5	make use of security in UAV/Drone communications	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
The creative industries: Concepts, Measurement, economic impact of the creative industries: Scenarios and theoretical models - Scenarios, Theoretical models, Measuring the economic impact of the creative industries - Direct impact of the creative industries. ***Task:*** *Implementation methods for photography in creative industries.*		
II	**Creative Industries' Needs: A Latent Demand**	8
Introduction, creative industries and film, emerging technologies - creative industries, importance of emerging technologies for creative industries, challenges. ***Task:*** *Comply on VR, AR and Drones together for Creative industries.*		
III	**Deployment and Deadly Abilities**	7+7=14
Part-A: The Deployment of Drones: The private invasion, The media invasion, The agricultural invasion, The commercial invasion, The medical invasion, The transportation invasion, The communication invasion, The controlled invasion. ***Task:*** *Develop design thinking method for drone application in agriculture fields.*		
Part-B: The Deadly Abilities of Drones: Drones in the police force, Drones in the military force, Drones in the animal world, Drones in the insect world. ***Task:*** *Recognize Do's and Don'ts of drone flying*		
IV	**Price Based Data Routing in Dynamic IoT**	8
Introduction, Background, IoT system model – IoT model, IoT node – Residual energy and power model, Load and buffer space, Delay, Trust, Pricing model, Communication model, Adaptive routing approach, Use case and theoretical analysis. ***Task:*** *Design an IoT model for any Drone application.*		
V	**Security in UAV/Drone Communications**	9
Introduction - PLS for UAV Systems - UAV as a mobile relay (UAV Relay), UAV as a mobile transmitter BS (UAV-BS), UAV as mobile jammer (UAV-Jammer), UAV as a flying UE (UAV-UE), One UAV as a cooperative jammer and another as a transmitter, Additional common attacks in UAV Systems - Attacker classification, Attack-type classification. ***Task:*** *Jamming of UAV remote control systems using software defined radio.*		
Textbooks:		
1. Virginia Santamarina-Campos et.al., "Drones and the Creative Industry Innovative Strategies for European SMEs", Springer, 2018 2. Fadi Al-Turjman, "Drones in IoT-enabled Spaces", CRC Press, 2019 3. Billy Crone, "Drones, Artificial Intelligence, & the Coming Human Annihilation", Get A Life Ministries, 2018.		
References:		
1. Ryan Nagelhout, "The Modern Nerd's Guide to Drone Racing", Gareth Stevens, 2018.		

5G TECHNOLOGIES
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-OEC-413	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO7	PO12	PSO1
CO1	explain basic principles of 5G communication	3	3	2	2	3	3	3
CO2	identify the 5G new radio, core network, mobile networks	3	3	2	2	3	3	3
CO3	analyze the physical architecture of 5G and its challenges	3	3	2	2	3	3	3
CO4	design the modulation and multiple access technique for 5G	3	3	2	2	3	3	3
CO5	evaluate the various channels, layers and links used in 5G	3	3	2	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to 5G Wireless Communications**	9
Introduction, Usage Scenario, Specifications and Use Cases, Performance - Speed, Latency, Standards, NR, Spectrum, Unlicensed Spectrum, Technology, Concerns, Interference Issues, Surveillance Concerns, Health Concerns. ***Task:*** *Write a program on SSBSC Modulation and Demodulation using SDR.*		
II	**5G Wireless Networks**	10
Cellular Systems Overview, Basics of New Radio (NR), Next Generation Core Network, Mobile Network Technologies, Network Softwarization and Slicing, Cell Clustering, Physical Infrastructure Improvements, Enabling Technologies, Multi-Tenancy Support. ***Task:*** *Write a program on Sampling and Quantization.*		
III	**Wireless Systems, Standards and architecture for 5G**	5+7=12
Part-A: Systems and Standards: Technology, Challenges, Requirement, High Speed, High Capacity, Massive Connected Devices, Ultra-low Latency and Ultra-High Reliability, Energy Saving, Cost Saving, Radio Technology, Utilization of High Frequency Bands, Massive Element Antenna Technologies. ***Task:*** *Write a program on Digital Quadrative Amplitude Modulation and Demodulation.*		
Part-B: Architecture, Generalized Physical Architecture, Radio Access Network, Evolved Packet Core, IP Multimedia Subsystem, Architecture of 5G, Security Architecture. ***Task:*** *Write a program on Bit Error Rate measurement of DQAM.*		
IV	**Modulation and Multiple Access Techniques for 5G**	8
Multiple Access Schemes, Basic Concept of OFDM, The Principles of OFDM, OFDM Technology, Requirements, Cyclic Prefix OFDM, Multipath Signal Transmission, CP Design in 5G NR, DFT-s-OFDM, DFT-S-OFDM and OFDMA, Modulation Considerations. ***Task:*** *Write a program on OFDM Transmitter and Receiver.*		
V	**Channels for 5G Wireless Communications**	9
Logical Channels for NR, Transport Channel, Logical, Transport and Physical Channel Mapping, Propagation Channel Model, Channel Models, Channel Hierarchy, Communications System Channel Mapping, NR Physical Layer Data Channels. ***Task:*** *Write a program on Bit Error Rate Measurement of M-ARYPSK.*		
Textbooks		
1. Fundamentals of 5G Wireless Communications: V. K. Sachan, Jay Devi Sachan, MPH. 2. Index Modulation for 5G Wireless Communications: Miaowen Wen, Xiang Cheng, Springer.		
References		
1. 5G Mobile and Wireless Communications Technology: AFIF OSSEIRAN Ericsson JOSE F. MONSERRAT, and PATRICK MARSCH, Cambridge University Press.		

