CMR
ENGINEERING COLLEGE
EXPLORE TO INVENT

CMR ENGINEERING COLLEGE
UGC AUTONOMOUS

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

R22
CSE (AI&ML)
SYLLABUS

Academic Regulations, Course Structure and Detailed Syllabus under Autonomous Status

BACHELOR OF TECHNOLOGY (B.TECH.)

(CMREC – R-22 Regulations)

(Applicable for the batch admitted from 2022-2023)

PRELIMINARY DEFINITIONS AND NOMENCLATURES

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

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

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

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

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

- **Branch:** Means specialization in a program like B.Tech. Degree program in Electronics and com-n munication Engineering, B.Tech degree program in Computer Science and Engineering, etc.

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

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

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

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

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

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

- **Continuous Internal Examination:** It is an examination conducted towards sessional assess-ment.

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

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

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

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

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

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

- **Curriculum:** Curriculum incorporates the planned interaction of students with instructional con-r tent, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

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

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

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

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

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

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

- **Honors:** An Honors degree typically refers to a higher level of academic achievement at anun- dergraduate level.

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

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

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

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

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

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

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

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

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

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

- **Regulations:** The regulations, common to all B.Tech. Programs offered by Institute, are desige nated as – CMREC Regulations – R-22 and are binding on all the stakeholders.

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

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

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

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

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

FOREWORD

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

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

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

All the faculty, parents, and students are requested to go through all the rules and regulations care-tfully. Any clarifications needed are to be sought at appropriate time and from the principal of the in-lstitute, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is requested for the successful implementation of the auton-somous system in the larger interests of the instituteand brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS (R22) FOR B.TECH REGULAR STUDENTSWITH EFFECT FROM THE ACADEMIC YEAR 2022-23

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

Jawaharlal Nehru Technological University Hyderabad (JNTUH) offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) at its non-autonomous constituent and affiliated colleges with effect from the academic year 2022-23.

2.0   Eligibility for Admission

2.1   Admission to the undergraduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any otherorder of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2   The medium of instructions for the entire undergraduate programme in Engineering & Technology will be **English** only.

3.0   B.Tech. Programme Structure

3.1   A student after securing admission shall complete the B.Tech. programme in a minimum period of four academic years (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 student shall forfeit seat in B.Tech course. Each student shall secure 160 credits (with CGPA ≥ 5) required for the completion of the undergraduate programme and award of the B.Tech. Degree.

3.2.   UGC/ AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 Semester Scheme

Each undergraduate programme is of 4 academic years (8 semesters) with the ac-ademicyear divided into two semesters of 22 weeks (≥ 90 instructional days) each and in each semester - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS) and Credit Based Semester System(CBSS) indicated by UGC, and curriculum/course structure sugs-gested by AICTE are followed.

3.2.2 Credit Courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorialperiods: practical periods: credits) structure based on the following general pattern.

•   One credit for one hour/ week/ semester for Theory/ Lecture (L) courses or Tutorials.

•   One credit for two hours/ week/ semester for Laboratory/ Practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab are mandatory courses. These courses will not carry anycredits.

3.2.3 Subject Course Classification

All subjects/ courses offered for the undergraduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The University has followed almost all the guidelines issued by AICTE/UGC.

S. No.	Broad Course Classification	Course Group/Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry subjects
2		ES - Engineering Sciences	Includes Fundamental Engineering Subjects
3		HS – Humanities and Social Sciences	Includes subjects related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	ElectiveCours-es(EℓC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter- disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. Project or UG Project or UG Major Project or Project Stage I & II
8		Industry Training/ Internship/ Industry Oriented Mini-	Industry Training/ Internship/ Industry Oriented Mini-Project/ Mini-Project/ Skill Development Courses
9		project/ Mini- Project/ Skill Development Courses	
		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor Courses	-	1 or 2 Credit Courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory Courses (non-credit)

4.0 Course Registration

4.1. A 'faculty advisor or counselor' shall be assigned to a group of 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their 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 'on-line registration', 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 **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, Faculty Advisor/ Counselor and the student.

4.4 A student may be permitted to register for all the subjects/ courses in a semester as specified in the course structure with maximum additional subject(s)/course(s) limitedto 6 Credits (any 2 elective subjects), based on **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 Choice for '**additional subjects/courses**', not more than any 2 elective subjects in any Semester, must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Mentor/HOD.

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

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

4.8. Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor 'within a period of 15 days' from the beginning of the current semester.

4.9 **Open Electives**: The students have to choose three Open Electives (OE-I, II & III) fromthe list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by his own (parent) department, if the student has notregistered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.

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

5.0 Subjects/ courses to be offered

5.1. A subject/ course may be offered to the students, **only if** a minimum of 15 students opt for it.

5.2. More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of 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).

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

5.4. In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the '**parent department**'.

6.0 Attendance requirements:

6.1. A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (including attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab) for that semester. **Two periods** of attendance for each theory subject shall be considered, if the student

Appears for the mid-term examination of that subject. **This attendance should also be included in the attendance uploaded every fortnight in the University Website.**

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

6.3. A stipulated fee shall be payable for 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,** including all academic credentials (internal marks etc.) of that semester. **They will not be promoted to the next semester**. They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re-admission into that semester asand when offered; 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.

7.0 Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendancerequire-l ments 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% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing '**C**' grade or above in that subject/ course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student isdeemed to have failed, if he (i) does not submit a report on Industry Oriented Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it isscheduled.

7.3 Promotion Rules:

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester toSecond year first semester	Regular course of study of first yearsecond semester. Must have secured at least 20 credits outof 40 credits i.e., 50% credits up to first yearsecond semester from all the relevantregular and supplementary examinations, whether the student takes thoseexaminations or not.
3.	Second year first semester toSecond year second semester	Regular course of study of second year first semester.
4	Second year second semesterto Third year first semester	Regular course of study of second year second semester. Must have secured at least 48 credits outof 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes thoseexaminations or not.

5	Third year first semester to Third year second semester	Regular course of study of third year first semester.
6	Third year second semesterto Fourth year first semester	Regular course of study of third year second semester. Must have secured at least 72 credits outof 120 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes thoseexaminations or not.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester.

7.4.   A student (i) shall register for all courses/subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA ≥ 5.0 (in each semester), andCGPA ≥ 5 (at the end of 8 semesters), (iv) **passes all the mandatory courses,** to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA **(at the end of undergraduate programme),** and shall be indicated in the grade card / marks memo of IV-year II semester.

7.5.   If a student registers for '**extra subjects**' (in the parent department or other departments/ branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those '**extrasubjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be considered while calculating the SGPA and CGPA. For such '**extra subjects**' registered, percentage of marks and letter grade alone will beindicated in the grade card / marks memo as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations Items6 and 7.1 – 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 reappearfor 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 carriedover, and added to the marks to be obtained in the SEE supplementary examination forevaluating performance in that subject.

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

8.0   Evaluation - Distribution and Weightage of Marks

8.1   The performance of a student in every subject/course (including practical's and Project

Stage – I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

8.2. In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

1. Mid Term Examination for 30 marks:

   a. Part - A : Objective/quiz paper/Short Answers for 10 marks.(5*2=10Marks)
   b. Part - B : Descriptive paper for 20 marks.

   The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

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

2. Assignment for 5 marks. (**Average of 2 Assignments** each for 5 marks)

3. Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks.

   While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

   Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shallbe taken as the final marks for assignment (for 5 marks).

   Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

- *The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.*

- *In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.*

  There is NO Computer Based Test (CBT) for R22 regulations.

  The details of the end semester question paper pattern are as follows:

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

   - Part-A is a compulsory question which consists of ten sub-questions from all

unitscarrying equal marks.

- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

8.3 For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks
2. **10 marks for viva-voce (**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the University.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

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

The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

8.4 There shall be an Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a SeniorFaculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.

8.5 The UG project shall be initiated at the end of the IV Year I Semester and the durationof the project work is one semester. The student must present Project Stage – I during IV Year I Semester before II Mid examinations, in consultation with his Supervisor, the title, objective and plan of action of his Project work to the departmental committeefor approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start his project work.

8.6 UG project work shall be carried out in two stages: Project Stage – I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage – II duringIV Year II Semester. Student has to submit project work report at the end of IV Year IISemester. The project shall be evaluated for 100 marks before commencement of SEETheory examinations.

8.7. For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a reporton Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

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

8.8 For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project/ Internship/SDC etc. and the main Project shall be different fromthe topic already taken. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum totalof the CIE and SEE taken together.

For conducting viva-voce of project, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

A student who has failed, may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear

for the same in the next subsequent semester, as and when it is scheduled.

8.9. A student shall be given only one time chance to re-register for a maximum of two sub-jects in a semester:

- If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva- voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject) areless than 35% and failed in those subjects.

A student must re-register for the failed subject(s) for 40 marks within four weeks of com-smencement of the class work in next academic year.

In the event of the student taking this chance, his Continuous Internal Evaluation marksfor 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

9.0 Grading Procedure.

9.1 Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory/Practicals/ Industry-Oriented Mini Project/Internship/SDC and Project

Stage. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corre-t sponding letter grade shall be given.

9.2. As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

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

9.3   A student who has obtained an '**F**' grade in any subject shall be deemed to have '**failed**' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4.   To a student who has not appeared for an examination in any subject, '**Ab**' grade will be allocated in that subject, and he is deemed to have '**Failed**'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remainthe same as those obtained earlier.

9.5.   A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6   A student earns Grade Point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. 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 …. For a course

9.7   A 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

$$\text{SGPA} = \{ \sum_{i=1}^{N} C_i\, G_i \} /_{i=1} \{ \sum^{N} C_i \} \text{ …. For each semester,}$$

where 'i' is the subject indicator index (considering all subjects in a semester), 'N' is the no. of subjects '**registered**' for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the ith sub-bject, and G_i represents the grade points (GP) corresponding to the letter gradeawarded for that i^{th} subject.

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 (of 160) 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 II semester onwards at the end of each semester as per the formula

$$\text{CGPA} = \{ \sum_{j=1}^{M} C_j\, G_j \} / \{ \sum_{j=1}^{M} C_j \} \text{ … for all S semesters registered}$$

(i.e., up to and inclusive of S semesters, S ≥ 2),

where '**M**' is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered**' i.e., from the 1stsemester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the jth subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative efs fects.

Illustration of calculation of SGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

SGPA = 152/21 = 7.24

Illustration of Calculation of CGPA up to 3ʳᵈ Semester:

Semester	Course/ Subject Title	Credits Allotted	LetterGrade Secured	CorrespondingGrade Point (GP)	Credit Points (CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21

III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	**69**		**Total Credit Points**	**518**

CGPA = 518/69 = 7.51

The calculation process of CGPA illustrated above will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. Programme.

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 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 Passing Standards

10.1 A student shall be declared successful or 'passed' in a semester, if he secures a GP ≥ 5 ('**C**' grade or above) in every subject/course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and he shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.00 ('**C**' grade or above) for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet 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.) and credits earned. There is NO exemption of credits in any case.

11.0 Declaration of results

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

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

% of Marks = (final CGPA – 0.5) x 10

12.0 Award of Degree

12.1. A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified**' for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.

12.2. A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 A student with final CGPA (at the end of the undergraduate programme) > 8.00, and fulfilling the following conditions - shall be placed in '**First Class with Distinction**'. How-w

ever, he

i. Should have passed all the subjects/courses in '**First Appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

ii. Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA > 8 shall be placed in **'First Class'.**

12.4 Students with final CGPA (at the end of the undergraduate programme) ≥ 7.0 but < 8.00 shall be placed in **'First Class'.**

12.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 6.00 but < 7.00, shall be placed in '**Second Class'.**

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 6, shall be placed in '**pass class'.**

12.7 A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of 'Gold Medal'.

12.9 Award of 2-Year B.Tech. Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech. II Year II Semester, if the student want to exit the 4-Year B.Tech. Program and *requests for the 2 -Year* B. Tech. (*UG) Diploma Certificate.*

2. The student **once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join** in B. Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of class work for that semester.*

3. *The students, who exit the 4-Year B. Tech. program after II Year of study and wish to re-join the B.Tech. program, must submit the 2 -Year B. Tech. (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.*

4. A student may be permitted to take one year break after completion of II Year II Semester or B. Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

13.0 Withholding of results

13.1 If the student has not paid the fees to the University 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.

14.0 Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of R20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R22 Regulations and he is required to complete the study of B.Tech. Programme within the stipulated period of eight academic years from the date of first admission in I Year.

2. A student who has been detained in any semester of II, III and IV years of R20 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of R20 Regulations, who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both R20 & R22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in R22 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.

5. 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 R22 Regulations. **There is NO exemption of credits in any case**.

6. If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22Regulations will be substituted by another subject to be suggested by the University.

Note: If a student readmitted to R22 Regulations and has not studied any subjects/topicsin his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the College Principals concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

15. Student Transfers

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

15.2 There shall be no transfers from one college/stream to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.

15.3. The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JNTUH, the students have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.

15.4 The transferred students from other Universities/Institutions to JNTUH affiliated colleges who are on rolls are to be provided one chance to write the CBT (for internal marks) in the **equivalent subject(s)** as per the clearance letter issued by the University.

15.5 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the **equivalent subject(s)** to the students transferred from other universities/institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

16.0 Scope

16.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

16.2. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

16.3 The University may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the University authorities.

16.4. Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

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ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME)
FROMTHE AY 2023-24

1. Eligibility for the award of B.Tech Degree **(LES)**

   The LES students after securing admission shall pursue a course of study for not lessthan three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA $\geq$ 5 from II year to IV-year B.Tech. Programme (LES) for the award of B.Tech. Degree.

3. The students, who fail to fulfil the requirement for the award of the degree in sixacademic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech.(LES).

5. Promotion rule

S. No	Promotion	Conditions to be fulfilled
1	Second year firΩ semeΩer tosecond year second semeΩer	Regular course of Ωudy of second yearfirΩ semeΩer.
2	Second year second semeΩer tothird year firΩ semeΩer	Regular course of Ωudy of secondyear second semeΩer. MuΩ have secured at leaΩ 24 creditsout of 40 credits i.e., 60% credits up to second year second semeΩer from all therelevant regular and supplementary examinations, whether the Ωudent takesthose examinations or not.
3	Third year firΩ semeΩer to third year second semeΩer	Regular course of Ωudy of third yearfirΩ semeΩer.
4	Third year second semeΩer tofourth year firΩ semeΩer	Regular course of Ωudy of third yearsecond semeΩer. MuΩ have secured at leaΩ 48 creditsout of 80 credits i.e., 60% credits up to third year second semeΩer from all the relevant regular and supplementary examinations, whether the Ωudent takesthose examinations or not.
5	Fourth year firΩ semeΩer to fourth year second semeΩer	Regular course of Ωudy of fourth yearfirΩ semeΩer.

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular)will hold good for B. Tech. (Lateral Entry Scheme).

7. LES students are not eligible for 2-Year B. Tech. Diploma Certificate.

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Malpractices Rules

Disciplinary Action For / Improper Conduct in Examinations

	Nature of Malpractices/Improperconduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other formof material concerned with or related to the subject of the examination (theory orpractical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any otherform of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled and sent to the University.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student isalso debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all thesubjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive

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

7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or fire-armin the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred andforfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred andforfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects ofthat semester/year.
11.	Copying detected on the basis of internalevidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.

12.	If any malpractice is detected which is not covered in the above clauses 1 to 11shall be reported to the University for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

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

2. Punishment for Institutions: (if the squad reports that the college is also involved inencouraging malpractices)

    *   A show-cause notice shall be issued to the college.
    *   Impose a suitable fine on the college.
    *   Shifting the examination center from one college to another college for a specificperiod of not less than one year.

* * * * *

B.Tech. CSE (AI & ML)
Choice Based Credit System (CBCS)
Applicable From 2022-23 Admitted Batch

I YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	MA101BS	Matrix Algebra and Differential Equations	3	1	0	4
2	AP102BS	Applied Physics	3	1	0	4
3	CS103ES	Programming for Problem Solving	3	0	0	3
4	EE104ES	Basic Electrical Engineering	3	0	0	3
5	IT105ES	IT Workshop Lab	0	0	3	1.5
6	AP106BS	Applied Physics Lab	0	0	2	1
7	CS107ES	Programming for Problem Solving Lab	0	0	3	1.5
8	EE108ES	Basic Electrical Engineering Lab	0	0	2	1
9	EN109BS	Skill Development Course - I (Interchange - Business English)	0	0	2	1
10		Induction Programme				
		Total Credits	**12**	**2**	**12**	**20**

I YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	MA201BS	Vector Calculus and Transforms	3	1	0	4
2	CH202BS	Engineering Chemistry	3	1	0	4
3	AI203ES	Data Structures Through C++	3	1	0	4
4	EN204HS	English for Skill Enhancement	2	0	0	2
5	ME205ES	Computer Aided Engineering Graphics Lab	0	0	3	1.5
6	CH206BS	Engineering Chemistry Lab	0	0	2	1
7	AI207ES	Data Structures Through C++ Lab	0	0	2	1
8	EN208HS	English Language and Communication Skills Lab	0	0	3	1.5
9	MA209HS	Skill Development Course - II (Aptitude and Logic Building)	0	0	2	1
		Total Credits	**11**	**3**	**13**	**20**

II YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	EC301ES	Analog & Digital Electronics	3	0	0	3
2	CS302PC	Computer Organization and Architecture	3	0	0	3
3	CS303PC	Operating Systems	3	0	0	3
4	CS304PC	Object Oriented Programming through Java	3	0	0	3
5	CS305PC	Discrete Mathematics	3	0	0	3
6	EC306ES	Analog & Digital Electronics Lab	0	0	2	1
7	CS307PC	Operating Systems Lab	0	0	2	1
8	CS308PC	Java Programming Lab	0	0	2	1
9	SD310PC	Skill Development Course - III (Node JS/ React JS/ Django)	0	0	2	1
10	*MC311	Gender Sensitization Lab	0	0	2	0
		Total Credits	**15**	**0**	**10**	**19**

* MC is a mandatory course. The results is either Satisfactory or Not Satisfactory

II YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	MA401BS	Mathematical and Statistical Foundations	3	1	0	4
2	AI402PC	Artificial Intelligence	3	0	0	3
3	IT403PC	Database Management Systems	3	0	0	3
4	AI404PC	Design and Analysis of Algorithms	3	1	0	4
5	CS405PC	Software Engineering	3	0	0	3
6	IT406PC	Database Management Systems Lab	0	0	2	1
7	CS408PC	Software Engineering Lab	0	0	2	1
8	CS409PC	Real-time Research Project/Field-Based Research Project	0	0	2	1
9	SD411PC	Skill Development Course - IV (Prolog/ Lisp/ Pyswip)	0	0	2	1
10	*MC412	Environmental Science	2	0	0	0
		Total Credits	**17**	**2**	**8**	**21**

* MC is a mandatory course. The results is either Satisfactory or Not Satisfactory

III YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	AI501PC	Python Programming	3	0	0	3
2	CS502PC	Automata Theory and Compiler Design	3	1	0	4
3	SM503MS	Business Economics and Financial Analysis	3	0	0	3
4	AI504PC/ CY512PE	Data Analytics Using R	3	0	0	3
5		Professional Elective - I	3	0	0	3
6	AI505PC	Python Programming Lab	0	0	2	1
7	EN506HS	Advanced Communication Skills Lab	0	0	2	1
8	AI507PC	Data Analytics Lab (R Programming)	0	0	2	1
9	SD512PC	Skill Development Course - V (UI design- Flutter)	0	0	2	1
10	*MC510	Intellectual Property Rights	2	0	0	0
		Total Credits	**17**	**1**	**8**	**20**

* MC is a mandatory course. The results is either Satisfactory or Not Satisfactory

III YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	AI601PC	Computer Networks	3	0	0	3
2	CS602PC	Machine Learning	3	0	0	3
3	AI603PC/ CS622PE	Natural Language Processing	3	0	0	3
4		Professional Elective –II	3	0	0	3
5		Open Elective-I / MOOCs	3	0	0	3
6	CS604PC	Machine Learning Lab	0	0	2	1
7	AI605PC	Computer Networks Lab	0	0	2	1
8	AI606PC	Natural Language Processing Lab	0	0	2	1
9	AI608Proj	Industrial Oriented Mini Project/ Summer Internship/Skill Development Course - VI (DevOps)	0	0	2	2
10	*MC609	Constitution of India	2	0	0	0
11	*MC610	Cyber Security	2	0	0	0
		Total Credits	**19**	**0**	**8**	**20**

* MC is a mandatory course. The results is either Satisfactory or Not Satisfactory

IV YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	AI 701 PC/ CS732PE / IT 732PE	Deep Learning	3	0	0	3
2	AI702PC	Nature Inspired Computing	3	0	0	3
3		Professional Elective course - III	3	0	0	3
4		Professional Elective course -IV	3	0	0	3
5		Open Elective-II / MOOCs	3	0	0	3
6	AI703PC	Cloud Computing Lab	0	0	4	2
7	AI704PC	Deep Learning Lab	0	0	2	1
8	AI705PROJ	Project Stage - I	0	0	6	3
		Total Credits	15	0	12	21

IV YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1		Professional Elective course -V	3	0	0	3
2		Professional Elective course -VI	3	0	0	3
3		Open Elective-III / MOOCs	3	0	0	3
4	AI801PROJ	Seminar	0	0	2	1
5	AI802PROJ	Project Stage – II	0	0	18	9
		Total Credits	9	0	20	19

Professional Electives

Professional Elective-I

1	AI511PE	Software Process & Project Management
2	CS504PC / IT512PE / AI512PE	Data Mining
3	AI513PE	Web Programming
4	CS511PE / AI514PE	Cryptography & Network Security

Professional Elective - II

1	AI621PE	Software Testing Methodologies
2	AI622PE	Pattern Recognition
3	AI623PE	Introduction to Data Science
4	AI624PE / ME611PE	Industrial Robotics

Professional Elective - III

1	AI731PE	Design Patterns
2	CS701PC / IT734PE / AI732PE	Big Data Analytics
3	AI733PE	Image Processing
4	AI734PE / ME831PE	Principles of Entrepreneurship

Professional Elective-IV

1	AI741PE	Object Oriented Analysis and Design
2	AI742PE	Data Analytics and Visualization
3	AI743PE	Speech Recognition
4	AI744PE	Computer Security & Audit Assurance

Professional Elective - V

1	AI851PE	Web Services and Service Oriented Architecture
2	AI852PE	Predictive Analytics
3	CS864PE / IT864PE /	Computer Vision

	AI853PE	
4	AI854PE / Cy851PE	Quantum Computing

Professional Elective - VI

1	AI861PE / DS851PE	Design Thinking
2	AI862PE	Bioinformatics
3	AI863PE	Semantic Web and Social Networks
4	CS851PE / AI864PE / DS863PE	Block Chain Technologies

Open Elective – I

1	AI611OE	Database Management Systems
2	AI612OE	Information Retrieval System
3	AI613OE	Python Programming

Open Elective – II

1	AI721OE	Introduction to Machine Learning
2	AI722OE	Introduction to Natural Language Processing
3	AI723OE	Data Analytics

Open Elective – III

1	AI831OE	Semantic Web and Social Networks
2	AI832OE	Applications of Natural Language Processing
3	AI833OE	Data Visualization

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B.Tech. CSE (AI & ML)

Choice Based Credit System (CBCS)

Applicable From 2022-23 Admitted Batch

I YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	MA101BS	Matrix Algebra and Differential Equations	3	1	0	4
2	AP102BS	Applied Physics	3	1	0	4
3	CS103ES	Programming for Problem Solving	3	0	0	3
4	EE104ES	Basic Electrical Engineering	3	0	0	3
5	IT105ES	IT Workshop Lab	0	0	3	1.5
6	AP106BS	Applied Physics Lab	0	0	2	1
7	CS107ES	Programming for Problem Solving Lab	0	0	3	1.5
8	EE108ES	Basic Electrical Engineering Lab	0	0	2	1
9	EN109BS	Skill Development Course - I (Interchange - Business English)	0	0	2	1
10		Induction Programme				
		Total Credits	**12**	**2**	**12**	**20**

I YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	MA201BS	Vector Calculus and Transforms	3	1	0	4
2	CH202BS	Engineering Chemistry	3	1	0	4
3	AI203ES	Data Structures Through C++	3	1	0	4
4	EN204HS	English for Skill Enhancement	2	0	0	2
5	ME205ES	Computer Aided Engineering Graphics Lab	0	0	3	1.5
6	CH206BS	Engineering Chemistry Lab	0	0	2	1
7	AI207ES	Data Structures Through C++ Lab	0	0	2	1
8	EN208HS	English Language and Communication Skills Lab	0	0	3	1.5
9	MA209HS	Skill Development Course - II (Aptitude and Logic Building)	0	0	2	1
		Total Credits	**11**	**3**	**13**	**20**

MA101BS: MATRIX ALGEBRA AND DIFFERENTIAL EQUATIONS
(Common for CSE, ECE, IT, CSM, CSD & CSC)

I Year B.Tech. I Sem.   **L T P C**
                                                                  3 1 0 4

Course Objectives: To learn
- Determine the rank of the matrix and applying this concept to solving the system of linear equations.
- Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
- Geometrical approach to the mean value theorems and their application to the mathematical problems.
- Partial differentiation Finding maxima and minima of function of two and three variables.
- Methods of solving the differential equations of first or derand higher order.

Course Outcomes

After learning the contents of this subject the student must be able to
- Solve the system of equations using matrices and interpret the rank of matrix using different methods.
- Apply the concept of Eigen values, Eigen vectors in Cayley Hamilton theorem and Quadratic forms.
- Examine the applications of Mean value theorems. Apply the concept of partial derivatives to find the extreme values of functions.
- Analyze the solutions of ODE of first order having first degree.
- Solve higher order differential equations.

UNIT-I
Theory of 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, L-U decomposition method.

UNIT-II
Eigen values and Eigen vectors: Eigen values and Eigen vectors and their properties (without proof); 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.