DATABASE MANAGEMENT SYSTEMS
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-OEC-414	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO12
CO1	design databases using E-R model	3	3	3	3	2
CO2	construct database using relational model	3	3	3	3	2
CO3	formulate SQL queries to interact with database	3	3	3	3	2
CO4	make use of transaction control commands	3	3	3	3	2
CO5	apply normalization on database to eliminate redundancy	3	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Database Systems and Database Design**	11
Introduction to Database Systems: Introduction and applications of DBMS, Purpose of data base, History of database, Database architecture - Abstraction Levels, Data Independence, Database Languages, Database users and DBA. **Introduction to Database Design:** Database Design Process, Data Models, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, Generalization, Specialization, Aggregation, Conceptual design with the E-R model for large Enterprise. ***Task:*** *Conceptual Designing using ER Diagrams.*		
II	**Relational Model**	9
Introduction to the relational model, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design: E-R to relational, Introduction to views, Destroying/altering tables and views. ***Task:*** *Converting ER Model to Relational Model.*		
III	**SQL Basics and Functions**	4+4=8
Part-A: SQL Basics: DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, in operator. ***Task:*** *Creation of Tables using SQL commands.*		
Part-B: Functions: Aggregate functions, Built-in functions - numeric, date, string functions, set operations. ***Task:*** *Practice Queries using Aggregate Operators.*		
IV	**Sub-queries and Transaction control commands**	10
Sub-queries: Introduction, correlated sub-queries, use of group by, having, order by, join and its types, Exist, Any, All, view and its types. **Transaction control commands:** ACID properties, concurrency control, Commit, Rollback, save point, cursors, stored procedures, Triggers. ***Task:*** *Practicing Sub queries and Joins.*		
V	**Normalization**	10
Introduction, Normal forms - 1NF, 2NF, 3NF, BCNF, 4NF and 5NF, concept of De-normalization and practical problems based on these forms. ***Task:*** *Implement normalization with an example.*		
Textbooks:		
1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, TMH. 2. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, 6th Edition, TMH.		

GO PROGRAMMING LAB

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CS-PC-412	-	-	2	1

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	write simple programs using Go programming concepts	3	3	3
CO2	articulate the variables of Go programming	3	3	3
CO3	make use of functions and packages of Go programming	3	3	3
CO4	pivot servers of Go programming	3	3	3
CO5	prioritize servers and concurrency in Go programming	3	3	3

List of Experiments

Note: Codes and execution available at https://www.golangprograms.com/basic-programs.html

Week	Title/Experiment
1	Write a Go Program to find LCM and GCD of given two numbers.
2	Write a Go Program to print pyramid of numbers.
3	Write a program to use struct that is imported from another package.
4	Write a Go Program to calculate standard deviation in Math package.
5	Write a Program in Go language to print Floyd's Triangle.
6	Write a Go Program to take user input and addition of two strings.
7	Write a Go Program to check whether a string is Palindrome or not.
8	Write a Go Program to Build a contact form.
9	Write a Go Program to calculate average using arrays.
10	Write a Go program to delete duplicate element in a given array.
11	Write a Go Program with example of Array Reverse Sort Functions for integer and strings.
12	Write a program comprising of Contains, Contains Any, Count and Equal Fold string functions.
13	Write a Go Program for CRUD using MYSQL from scratch.
14	Write a Go Program to create multiple goroutines and implement how the goroutines scheduler behaves with three logical processors for CRUD using MYSQL from scratch.

References

1. GO Programming Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Build a database using Go Programming.
2. Create a calculator in Go Programming.
3. Create a countdown using Go Programming.
4. Create a Tic Tac Toe using Go Programming.
5. Convert a text file to PDF using Go Programming.
6. Build a simple website using Go Programming.
7. Build a book management system using Go Programming
8. Build a restaurant management system using Go Programming.
9. Build a office management system using Go Programming.
10. Build a simple server in Go Programming.

INDUSTRY ORIENTED MINI-PROJECT

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CD-PR-411	-	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PSO2
CO1	identify the problem statement, assess the scope and develop a prototype	3
CO2	execute the project using modern tools and prepare the report	3
CO3	demonstrate leadership, management skills for project development with ethics	3
CO4	function effectively as individual / member / leader in project teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines

S. No.	Title
The objective of the industry oriented mini-project work is to imbibe students with technical, analytical and innovative ideas to facilitate with theoretical and practical learning pertaining to relevant domain of interest. An individual or a peer of 2-5 students work under the guidance / mentorship of a departmental faculty and industry expert with the aim of addressing solution to real world / societal problems using various R&D/industrial techniques. The team work fosters the communication and leadership skills among peers to survive and exercise during their career.	
1	Survey and study of published literature on the approved / assigned topic.
2	Conduct preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility / ethnographical study.
3	Prepare an abstract/synopsis on the opted topic and submit to the Guide/Supervisor for approval.
4	Prepare an Action Plan for conducting the investigation, including team work.
5	Apply suitable methodology for Designing / Modeling / Simulation / Experimentation.
6	Develop an end product/process along with conclusions, recommendations and future scope.
7	Prepare and submit the final dissertation in the prescribed format to the Department.
8	Present and execute the industry oriented mini-project before External Committee for viva-voce.

B.TECH.-VIII-SEMESTER SYLLABUS

PREDICTIVE ANALYTICS
(Professional Elective –V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-CD-PE-421	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	explain the concepts of predictive analytics	3	2	2	2	3	3
CO2	demonstrate malware detection in context of immunity	3	3	3	3	3	3
CO3	make use of modelling toolkits and software solutions	3	3	3	3	3	3
CO4	demonstrate IBM Watson computer	3	2	3	3	3	3
CO5	illustrate use of persuasion in prediction	3	2	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	7
Introduction, The analytical model, Two types - predictive and descriptive, The profitability seesaw, Applying predictive analytics to e-mail marketing, Generating customer knowledge, Competing on analytics, Data protection and privacy issues. ***Task:*** *Draw an analytical model to generate customer knowledge.*		
II	**Using data mining to build predictive models**	10
Data mining and its stakeholders, The data-mining process, Involvement of the stakeholders, The relationship between data mining, data science and statistics. **Managing the data for predictive analytics**: Roles, useful data, data sources, types of data - structured and unstructured, Data quality checks - the data audit, data preparation. ***Task:*** *Perform structured and unstructured data audit.*		
III	**Modelling Toolkits and Software Solutions**	7+9=16
Part-A: The Analytical Modelling Toolkit: Types of techniques, Widely used predictive models, Widely used descriptive methods, The Bayesian approach, Combining models together. ***Task:*** *Perform predictive data modelling.*		
Part-B: Software Solutions for Predictive Analytics: The architecture required for data mining, Software for analytical modelling, Communicating models between development and deployment, Model management, Scalable analytics in the Cloud. ***Task:*** *Draw a data mining architecture for development and deployment.*		
IV	**Watson and the Jeopardy**	7
Watson - IBM's Jeopardy! Playing computer, Why does it need predictive modelling in order to answer questions, and what secret sauce empowers its high performance? How does the iPhone's Siri compare? Why is human language such a challenge for computers? ***Task:*** *Perform a case study on IBM Watson.*		
V	**Persuasion by the Numbers**	8
What is the scientific key to persuasion? Why does some marketing fiercely backfire? Why is human behaviour the wrong thing to predict? What voter predictions helped Obama win in 2012 more than the detection of swing voters? How could doctors kill fewer patients inadvertently? ***Task:*** *Perform a case study on voter prediction.*		
Textbooks:		
1. Barry Leventhal, "Predictive Analytics for Marketers - Using Data Mining for Business Advantage", KaganPage, 2018 2. Eric Siegel, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, Or Die", Wiley, 2016.		
References:		
1. Anasse Bari, Mohamed Chaouchi, and Tommy Jung, Predictive Analytics For Dummies", John Wiley & Sons", 2014.		