UNIT-III
Mean value theorems & **Partial Differentiation and applications**: Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem. Taylor's Series. (All theorems without proof). Jacobian; Functional dependence and independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-IV
First Order ODE
Exact differential equations, Equations reducible to exact differential equations, Linear and Bernoulli's equations; Applications: Newton's law of cooling, Law of natural growth and decay. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT-V

Higher Order ODE

Second order linear differential equations with constant coefficients: non-Homogeneous terms of the type , polynomials in x, ; method of variation of parameters. Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation.

TEXT BOOKS
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. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.

REFERENCES BOOKS
1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

AP102BS: APPLIED PHYSICS
(Common for CSE, ECE, IT, CSM, CSD & CSC)

I Year B.Tech. I Sem.

L T P C
3 1 0 4

Course Objectives
The course primarily aims at understanding the behavior of matter in the condensed state and tries to explore the causes with reference to micro level mechanism of the solid matter.

- The objective of the first chapter is to study the micro level behavior of the quantum particles of the matter and assess the draw backs of the free electron theory leading to the introduction of the Band Theory of Solids.
- The second chapter focuses on the working principles and applications of basic semiconductor devices.
- In the third chapter task to discuss dielectric, magnetic properties of the materials and applications.
- In the fourth chapter plan to discuss on fabrication of nano particles and their characterization techniques.
- In the fifth chapter, it is expected to understand the basic principles behind the coherent artificial light source (LASER) with reference to their construction, mechanism, operation and classification etc. In second part of this chapter aimed at to study an advanced communication system presently ruling the world throughout i.e. Fiber Optic communication system.

Course Outcomes: After learning the contents of this paper the student must be able to
- **Predict** the behavior of particle and wave and **solve** their wave functions.
- **Distinguish** the different types of Semiconductor devices
- **Recall** and **choose** different materials based on their properties.
- **Categorize** Nano materials by fabrication methods.
- **Examine** normal light and laser light and its **application** in communication.

UNIT - I
Quantum Physics And Solids Quantum Mechanics
Introduction to quantum physics, blackbody radiation – Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law, Planck's radiation law - photoelectric effect –de-Broglie hypothesis- Davisson and Germer experiment –Heisenberg uncertainty principle - Born interpretation of the wave function – time independent Schrodinger wave equation - particle in one dimensional potential box.

Solids: Symmetry in solids, free electron theory (Drude & Lorentz) Variation of Fermi level- with temperature - Bloch's theorem -Kronig-Penney model – E-K diagram- effective mass of electron-origin of energy bands- classification of solids.

UNIT - II
Semiconductors And Devices
Intrinsic and extrinsic semiconductors – Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and characteristics of P-N Junction diode, Zener diode and bipolar junction transistor (BJT) – structure, materials, working principle and characteristics: LED, PIN diode, avalanche photo diode (APD) and solar cells.

UNIT - III

Dielectric, Magnetic And Energy Materials

Dielectric Materials: Basic definitions- types of polarizations (qualitative) – piezoelectric, ferroelectric and pyroelectric materials – applications – liquid crystal displays (LCD).

Magnetic Materials: Basic definitions- Hysteresis - soft and hard magnetic materials - magnetostriction, magnetoresistance - applications - memory devices, magnetic field sensors and multiferroics.

Energy Materials: Conductivity of liquid and solid electrolytes- super ionic conductors - materials and electrolytes for super capacitors - rechargeable ion batteries, solid fuel cells.

UNIT - IV
Nanotechnology
Introduction, Nanoscale, quantum confinement, surface to volume ratio, bottom-up fabrication: sol-gel, precipitation, combustion methods – top-down fabrication: ball milling - physical vapor deposition (PVD) - chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nano materials.

UNIT – V

Laser And Fiber Optics

Lasers: Laser beam characteristics-three quantum processes-Einstein coefficients and their relations-lasing action - pumping methods- ruby laser, He-Ne laser , CO_2 laser, semiconductor laser-applications of laser.

Fiber Optics: Introduction to optical fiber- advantages of optical Fibers - total internal reflection, construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers-losses in optical fiber- optical fiber for communication system – applications: medical, sensor and communication.

TEXT BOOKS
1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" A Text book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019
3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4 thEdition,2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2ndEdition,2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.

REFERENCE BOOKS
1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons,11th Edition, 2018.
3. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.
4. A.K. Bhandhopadhya - Nano Materials, New Age International, 1stEdition, 2007.
5. Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group.
6.   Energy Materials, Taylor & Francis Group, 1st Edition, 2022.

CS103ES: PROGRAMMING FOR PROBLEM SOLVING
(Common for CSE, ECE, IT, CSM, CSD & CSC)

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

Course Objectives

- T*o learn the fundamentals of computers.*
- *To understand the various steps in program development.*
- *To learn the syntax and semantics of the C programming language.*
- *To learn the usage of structured programming approaches in solving problems.*

Course Outcomes: *The student will learn*

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

UNIT – I
Introduction to Programming

Compilers, compiling and executing a program.

Representation of Algorithm - Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number Flowchart/Pseudocode with examples, Program design and structured programming

Introduction to C Programming Language: *variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators*

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops

I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

UNIT – II
Arrays, Strings, Structures and Pointers

Arrays: *one and two dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings*

Structures: *Defining structures, initializing structures, unions, Array of structures*

Pointers: *Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self- referential structures, usage of self referentia*l structures in linked list (no implementation) Enumeration data type

UNIT – III
Preprocessor and File handling in C
Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

UNIT – IV
Function and Dynamic Memory Allocation
Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

UNIT – V
Searching and Sorting
Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexity through the example programs

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

REFERENCE BOOKS
1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

EE104ES: BASIC ELECTRICAL ENGINEERING
(Common to CSM, CSD & CSC)

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

COURSE OBJECTIVES
- To introduce the concepts of electrical circuits and its components.
- To understand magnetic circuits, DC circuits and AC single phase and three phase circuits.
- To study and understand behavior of transformers.
- To study and understand behavior of DC machines.
- To study and understand behavior of AC machines.

COURSE OUTCOMES
- Recall the basics of electric, magnetic and electromagnetic circuits.
- Classify the types of machines and explain their working principles.
- Explain the construction of DC and AC machines.
- Analyze the characteristics of 1-Phase and 3-Phase machines.
- Interpret different losses in the machines and determine their efficiency and regulation.

UNIT- I
D.C Circuits
Electrical circuit elements (R,L,C), voltage and current sources, KVL & KCL, analysis of simple circuits with DC excitation. Superposition, Thevenin's and Norton's theorems. Time-domain analysis of first – order RL and RC circuits.

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

UNIT-III
Transformers
Ideal and practical transformers, equivalent circuits, losses in transformers, regulations and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV
DC Machines
DC generators: Construction, working, emf equation and classification, DC motors: construction, working, back emf, torque equation, classification, characteristics, Loss components and efficiency.

UNIT-V
AC Machines
Generation of rotating magnetic fields , construction and working of a three-phase induction motor, significance of torque-slip characteristic, starting methods, Loss components and efficiency, construction and working of synchronous generators.

SUGGESTED TEXT-BOOKS/REFERENCE-BOOKS

1. Basic electrical engineering -D. P. Kothari and I. J. Nagrath, 3rd edition 2010, Tata Mc Graw Hill.

2. D.C.Kulshreshtha, " Basic electrical engineering", Mc Graw Hill, 2009.

3. L.S. Bobrow , " Fundamentals of electrical engineering" , oxford university press, 2011.

4. Electrical and Electronics Technology, E. Hughes, 10th edition, Pearson, 2010.

5. Electrical engineering fundamental, Vincent Deltoro, second edition, Prentice Hall India, 1989.

IT105ES: IT Workshop

I Year B.Tech. I Sem.   **L T P C**
                                                                                              0 0 3 1.5

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

Course Outcomes
- Perform Hardware troubleshooting
- Understand Hardware components and inter dependencies
- Safeguard computer systems from viruses/worms
- Document/ Presentation preparation
- Perform calculations using spreadsheets

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

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

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

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

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

Task 3: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD
Task 1 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Us-

ing LaTeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

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

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

Excel

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

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

Task 2 : Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

PowerPoint

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

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

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

REFERENCE BOOKS

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dreamtech
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
7. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan– CISCO Press, Pearson Education.

AP106BS: APPLIED PHYSICS LAB
(Common for CSE, ECE, IT, CSM, CSD & CSC)

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

Course Objectives: The objectives of this course for the student are to:
- Understand the basic principles of quantum physics and band theory of solids.
- Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
- Study the fundamental concepts related to the dielectric, magnetic and energy materials.
- Identify the importance of nano scale, quantum confinement and various fabrications techniques.
- Study the characteristics of lasers and optical fibres.

Course Outcomes
- Recalls the appropriate Principle, theory and formula for the experiment.
- Choose the appropriate procedures and techniques for the different experiments.
- Identify the different measuring devices and meters to record the data accurately.
- Apply the mathematical concepts/equations to obtain results.
- Analyze the experimental applications in real life by interpreting the results.