DATA STREAMING TECHNIQUES
(Professional Elective – V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-CD-PE-422	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	explain the concepts of data streaming	3	2	2	2	2	3
CO2	demonstrate about stream processing applications	3	3	2	3	3	3
CO3	make use of data handling and transportation	3	3	3	3	3	3
CO4	illustrate data analysis algorithms	3	3	3	3	3	3
CO5	adapt message queuing tier in business problems	3	3	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	7
Overview, Towards continuous data processing: the requirements, Stream processing foundations, Stream processing, Differences of a real time and streaming systems, The architectural blueprint, Security for streaming systems. ***Task:*** *Draw the architectural blue print of streaming systems.*		
II	**Stream Processing**	10
Overview, Stream processing applications - Network monitoring for cyber security, Transportation grid monitoring and optimization, SCADA systems, Stream Processing Systems - Data, Processing. ***Task:*** *Analyze the working mechanism of SCADA systems.*		
III	**Data Ingestion and Decoupling the Data Pipeline**	7+7=14
Part-A: Data Ingestion: Common interaction patterns - Request/response pattern, Request/ acknowledge pattern, Publish/subscribe pattern, One-way pattern, Stream pattern, Scaling the interaction patterns - Request/response optional pattern, Scaling the stream pattern. ***Task:*** *Write a program to identify various streaming patterns.*		
Part-B: Decoupling the Data Pipeline: Message queuing tier, Core concepts - producer, broker, and consumer, Isolating producers from consumers, Durable messaging, Message delivery semantics, Security, Fault tolerance. ***Task:*** *Write a program to identify Message delivery semantics.*		
IV	**Algorithms for Data Analysis**	8
Accepting constraints and relaxing, Thinking about time - Sliding window, Tumbling window, Summarization techniques - Random sampling, Counting distinct elements, Frequency, Membership. ***Task:*** *Write a program to count distinct elements.*		
V	**Storing and Availability of Data**	9
Long-term storage, Keeping it in-memory - Embedded in-memory/flash-optimized, Caching system, In-memory database and data grid, Communications patterns - Data Sync, Remote Method Invocation and RPC, Simple Messaging, Webhooks, HTTP, Server-sent events, Web-Sockets. ***Task:*** *Perform RPC between two systems.*		
Textbooks:		
1. Andrew G. Psaltis, "Streaming Data - Understanding the real-time pipeline", Manning publications, 2017. 2. Deepak S. Turaga,"Fundamentals of Stream Processing Application Design, Systems, and Analytics", Cambridge University Press, 2013.		
References:		
1. Garofalakis, Minos, "Data Stream Management: Processing High-Speed Data Streams", Springer, 2016.		

HEALTHCARE DATA ANALYTICS
(Professional Elective – V)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-CD-PE-423	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	explain the concepts of data sources and basic analytics	3	2	2	3	3	3
CO2	demonstrate about data applications and systems	3	3	3	3	3	3
CO3	illustrate the components and systems of EHR	3	3	3	3	3	3
CO4	adapt biomedical image analysis	3	2	3	3	3	3
CO5	make use of image segmentation and registration	3	2	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Healthcare data sources and basic analytics – Electronic health records, Biomedical image analysis, Sensor data analysis, Biomedical signal analysis, Genomic data analysis, Clinical text mining, Mining biomedical literature, Social media analysis. ***Task:*** *Perform Genomic data analysis.*		
II	**Advanced Data Analytics, Applications and Practical Systems**	7
Clinical prediction models, Temporal data mining, Visual analytics, Clinco-genomic data integration, Information retrieval, Privacy-preserving data publishing, Data analytics for pervasive health, Healthcare fraud detection, Data analytics for pharmaceutical discoveries. ***Task:*** *Write a program to find health care fraud detection.*		
III	**Electronic Health Records (HER)**	9+8=17
Part-A: Components of EHR: Administrative system components, Laboratory system components and vital signs, Radiology system components, Pharmacy system components, Computerized physician order entry (CPOE), Clinical documentation. ***Task:*** *Write a program to analyze clinical data.*		
Part-B: Coding Systems: International classification of diseases – ICDS-9, ICD-10, ICD-11, Current procedural terminology (CPT), Systematized nomenclature of medical clinical terms (SNOMED-CT). ***Task:*** *Write a program to predict disease based on symptoms.*		
IV	**Biomedical Image Analysis**	7
Biomedical imaging modalities – Computed tomography, Positron emission tomography, Magnetic resonance imaging, Ultrasound, Microscopy, Biomedical imaging standards and systems, Object detection – Template matching, Model based detection, Data driven detection methods. ***Task:*** *Write a program to analyze medical image.*		
V	**Image Segmentation and Registration**	9
Image segmentation - Thresholding, Watershed transform, Region growing, Clustering, Image registration – Registration transforms, similarity and distance metrics, Registration optimizers, Feature extraction – Object features, Features selection and dimensionality reduction, Principal component analysis. ***Task:*** *Write a program on dimensionality reduction.*		
Textbooks:		
1. Chandan K Reddy et.al., "Healthcare Data Analytics", CRC Press, 2015. 2. Hui Yang, Eva K. Lee, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement", Wiley, 2016.		
References:		
1. Sergio Consoli, "Data Science for Healthcare: Methodologies and Applications", Springer, 2019.		