LIST OF EXPERIMENTS:
1. Determination of work function and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode.
5. Input and output characteristics of BJT (CE, CB & CC configurations)
6. a) V-I and L-I characteristics of light emitting diode (LED)
   b) V-I Characteristics of solar cell
7. Determination of Energy gap of a semiconductor.
8. Determination of the resistivity of semiconductor by two probe method.
9. Study B-H curve of a magnetic material.
10. Determination of time constant of RC Circuit
11. a) Determination of the beam divergence of the given LASER beam
    b) Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
12. Understanding the method of least squares – torsional pendulum as an example.

Note: Any 8 experiments are to be performed.

REFERENCE BOOK
1. Applied Physics Lab Manual, CMREC, Hyd.
2. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

CS107ES: PROGRAMMING FOR PROBLEM SOLVING LAB

I Year B.Tech. I Sem.   **L   T   P   C**

                                                                    0   0   3   1.5

[Note:The programs may be executed using any available Open Source/ Freely available IDE Some of the Tools available are:
CodeLite: https://codelite.org/ Code:Blocks: http://www.codeblocks.org/
DevCpp : http://www.bloodshed.net/devcpp.html Eclipse: http://www.eclipse.org
This list is not exhaustive and is NOT in any order of preference]

Course Objectives: The students will learn the following:
- To work with an IDE to create, edit, compile, run and debug programs
- To analyze the various steps in program development.
- To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
- To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
- To Write programs using the Dynamic Memory Allocation concept.
- To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:
- formulate the algorithms for simple problems
- translate given algorithms to a working and correct program
- correct syntax errors as reported by the compilers
- identify and correct logical errors encountered during execution
- represent and manipulate data with arrays, strings and structures
- use pointers of different types
- create, read and write to and from simple text and binary files
- modularize the code with functions so that they can be reused

Practice sessions

a.   Write a simple program that prints the results of all the operators available in C (including pre/ post increment , bitwise and/or/not , etc.). Read required operand values from standard input.

b.   Write a simple program that converts one given data type to another using auto conversion and casting. Take the values from standard input.

Simple numeric problems

a.   Write a program for finding the max and min from the three numbers.

b.   Write the program for the simple, compound interest.

c.   Write a program that 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.

d.   Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:

      5 x 1 = 5

      5 x 2 = 10

5 x 3 = 15

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

Expression Evaluation

a. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula $s = ut+(1/2)at^2$ where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).

b. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

c. Write a program that finds if a given number is a prime number

d. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.

e. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

f. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

g. Write a C program to find the roots of a Quadratic equation.

h. Write a C program to calculate the following, where x is a fractional value. i. $1-x/2 +x^2/4-x^3/6$

j. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+$ $+x^n$. For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Arrays, Pointers and Functions

a. Write a C program to find the minimum, maximum and average in an array of integers.

b. Write a function to compute mean, variance, Standard Deviation, sorting of n elements in a single dimension array.

c. Write a C program that uses functions to perform the following:

d. Addition of Two Matrices

e. Multiplication of Two Matrices

f. Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be the same.

g. Write C programs that use both recursive and non-recursive functions

h. To find the factorial of a given integer.

i. To find the GCD (greatest common divisor) of two given integers.

j. To find x^n

k. Write a program for reading elements using a pointer into an array and display the values using the array.

l. Write a program for display values reverse order from an array using a pointer.

m.   Write a program through a pointer variable to sum of n elements from an array.

Files

a.   Write a C program to display the contents of a file to standard output device.

b.   Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.

c.   Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.

d.   Write a C program that does the following:

It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function)

Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function)

The program should then read all 10 values and print them back.

e.   rite a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).

Strings

a.   Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.

b.   Write a C program that converts a number ranging from 1 to 50 to Roman equivalent

c.   Write a C program that uses functions to perform the following operations:

d.   To insert a sub-string into a given main string from a given position.

e.   To delete n Characters from a given position in a given string.

f.   Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)

g.   Write a C program that displays the position of a character ch in the string S or − 1 if S doesn't contain ch.

h.   Write a C program to count the lines, words and characters in a given text.

Miscellaneous

a.   Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

b.   Write a C program to construct a pyramid of numbers as follows:

```
1               *           1           1           *
1 2             * *         2 3         2 2         * *
1 2 3           * * *       4 5 6       3 3 3       * * *
                                        4 4 4 4     * *
                                                    *
```

Sorting and Searching

a.   Write a C program that uses non recursive function to search for a Key value in a given

b.   list of integers using linear search method.

c.   Write a C program that uses non recursive function to search for a Key value in a given

d.   sorted list of integers using binary search method.

e.   Write a C program that implements the Bubble sort method to sort a given list of

f.   integers in ascending order.

g.   Write a C program that sorts the given array of integers using selection sort in descending order

h.   Write a C program that sorts the given array of integers using insertion sort in ascending order

i.   Write a C program that sorts a given array of names

TEXT BOOKS

1.   Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson

2.   B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS

1.   Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PHI

2.   E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill

3.   Yashavant Kanetkar, Let Us C, 18th Edition, BPB

4.   R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)

5.   Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.

6.   Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition

7.   Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

EE108ES: BASIC ELECTRICAL ENGINEERING LAB
(Common to CSM/CSD/CSC)

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

Course objectives
- To analyze a given network by applying various electrical laws and network theorems.
- To know the response of electrical circuits for different excitations
- To calculate, measure and know the relation between basic electrical parameters.
- To analyze the performance characteristics of DC and AC electrical machines.

Course Outcomes
- Verify basic electrical laws and network theorems.
- Analyze the transient responses of R, L and C circuits for different input conditions.
- Understand the measurement, calculation and relation between the basic electrical parame-e ters.
- Evaluate the basic characteristics of transformers and electrical machines through various testt-ing methods.

List of experiments/demonstrations:
1. Verification of Ohms Law.
2. Verification of KVL and KCL.
3. Transient Response of Series RL, RC and RLC circuits using DC excitation.
4. Verification of Thevenin's and Norton's theorems.
5. Verification of Superposition theorem.
6. Resonance in series RLC circuit.
7. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
8. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
9. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star).
10. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
11. Performance Characteristics of DC Shunt Motor.
12. Performance Characteristics of a Three-phase Induction Motor.
13. No-Load Characteristics of a Three-phase Alternator

EN109BS : INTERCHANGE - BUSINESS ENGLISH
(Common for CSE, ECE, IT, CSM, CSD & CSC)

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

Introduction:

The rapid break down of national barriers over the last decade has resulted in English language skills acquiring a great deal of importance in business sector. In a world with ever-growing levels of globalization and inter connectivity, the significance of English increased rapidly. But lack of expo-sure towards English Communication is a serious handicap forany aspirants. By recognizing this, the institution has focused to train the Engineering Students in Business Communication through **"Inter-change"**. Interchange is a multi-skills English module Course that has been used by over 50 million students worldwide. It has been introduced in B.Tech first year to prepare the students to get the advantage when enter the job world. In today's globalization, it is more significant to show employers that you can communicate in English effectively in every-day business circumstances.

Course Objectives
The trusted methodology and proven approach help the students to learn English.
- To train the students to qualify the Interchange examination.
- Develop study skills and communication skills in formal and informal situations.
- The clear communicative approach delivers results and helps students become confident speak-ers of English right from the beginning.

Course Outcomes: Students should be able to
- Use English Language effectively in spoken and written forms.
- Comprehend the given texts and respond appropriately.
- Communicate confidently and clearly in various contexts or different situations.

UNIT I
- **Pronunciation:** Linked sounds -- Stress with compound nouns -- listening to the Descriptions.
- **Grammar:** Relative pronouns -- Gerundsand Noun Phrases**.**
- **Speaking:** Describing personalities -- Talking about possible careers and deciding between two jobs.
- **Reading /Writing:** Reading about unusual social networking sites and different types of work-places --Writing a description about of a good friend and about two career choices.

UNIT II
- **Pronunciation:** Unreleased consonants and Intonation in Complex sentence -- listening to peo-ple for New stories and Information about living aboard.
- **Grammar:** Requesting with Modals -- If clauses -- Past tense forms.
- **Speaking:** Making formal and informal requests – messages -- Narrating a story and talking about expanding yours horizons.
- **Reading /Writing:** Reading about the life reliability of online content -- moving to another country

and problem with ride sharing--Writing a personal account-- pamphlet for tourists and critical online review.

UNIT III

- **Pronunciation:** Contrastive stress -- Auxiliary Verbs reduction--Listening for Solution-- Additional information-- New year's Resolution.

- **Grammar:** Prepositions of cause --Phases and present tenses forms.

- **Speaking:** Identifying and describing Problems -- Coming up with solutions -- Learner choices and Learning methods and life skills.

- **Reading** /**Writing:** Reading about a creative solution, Different Studying style, Futuristic and their Predications for the year 2050 -- Writing about a skill-- Message of Advice and Biography.

UNIT IV

- **Pronunciation**: Sentence stress -- reduction of have and been words and past modals.