MINING MASSIVE DATASETS
(Professional Elective - VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-CD-PE-424	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	explain the concepts of dataset mining	3	2	2	3	3	3
CO2	use mapreduce for large scale file systems	3	3	3	3	3	3
CO3	select similar items of a large dataset	3	3	2	3	3	3
CO4	make use of web advertising	3	3	3	3	3	3
CO5	sketch social network graphs for mining	3	2	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Statistical Modeling, Machine Learning, Computational Approaches to Modeling, Feature Extraction, Statistical Limits on Data Mining - Total Information Awareness, Bonferroni's Principle, Things Useful to Know - Importance of Words in Documents, Hash Functions, Indexes, Secondary Storage, The Base of Natural Logarithms, Power Laws. ***Task:*** *Perform a case study on Bonferroni's Principle.*		
II	**MapReduce and the New Software Stack**	8
Distributed File Systems - Physical Organization of Compute Nodes, Large-Scale File-System Organization, MapReduce - The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution. ***Task:*** *Perform a case study on Mapreduce.*		
III	**Finding Similar Items**	8+6=14
Part-A: : Applications of Near-Neighbor Search: Jaccard Similarity of Sets, Similarity of Documents, Collaborative Filtering as a Similar-Sets Problem, Shingling of Documents - k-Shingles, Choosing the Shingle Size, Hashing Shingles, Shingles Built from Words. ***Task:*** *Perform a case study on Jaccard Similarity of Sets.*		
Part-B: Similarity-Preserving Summaries of Sets, Matrix Representation of Sets, Minhashing, Minhashing and Jaccard Similarity, Minhash Signatures, Computing Minhash Signatures. ***Task:*** *Perform a case study on similarity preserving.*		
IV	**Advertising on the Web**	9
Issues in On-Line Advertising - Advertising Opportunities, Direct Placement of Ads, Issues for Display Ads, On-Line Algorithms - On-Line and Off-Line Algorithms, Greedy Algorithms, The Competitive Ratio, The Matching Problem - Matches and Perfect Matches, The Greedy Algorithm for Maximal Matching, Competitive Ratio for Greedy Matching. ***Task:*** *Perform a case study on web advertising opportunities.*		
V	**Mining Social-Network Graphs**	9
Social Networks as Graphs - Varieties of Social Networks, Graphs with Several Node Types, Clustering of Social-Network Graphs - Distance Measures for Social-Network Graphs, Applying Standard Clustering Methods, Betweenness, The Girvan-Newman Algorithm, Using Betweenness to Find Communities. ***Task:*** *Perform a case study onSocial-Network Graphs.*		
Textbooks		
1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3rd Edition.		
References		
1. Jiawei Han & Micheline Kamber, Data Mining - Concepts and Techniques 3rd Edition Elsevier.		

INFORMATION STORAGE AND RETRIEVAL
(Professional Elective - VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-CD-PE-425	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	outline the importance of Information storage and Retrieval	3	3	3	3	3	3
CO2	illustrate cataloging and indexing in information storage	3	2	3	3	3	3
CO3	adapt automatic indexing and clustering in information storage	3	3	3	3	3	3
CO4	implement user search techniques	3	3	3	3	3	3
CO5	apply text search algorithm in information retrieval	3	2	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses. **Information Retrieval System Capabilities**: Search, Browse, Miscellaneous. ***Task:*** *Perform a case study on Information Retrieval System Capabilities.*		
II	**Cataloging and Indexing**	7
Objectives, Indexing Process, Automatic Indexing, Information Extraction. Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure. ***Task:*** *Perform a case study on Hypertext data structure.*		
III	**Automatic Indexing and Clustering**	9+8=17
Part-A: Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages ***Task:*** *Perform a case study on Statistical indexing*		
Part-B: Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters. ***Task:*** *Perform a case study on Hierarchy of clusters.*		
IV	**Search Techniques and Visualization**	7
User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean systems, Searching the Internet and hypertext. **Information Visualization:** Introduction, Cognition and perception, Information visualization technologies. ***Task:*** *Perform a case study on Cognition and perception of human being.*		
V		9
Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example - TREC results. ***Task:*** *Perform a case study on Software text search algorithms.*		
Textbooks:		
1. Information Storage and Retrieval Systems: Theory and Implementation by Gerald J. Kowalski, Mark T. Maybury , Second Edition, Kluwer Academic Publishers. 2000		
References:		
1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992. 2. Modern Information Retrival By Yates Pearson Education.		

TIME SERIES ANALYSIS AND FORECASTING
(Professional Elective - VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-CD-PE-426	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO1
CO1	explain the concepts of time series analysis and forecasting	3	3	3	2	3	3
CO2	adapt statistics and forecasting techniques	3	3	3	3	3	3
CO3	illustrate the methods of regression analysis and forecasting	3	3	3	2	3	3
CO4	make use of exponential smoothing methods	3	3	3	3	3	3
CO5	demonstrate transfer functions and intervention models	3	2	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	6
The Nature and Uses of Forecasts, Some Examples of Time Series, The Forecasting Process, Data for Forecasting - The Data Warehouse, Data Cleaning, Imputation, Resources for Forecasting Five important practical problems, Basic ideas in model building. ***Task:*** *Write a program to visualize time series data.*		
II	**Statistics Background for Forecasting**	11
Introduction, Graphical displays - Time series plots, Plotting smoothed data, Numerical description of time series data - Stationary time series, Auto covariance and autocorrelation functions, variogram, Use of data transformations and adjustments - Transformations. ***Task:*** *Write a program for Stationary Time Series.*		
III	**Regression Analysis and Forecasting**	7+6=13
Part-A: Regression Analysis: Introduction, Least squares estimation in linear regression, Statistical inference in linear regression- Test for significance of regression, Tests on individual regression coefficients and groups of coefficients, Confidence intervals on individual regression. ***Task:*** *Write a program to display significance of regression.*		
Part-B: Forecasting: Variable selection methods in regression, Generalized and weighted least squares - Generalized least squares, weighted least squares, Discounted least squares, Regression models for general time series data. ***Task:*** *Write a program for linear weighted least squares.*		
IV	**Exponential Smoothing Methods**	12
Introduction, First-order exponential smoothing, The initial value, $\tilde{y}0$, The value of λ, Modelling time series data, Second-order exponential smoothing, Higher-order exponential smoothing, Forecasting - Constant process. ***Task:*** *Write a program on exponential smoothing technique.*		
V	**Transfer Functions and Intervention Models**	6
Introduction, Transfer function models, Transfer function–noise models, Cross-correlation function, model specification, Forecasting with transfer function–noise models, Intervention analysis associated R commands. ***Task:*** *Write a program for cross correlation function.*		
Textbooks		
1. Douglas C. Montgomery, Introduction to Time Series Analysis and Forecasting, 2nd Edition, Wiley, 2015. 2. George E. P. Box et.al., Time Series Analysis: Forecasting and Control, 5th Ed, Wiley, 2015.		
References		
1. Rami Krispin, Hands-On Time Series Analysis with R: Perform Time Series Analysis and Forecasting Using R, Packt Publishing, 2019.		

INTELLECTUAL PROPERTY RIGHTS
(Open Elective-III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-OEC-421	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO6	PO8	PO12
CO1	outline basics of intellectual property law	3	3	3	3
CO2	identify the various trademarks	3	3	3	3
CO3	analyze patent and copy rights law	3	3	3	3
CO4	differentiate trade secret and unfair practice	3	2	3	2
CO5	summarize new developments in Intellectual Property Rights	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Intellectual property**	10
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights. ***Task:*** *Draw a flow chart for filing IPR.*		
II	**Trade Marks**	9
Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes. ***Task:*** *Perform a case study on grant of trade mark.*		
III	**Law of copy rights and patents**	5+4=9
Part-A: Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues. ***Task:*** *Draw a flow chart for a copy right.*		
Part-B: Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. ***Task:*** *Draw a flow chart for filing a patent.*		
IV	**Trade Secrets and Unfair competition**	10
Trade Secrets: Trade secretes law; determination of trade secretes status and litigation. **Unfair competition:** Misappropriation right of publicity, false advertising. ***Task:*** *Perform a case study on geographical indications.*		
V	**New development of intellectual property**	10
Recent Trends in copy right law, patent law, intellectual property audits at national and international level. ***Task:*** *Perform a case study intellectual property audits.*		
Textbooks:		
1. Intellectual property right, Deborah, E. Bouchoux, Cengage Learning. 2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, TMH.		