- **Grammar:** Future tense forms -- Time clauses and Infinitive clauses.

- **Speaking:** Talkingabout things done -- Historic events and things to be accomplished in the future.

- **Reading** /**Writing:** Reading about conflict with a friend-- what makes some Advertisement memorable? --Writing a message of Apology--Wed commercial about a complicated situation.

UNIT V

- **Pronunciation:** Review of Stress in Compound nouns-- Intonation in Question Tags-- listening for parts of Movie and find solutions to everyday annoyances.

- **Grammar:** Passive voice and Relative Clause.

- **Speaking:** Describing qualities for Success -- Interviewing for a job-- Drawing conclusion-- Giving Opinions for and against Controversial topics.

- **Reading** /**Writing:** Reading about Unexplained events -- Plagiarism in the digital Age -- Writing about complicated situations -- process and Persuasive Essay-- Writing a Personal statement for an Application.

PRESCRIBED TEXTBOOKS

- Jack C. Richards & Jonathan Hull and Susan proctor (2017) "Interchange Book-2 Fifth Edition" by Cambridge University Press.
- Jack C. Richards & Jonathan Hull and Susan proctor (2017) "Interchange Book-3 Fifth Edition" by Cambridge University Press.

Website links:

- http://www.cambridge.org
- http://www.learnenglish.com
- http://www.eslgames.com
- https://www.cambridgeenglish.org/supporting-teachers/
- https://britishcouncil.zoom.us/webinar/register/WN_Ddm6jFvxTpWAfYwWeZzX_Q
- https://www.cambridge.org/gb/education/elevate-trial/

- https://learnenglishteens.britishcouncil.org/skills/listening

MA201BS: VECTOR CALCULUS AND TRANSFORMS

I Year B.Tech. II Sem. **L T P C**
                                   3 1 0 4

Course Objectives: To learn

- Concept, properties of Laplace transform and solving ordinary differential equations using Lapp lace transforms techniques.
- Evaluation of double integrals. Evaluation of improper integrals using Beta and Gamma func-c tions.
- The physical quantities involved in engineering field related to vector valued functions.
- The basic properties of vector valued functions and their applications to line, surface and voll- ume integrals.

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

- Find the Laplace transforms for given functions.
- Apply the Laplace transforms techniques for solving ODE.
- Solve the double integrals and evaluate the improper integrals using Beta and Gamma funce tions.
- Determine gradient, divergent and curl by using vector differentiation.
- Evaluate the line, surface and volume integrals and converting them from one to another.

UNIT-I

Laplace Transforms

Laplace Transforms; Laplace Transform of standard functions; first shifting theorem; Laplace trans- forms of functions when they are multiplied and divided by 't'. Laplace transforms of derivatives and integrals of function; Evaluation of integrals by Laplace transforms; Laplace transforms of Special functions; Laplace transform of periodic functions.

UNIT- II
Inverse Laplace Transforms

Inverse Laplace transform by different methods, convolution theorem (without proof), solving ODEs by Laplace Transform method.

UNIT-III
Beta And Gamma Functions And Double Integration

Beta and Gamma Functions, their properties, evaluation of improper integral using Beta and Gamma Functions. Evaluation of Double Integrals (Cartesian and polar coordinates); Change of order of inte- gration (only Cartesian form); Change of variables.

UNIT-IV

Vector Differentiation

Vector point functions and scalar point functions. Gradient Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

UNIT-V

Vector Integration

Line, Surface and Volume Integrals. Vector integral theorems: Green's, Gauss divergence and Stoke's (without proof) and their applications.

TEXT BOOKS

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. B.V.Ramana, A text Book of Engineering Mathematics, Tata Mc Graw Hill.

REFERENCES

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9[th]Edition, Pearson, Reprint, 2002.

2. S.R.K. Iyengar and R. K. Jain, Advanced Engineering Mathematics, Narosa Publication.

CH202BS: ENGINEERING CHEMISTRY

I Year B.Tech. II Sem.   **L T P C**
                                                              3 1 0 4

Course Objectives

- To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
- To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
- To acquire the knowledge of electrochemistry and water treatment which are essential for the Engineers and in industry.
- To identify the type of corrosion and apply various principles for its preventions which are essential for an engineer in industry
- To impart the basic knowledge about solid fuel- coal, liquid fuels- petroleum, kerosene oil and-diesel, gaseous fuels – LPG, natural gas their origin, classification, calorific value and its determination.

Course Outcomes

- The basic concepts included in this course will help the student to gain:
- The knowledge of the physical & chemical parameters of quality of water and explain the process of water treatment
- The knowledge to analyze atomic, molecular and electronic changes, band theory related to conductivity.
- The required principles and concepts of electrochemistry, batteries, polymers and their applications
- Identify the mechanism of corrosion of materials on basis of electrochemical approach and devise corrosion control methods.

UNIT-I

Water technology: Sources of water, Impurities in water, Hardness of water, Temporary and permanent hardness, Units of hardness. Estimation of temporary and permanent hardness of water-EDTA method, Numerical problems. Potable water Treatment-Specifications, Steps involved in Treatment-Sedimentation, Coagulation, Filtration, Sterilization , Chlorination and Break point Chlorination, ozonization. Boiler Troubles-Scales and sludges, Caustic embrittlement, Priming and foaming, Boiler corrosion. Internal conditioning methods - Phosphate, Carbonate, Calgon and Colloidal conditioning. External conditioning method- Ion exchange method.Desalination of Brackish Water- Reverse Osmosis and Electro dialysis

UNIT-II

Energy Sources: Introduction, Calorific value of fuel – HCV, LCV- Dulongs formula (Numerical problem).Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process. Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages

UNIT III

Electrochemistry & Batteries: Electrochemistry: Introduction, Electrode potential, Standard electrode potential ,Electro chemical series and its applications. Electrochemical cell, E.M.F of the cell, Nernst equation- derivation and applications- Determination of EMF, Determination of Equilibrium constant Numerical problems. Types of electrodes- Construction and working and determination of pH using Calomel electrode, Quinhydrone electrode and Glass electrode. Batteries: Construction and working of primary (Lithium cell), secondary (Lead acid storage battery and Lithium-ion battery). Fuel cells: Construction, working and application of H2-O2 and methanol-oxygen fuel cells. Introduction to Solar cells and its applications

UNIT IV

Corrosion and its Control: Introduction, Definition, Causes and effects of corrosion. Theories of chemical and electrochemical corrosion.Types of corrosion- Galvanic, Waterline and Pitting corrosion, Factors affecting rate of corrosion.Corrosion control methods- Cathodic protection-Sacrificial anode and impressed current cathodic methods. Surface coatings- Metallic coatings, hot dipping, galvanizing and tinning, Electroplating.

UNIT V

Engineering Materials and Corrosion: **Polymers:** Types of polymerizations (addition, condensation and copolymerization). Mechanism of Free radical Addition polymerization .Plastics: Thermoplastic and Thermosetting resins. Preparation , Properties and engineering applications of PVC, Bakelite, Teflon Fibre Reinforced Plastics (FRP) – applications. Rubbers: Natural rubber and its vulcanization. Bio-degradable polymers-preparation and applications of Polyvinyl acetate .Conducting polymers-Characteristics and Classification with examples-mechanism of conduction in trans polyacetylene and applications of conducting polymers. **Smart materials-** Introduction, classification and their engineering applications-Shape memory materials- Poly L- Lactic acid.

TEXT BOOKS
1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi and Rath, Cengage learning 2nd Edition 2022.
3. A text book of Engineering Chemistry by M. Thirumala Chary, E.Laxminarayana and K. Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

REFERENCES BOOKS
1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015).
2. Text book of Engineering Chemistry by S.S.Dara, S Chand Publications 2022

AI203ES: DATA STRUCTURES THROUGH C++
(Common for CSM, CSD, and CSC)

I Year B.Tech. II Sem.   **L T P C**

         3 1 0 4

Prerequisites: Programming for Problem Solving

Course Objectives

- To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures.
- To understand the notations used to analyze the Performance of algorithms.
- To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
- To choose an appropriate data structure for a specified application.
- To understand and analyze various searching and sorting algorithms.
- To learn to implement ADTs such as lists, stacks, queues, trees, graphs, search trees in C++ to solve problems.

Course Outcomes

- Ability to choose appropriate data structures to represent data items in real world problems.
- Ability to analyze the time and space complexities of algorithms.
- Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.
- Able to analyze and implement various kinds of searching and sorting techniques.

UNIT - I

C++ Programming Concepts: Review of C, input and output in C++, functions in C++- value parameters, reference parameters, Parameter passing, function overloading, function templates, Exceptions-throwing an exception and handling an exception, arrays, pointers, new and delete operators, class and object, access specifiers, friend functions, constructors and destructor, Operator overloading, class templates, Inheritance and Polymorphism.