PRINCIPLES OF ENTREPRENEURSHIP
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-OEC-422	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO7	PO8	PO9	PO11	PO12
CO1	illustrate concept & types of entrepreneurship	3	3	2	3	2
CO2	distinguish individual and corporate entrepreneurship	3	3	3	3	2
CO3	identify the process of launching new ventures	3	3	3	3	3
CO4	assess legal challenges of entrepreneurship	3	3	3	3	3
CO5	build entrepreneurial strategies	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Entrepreneurship**	10
The revolution impact of entrepreneurship- The evolution of entrepreneurship - Approaches to entrepreneurship - Process approach - Twenty first centaury trends in entrepreneurship. ***Task:*** *Perform a case study on a successful women entrepreneur.*		
II	**Individual and corporate entrepreneurship**	9
The entrepreneurial journey - Stress and the entrepreneur- the entrepreneurial ego- Entrepreneurial motivations - Corporate Entrepreneurial Mindset the nature of corporate entrepreneur. ***Task:*** *Prepare a report on Mindset of the corporate entrepreneur.*		
III	**Launching Entrepreneurial Ventures**	5+5=10
Part-A: Opportunities identification - entrepreneurial Imagination and Creativity - the nature of the creativity Process - Innovation and Entrepreneurship - Methods to initiate Ventures. ***Task:*** *Prepare a report on initiation of a venture.*		
Part-B: Creating New Ventures - Acquiring an established entrepreneurial venture – Franchising - hybrid disadvantage of Franchising. ***Task:*** *Develop a startup plan.*		
IV	**Legal challenges of Entrepreneurship**	9
Intellectual Property Protection-Patents, Copyrights, Trademarks and Trade Secrets-Avoiding Pitfalls- Formulation of the entrepreneurial Plan- The challenges of new venture start-ups. ***Task:*** *Prepare a report on statutory compliances for IPR protection.*		
V	**Strategic perspectives in entrepreneurship**	10
Strategic Planning-Strategic actions-strategic positioning-Business stabilization-Building the adaptive firms-understanding the growth stage-unique managerial concern of growing ventures. ***Task:*** *Prepare a strategic plan for positioning and stabilization of an enterprise.*		
References:		
1. Arya Kumar "Entrepreneurship- creating and leading an entrepreneurial org" Pearson 2012. 2. 'Entrepreneurship: New Venture Creation' David H Holt PHI, 2013. 3. Entrepreneurship: Text and Cases P. Narayana Reddy, Cengage, 2010.		

PRECISION AGRICULTURE
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-OEC-423	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PSO2
CO1	explain the concepts of precision agriculture	3	3	3	3	3	3
CO2	outline the components of precision agriculture	3	3	3	3	3	3
CO3	illustrate about tools technologies and sampling	3	3	3	3	3	3
CO4	adapt recent advances in precision agriculture	3	3	3	3	3	3
CO5	make use of feasibility and evaluation of precision farming	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Accuracy and precision, Comparison chart, Target comparison, Number of measurements, Quality, Bias, Degree of accuracy, A brief history of precision agriculture, Defining precision agriculture, Variability and the production system, Need for precision agriculture. ***Task:*** *Write a program on finding the precision in agricultural dataset.*		
II	**Components of Precision Agriculture**	9
Components of Precision Agriculture, Spatial Data Management, Geographical Positioning, Geographical Information System, Remote Sensing, Soil Sampling and Mapping, Yield Monitoring and Mapping, Components of a Yield Monitor. ***Task:*** *Perform a case study on Yield Monitoring.*		
III	**Tool, Technologies and Sampling**	6+6=12
Part-A: Tool and Technologies in Precision Agriculture: Global Positioning System (GPS), Sensor Technologies, Geographic Information System (GIS), Grid Soil Sampling and Variable Rate Fertilizer (VRT), Online Resources for Precision Agriculture. ***Task:*** *Perform a case study on Tool and Technologies in Precision Agriculture.*		
Part-B: Precision Soil Sampling: Introduction, Soil Sampling, Sampling Procedures – Depth, Pattern, Soil Sampling Instructions and Pattern Options, Grid Soil Sampling - Advantages and Disadvantages, Zone Sampling - Method, Advantages and Disadvantages, Prescription Maps. ***Task:*** *Perform a comparative analysis on soil sampling procedures.*		
IV	**Recent Advances in Precision Agriculture**	9
Internet of Things in Precision Agriculture, Prerequisites of IoT Applications in Agriculture, Structure of IOT for Agriculture, Drones or Unmanned Aerial Vehicles (UAVs). ***Task:*** *Perform a case study on design concept of UAVs.*		
V	**Feasibility and Evaluation of Precision Farming in India**	9
Present Scenario, Economic Feasibility of Precision Farming, Constraints in the Adoption of Precision Agriculture, Capital Expenditures in Precision Agriculture, Farm Size and Technology Adoption, Profitability, Environmental Benefits. ***Task:*** *Perform the profitability analysis in Precision Agriculture.*		
Textbooks:		
1. Latief Ahmad and Syed Sheraz Mahdi, "Satellite Farming - An Information and Technology Based Agriculture" Springer, 2018. 2. Pedersen, Søren Marcus, "Precision Agriculture: Technology and Economic Perspectives" Springer, 2018.		
References:		
1. Ryan Nagelhout, "The Modern Nerd's Guide to Drone Racing", Gareth Stevens, 2018. 2. Oerke, E.C et.al., "Precision Crop Protection - the Challenge and Use of Heterogeneity" Springer, 2010.		

WEB TECHNOLOGIES
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-OEC-424	3	-	-	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12
CO1	design web pages using HTML and JavaScript	3	3	3	3	3
CO2	develop web applications using PHP	3	3	3	2	3
CO3	make use of XML and DTD for web design	3	3	3	2	2
CO4	build web applications using servlets and session tracking	3	3	3	2	2
CO5	establish database connectivity using JSP and JDBC	3	3	3	2	2

Syllabus

Unit	Title/Topics	Hours
I	**Web, HTML and Java Script**	10
Web: Introduction, Internet and web, web browsers, web servers, protocols. **HTML:** Basics, elements, attributes, tags- list, tables, images, forms, frames, cascading style sheets. **Java Script**: Introduction to scripting, control structures, conditional statements, arrays, functions, objects. ***Task:*** *Develop static pages (using Only HTML) of an online Book store.*		
II	**PHP**	10
Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls, handling file uploads, connecting to database, executing simple queries. ***Task:*** *A web application that takes name and age from an HTML page using PHP.*		
III	**XML, Parsing and Introduction to DTD**	4+4=8
Part-A: XML: Basics of XML, Elements, Attributes, Name space, **Parsing:** DOM and SAX Parsers. ***Task:*** *Create XML document to display student details.*		
Part-B: Introduction to DTD: internal and external DTD, Elements of DTD, DTD Limitations, XML Schema, Schema structure, XHTML. ***Task:*** *Write a program to demonstrate DTD.*		
IV	**Servlets and Session Tracking**	10
Servlets: Introduction, Lifecycle, Generic and HTTP servlet, passing parameters to servlet, HTTP servlet Request & Response interfaces, Deploying web Applications, **Session Tracking:** Hidden form fields, cookies, URL- Rewriting, session. ***Task:*** *Write a servlet program with an example.*		
V	**JSP and JDBC**	10
JSP: Introduction, Difference Between servlets & JSP, Anatomy of JSP page, JSP elements: Directives, comments, Expressions, scriptlets, Declaration, Implicit JSP objects using Action elements. **JDBC:** Introduction, JDBC Drivers, Loading Driver, establishing connection, Executing SQL statement in JSP pages, MVC architecture. ***Task:*** *Write a JSP program for user validation.*		
Textbooks:		
1. Web Technologies, Uttam K Roy, Oxford University Press. 2. The Complete Reference PHP- Steven Hozner, TMH.		
References:		
1. Java Server Pages-Hans Bergsten, SPD O'Reilly. 2. JavaScript, D. Flanagan O'Reilly, SPD.		

MAJOR PROJECT

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-CD-PR-421	-	-	20	10

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PSO2
CO1	identify the problem statement, assess the scope and develop a prototype	3
CO2	execute the project using modern tools and prepare the report	3
CO3	demonstrate leadership, management skills for project development with ethics	3
CO4	function effectively as individual / member / leader in project teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines

S. No.	Title
The objective of the project work is to imbibe students with technical, analytical and innovative ideas to facilitate with theoretical and practical learning pertaining to relevant domain of interest. An individual or a peer of 2-5 students work under the guidance / mentorship of a departmental faculty with the aim of addressing solution to real world / societal problems using various R & D techniques. The team work fosters the communication and leadership skills among peers to survive and exercise during their career.	
1	Survey and study of published literature on the approved / assigned topic.
2	Conduct preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility / ethnographical study.
3	Prepare an abstract/synopsis on the opted topic and present before Departmental Review Committee (DRC).
4	Prepare an Action Plan for conducting the investigation, including team work.
5	Apply suitable methodology for Designing / Modeling / Simulation / Experimentation as needed.
6	Develop an end product or process along with conclusions, recommendations and future scope.
7	Present and execute the project before DRC for CIE.
8	Prepare and publish a paper in Conference / Journal, if possible.
9	Prepare and submit the final dissertation in the prescribed format to the Department.
10	Present and execute the project before External Committee for viva-voce.