Basic Concepts - Data objects and Structures, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Complexity Analysis Examples, Introduction to Linear and Non Linear data structures.

UNIT - II

Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

Linear list ADT-array representation and linked representation, Singly Linked Lists- Operations-Insertion, Deletion, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.

Stack ADT, definition, array and linked implementations, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition, array and linked Implementations, Circular queues-Insertion and deletion operations.

UNIT - III

Trees – definition, terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees-array and linked representations, Binary Tree traversals, Threaded binary trees, Priority Queues –Definition and applications, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

UNIT - IV

Searching - Linear Search, Binary Search, Hashing-Introduction, hash tables, hash functions, Overflow Handling, Comparison of Searching methods.

Sorting- Radix Sort, Quick sort, Heap Sort, Merge sort, Comparison of Sorting methods.

UNIT - V

Graphs–Definitions, Terminology, Applications and more definitions, Properties, Graph ADT, Graph Representations- Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS, Complexity analysis,

Search Trees-Binary Search Tree ADT, Definition, Operations- Searching, Insertion and Deletion, Balanced search trees-AVL Trees-Definition and Examples only, B-Trees- Definition and Examples only, Red-Black Trees-Definitions and Examples only, Comparison of Search Trees.

TEXT BOOKS

1. Data structures, Algorithms and Applications in C++, 2nd Edition, Sartaj Sahni, Universities Press.
2. Data structures and Algorithms in C++, Adam Drozdek, 4th edition, Cengage learning.

REFERENCE BOOKS

1. Data structures with C++, J. Hubbard, Schaum's outlines, TMH.
2. Data structures and Algorithms in C++, M.T. Goodrich, R. Tamassia and D. Mount, Wiley India.
3. Data structures and Algorithm Analysis in C++, 3rd edition, M. A. Weiss, Pearson.
4. Classic Data Structures, D. Samanta, 2nd edition, PHI.

EN204HS: ENGLISH FOR SKILL ENHANCEMENT

(Common for CSE, ECE, IT, CSM, CSD & CSC)

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

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of "English for Skill Enhancement" has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing.

Course Objectives: This course will enable the students to:

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.

2. Develop study skills and communication skills in various professional situations.

3. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

Course Outcomes: Students will be able to:

CO-1: Choose appropriate vocabulary and sentence structures for oral and written   communication.

CO-2: Demonstrate their understanding of the rules of functional grammar.

CO-3: Compare and Contrast the given text and respond appropriately.

CO-4: Take an active part in drafting paragraphs, letters, essays, description and reports in various contexts.

CO-5: Develop basic proficiency in reading and writing.

UNIT-I

Chapter entitled '***Toasted English***' **by R.K.Narayan** from ***"English:Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes- Synonyms and Antonyms.

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Importance of Proper Punctuation- Paragraph writing – Types, Features of a Paragraph -Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT –II

Chapter entitled **'Appro JRD' by Sudha Murthy** from ***"English: Language, Context and Culture"*** ***published*** by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs.

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

Reading: Sub-Skills of Reading – Skimming and Scanning.

Writing: Defining-Describing People, Objects, Places and Events.

UNIT –III

Chapter entitled '**Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al** from "*English: Language, Context and Culture"* published by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Confused- Idioms and Phrases.

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

Reading: Sub-Skills of Reading -Intensive Reading and Extensive Reading.

Writing: Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, and Job Application with CV/Resume.

UNIT –IV

Chapter entitled '**Art and Literature' by Abdul Kalam** from *"English: Language, Context and Culture"* published by Orient BlackSwan, Hyderabad.

Vocabulary: Standard Abbreviations in English.

Grammar: Redundancies in Oral and Written Communication.

Reading: Survey, Question, Read, Recite and Review (SQ3R Method).

Writing: Essay Writing and Précis Writing.

UNIT –V

Chapter entitled '**Go, Kiss the World' by Subroto Bagchi** from *"English: Language, Context and Culture"* published by Orient BlackSwan, Hyderabad.

Vocabulary: Technical Vocabulary and their usage

Grammar: Error identification.

Reading: Techniques for Reading Comprehension.

Writing: Technical Reports- Characteristics of a Report - Structure of Reports (Manuscript Format) and Advertisement making.

TEXT BOOK

1.   "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

REFERENCE BOOKS

1.   Effective Academic Writing by Liss and Davis (OUP)
2.   Richards, Jack C. (2022) Interchange Series. Introduction, 1, 2, 3. Cambridge University Press

3.   Wood, F.T. (2007). Remedial English Grammar. Macmillan.

4.   Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd.

5.   Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.

6.   Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition.

ME205ES: COMPUTER AIDED ENGINEERING GRAPHICS LAB
(Common for CSC, CSD, & CSM)

I Year B.Tech. II Sem.   **L T P C**
                                           0 0 3 1.5

Pre-requisites: Nil

Course Objectives
- To develop the ability of visualization of different objects through h technical drawings
- To acquire computer drafting skill for communication of concepts, ideas in the design of engi-i neering products

Course Outcomes: At the end of the course, the student will be able to:
- Apply computer aided drafting tools to create 2D and 3D objects
- sketch conics and different types of solids
- Appreciate the need of Sectional views of solids and Development of surfaces of solids
- Read and interpret engineering drawings
- Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting.

UNIT - I

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Scales — Plain & Diagonal, Conic Sections including the Rectangular Hyperbola — General method only Cycloid, Epicycloid and Hypocycloid, Introduction to Computer aided drafting — views, com- mand s and conics

UNIT- II

Orthographic Projections: Principles of Orthographic Projections — Conventions Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections — points, lines and planes

UNIT - III

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

UNIT - IV

Development of Surfaces of Right Regular Solids — Prism, Cylinder, Pyramid and Cone, Develop- ment of surfaces using computer aided drafting

UNIT - V

Lsometric: Projections: Principles of lsometric Projection — Isometric Scale — lsometric Views — Conventions — lsometric Views of Lines, Plane Figures, Simple and Compound Solids — Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa —Conventions. Conversion of orthographic projection into isometric view using computer aided drafting.

TEXT BOOKS

1. Engineering drawing N.D. Bhatt / Charotar
2. Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapoovan, Vikas: S. Chand and company Ltd.

REFERENCE BOOKS

1. Engineering Drawing, Basant Agrawal and C M Agrawal, Third Edition McGraw Hill
2. Engineering Graphics and Design, WILEY, Edition 2020
3. Engineering Drawing, M. B. Shah, B.C. Rane / Pearson.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford
5. Computer Aided Engineering Dra.v.ng — K Balaveera Reddy et al — CBS Publishers

Note: Both Internal as well as External examinations are conducted using Computer Aided Drafting.

CH206BS: Engineering Chemistry Lab

I Year B.Tech. II Sem. **L T P C**

0 0 2 1

LIST OF EXPERIMENTS: (PERFORM ANY 10 EXPERIMENTS)

Volumetric Analysis:

Experiment No. 1: Estimation of Hardness of water by EDTA Complexometry method

Conductometry:

Experiment No 2: Determination of the concentration of strong acid HCl by Conductometry

Experiment No 3: 3.Determination of the concentration of weak acid CH3COOH by Conductometry

Potentiometry:

Experiment No 4: Estimation of Ferrous iron by Potentiometry using dichromate

Experiment No 5: Estimation of the amount of strong acid HCl by potentiometry.

pH Metry:

Experiment No 6: Determination of strong acid concentration using pH meter

Preparation:

Experiment No 7: Preparation of Bakelite.

Experiment No 8: Preparation Nylon 6,6

Viscosity

9.   Determination of viscosity of lubricant by using Ostwald Viscometer

Preparation

10.   Preparation of Hand Sanitizer

Virtual Lab experiments

1.   Construction of Fuel cell and its working.

2.   Smart materials for Biomedical applications.

3.   Batteries for electrical vehicles.

4.   Functioning of solar cell and its applications.

TEXT BOOKS

1.   Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)

2.   Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.

3.   College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

AI207ES: DATA STRUCTURES THROUGH C++ LAB
(Common for CSM, CSD, AND CSC)

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

Prerequisites: A Course on "Programming for problem solving".

Course Objectives
- To write and execute programs in C++ to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees.
- To learn to write C++ programs to implement various sorting and searching algorithms.

Course Outcomes
- Able to identify the appropriate data structures and algorithms for solving real world problems.
- Able to implement various kinds of searching and sorting techniques.
- Able to implement data structures such as stacks, queues, Search trees, and hash tables to solve various computing problems.

List of Experiments
1. Write a C++ program that uses functions to perform the following:

   a) Create a singly linked list of integers.

   b) Delete a given integer from the above linked list.

   c) Display the contents of the above list after deletion.
2. Write a template-based C++ program that uses functions to perform the following:

   a) Create a doubly linked list of elements.

   b) Delete a given element from the above doubly linked list.

   c) Display the contents of the above list after deletion.
3. Write a C++ program that uses stack operations to convert a given infix expression into its postfix equivalent, Implement the stack using an array.
4. Write a C++ program to implement a double ended queue ADT using an array, using a doubly linked list.
5. Write a C++ program that uses functions to perform the following:

   a) Create a binary search tree of characters.

   b) Traverse the above Binary search tree recursively in preorder, in order and post order,
6. Write a C++ program that uses function templates to perform the following:

   a) Search for a key element in a list of elements using linear search.

   b) Search for a key element in a list of sorted elements using binary search.
7. Write a template-based C++ program that implements Quick sort algorithm to arrange a list of elements in ascending order.
8. Write a C++ program that implements Heap sort algorithm for sorting a list of integers in ascending order.

9.   Write a C++ program that implements Merge sort algorithm for sorting a list of integers in ascending order

10.   Write a C++ program to implement all the functions of a dictionary (ADT) using hashing.

11.   Write a C++ program that implements Radix sort algorithm for sorting a list of integers in ascending order

12.   Write a C++ program that uses functions to perform the following:

   a) Create a binary search tree of integers.

   b) Traverse the above Binary search tree non-recursively in inorder.

13.   Write a C++ program that uses functions to perform the following:

   a) Create a binary search tree of integers.

   b) Search for an integer key in the above binary search tree non-recursively.

   c) Search for an integer key in the above binary search tree recursively.

REFERENCE BOOKS

1.   Data Structures using C++, D. S. Malik, 2nd edition, Cengage learning.

2.   Data Structures using C++, V. Patil, Oxford University Press.

3.   Fundamentals of Data structures in C++, 2nd edition, E. Horowitz, S. Sahni and D. Mehta, Universities Press.

4.   C++ Plus Data Structures, 4th edition, Nell Dale, Jones and Bartlett student edition.

EN208HS: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB
(Common for CSE, ECE, IT, CSM, CSD & CSC)

I Year B.Tech. II Sem.   **L T P C**
                                                                0 0 3 1.5

INTRODUCTION

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

Course Objectives:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize the impact of   dialects.
- To train students to use language appropriately for public speaking, group discussions and interviews

Course Outcomes: Students will be able to

- **Use** English with proper pronunciation.
- **Describe** the persons, places, objects and events.
- **Choose** appropriate vocabulary for oral and written communication.
- **Develop** speaking skills with clarity and confidence.

English Language and Communication Skills Lab (ELCS) shall have two parts:

a.   Computer Assisted Language Learning (CALL)Lab

b.   Interactive Communication Skills (ICS)Lab

    The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I
CALL Lab:

Listening Skill- Its importance-Types-Barriers-Effective Listening.

Introduction to Phonetics – Speech Sounds- Vowels and Consonants -Minimal Pairs- Past Tense Marker and Plural Marker.

ICS Lab:

Ice-Breaking Activity and JAM Session.

Exercise – II

CALL Lab: Structure of Syllables - Word Stress - Weak Forms and Strong Forms –Intonation.

ICS Lab: Features of Good Conversation- Situational Dialogues – Role Play- Expressions in Various Situations –Telephone Etiquette.

Exercise - III

CALL Lab: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).

ICS Lab: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing.

Exercise – IV

CALL Lab: Listening for General Details - Listening Comprehension.

ICS Lab: Non-verbal Communication- Making a Short Speech -Extempore- Power Point Presentation.

Exercise – V

CALL Lab: Listening for Specific Details - Listening Comprehension.

ICS Lab: Debate and Group Discussion.

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**

    The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self-study by students.

    System Requirement (Hardware component):

    Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

    i)   Computers with Suitable Configuration

    ii)   High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**

    The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.

SUGGESTED SOFTWARE

1. Oxford Advanced Learner's Compass, 10th Edition.
2. English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
3. English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
4. English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
5. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

REFERENCE BOOKS

1.   (2022). *English Language Communication Skills-Lab Manual cum Workbook.* Cengage Learn-
      ing India Pvt. Ltd.

2.   Kumar, Sanjay & Lata, Pushp. (2019). *Communication Skills: A Workbook.* Oxford University
      Press

3.   Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.*Orient
      Black Swan Pvt. Ltd.

4.   Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach.* Cambridge
      University Press

MA209HS: SKILL DEVELOPMENT COURSE
(APTITUDE AND LOGIC BUILDING)

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

Course Objectives

- To enhance the problem-solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of competitive examinations.

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

- Evaluate the problems on Percentage, profit and loss.
- Solve the problems given on Partnerships and simple and compound interest.
- Evaluate the problems on Time & Work, Pipes & Cisterns, Boats & Streams.
- Determine the solutions for the problems based on Time & Distance, Trains.
- Interpret the diagrams and solve the questions related to clocks and calendar.

Unit-I
Percentages and Profit & Loss
Percentages: Percentage difference, Percentage increase & decrease, fraction to Percentage, Percentage vs per cent. Profit & Loss: Cost price, selling price, percentages of profit & loss.

Unit-II
Partnerships and Simple & Compound interest
Partnerships: definition, Ratio of division of gains, working and sleeping partners.

Simple &Compound interest: Principal amount, time & rate of interest.

Unit-III
Time & Work, Pipes & Cisterns and Boats & Streams
Time & Work: Introduction, time & work by using fractions and percentages.

Pipes & Cisterns: Inlet, Outlet, time to emptying & filling a tank.

Boats & Streams: Upstream, downstream, still water, stream related problems, average speed, distance, speed when time is given.

Unit-IV
Time & Distance and Trains
Time & Distance: Time, Speed, Average and Distance related problems.

Trains: Pass a point, Stationary object of length, moving objects same & opposite directions.

Unit-V
Clocks and Calendars
Clocks: Introduction, minute space, minute& hour hands angle between hands.

Calendars: Odd & Even day, week, leap& Ordinary year, century.

TEXTBOOK
1. Quantitative aptitude by Dr.R.S. Agarwal, S.Chand publications.
2. Verbal and Non-Verbal Reasoning by Dr.R.S.Agarwal.

REFERENCES
1. Fast track Objective Arithmetic by Rajesh verma – Arihant Publications: fourth edition (2018).
2. Quantitative aptitude for all Competitive Examinations by Abhijith Guha – McGraw Hill Education: sixth edition (2016).

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B.Tech. CSE (AI & ML)
Choice Based Credit System (CBCS)
Applicable From 2022-23 Admitted Batch

II YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	EC301ES	Analog & Digital Electronics	3	0	0	3
2	CS302PC	Computer Organization and Architecture	3	0	0	3
3	CS303PC	Operating Systems	3	0	0	3
4	CS304PC	Object Oriented Programming through Java	3	0	0	3
5	CS305PC	Discrete Mathematics	3	0	0	3
6	EC306ES	Analog & Digital Electronics Lab	0	0	2	1
7	CS307PC	Operating Systems Lab	0	0	2	1
8	CS308PC	Java Programming Lab	0	0	2	1
9	SD310PC	Skill Development Course - III (Node JS/ React JS/ Django)	0	0	2	1
10	*MC311	Gender Sensitization Lab	0	0	2	0
		Total Credits	**15**	**0**	**10**	**19**

* MC is a mandatory course. The results is either Satisfactory or Not Satisfactory

II YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	MA401BS	Mathematical and Statistical Foundations	3	1	0	4
2	AI402PC	Artificial Intelligence	3	0	0	3
3	IT403PC	Database Management Systems	3	0	0	3
4	AI404PC	Design and Analysis of Algorithms	3	1	0	4
5	CS405PC	Software Engineering	3	0	0	3
6	IT406PC	Database Management Systems Lab	0	0	2	1
7	CS408PC	Software Engineering Lab	0	0	2	1
8	CS409PC	Real-time Research Project/Field-Based Research Project	0	0	2	1
9	SD411PC	Skill Development Course - IV (Prolog/ Lisp/ Pyswip)	0	0	2	1
10	*MC412	Environmental Science	2	0	0	0
		Total Credits	**17**	**2**	**8**	**21**

* MC is a mandatory course. The results is either Satisfactory or Not Satisfactory

EC301ES: ANALOG & DIGITAL ELECTRONICS
(Common to IT and CSM Branches)

B.TECH. II Year I Sem.   **L T P C**
                                                                  3 0 0 3

Course Objectives

·   To introduce components such as diodes, BJTs and FETs

·   To know the applications of components

·   To give understanding of various types of amplifier circuits

·   To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems

·   To understand the concepts of combinational logic circuits and sequential circuits.

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

·   Know the characteristics of various components

·   Understand the utilization of components.

·   Design and analyze small signal amplifier circuits

·   Learn Postulates of Boolean algebra and to minimize combinational functions

·   Design and analyze combinational and sequential circuits

·   Know about the logic families and realization of logic gates.

UNIT - I

Diodes and Applications: Junction diode characteristics. Open circuited p-n lunction, p-n junction as a rectifier, V-l characteristics, effect of temperature, diode resistance, diffusion capacitance. Diode switching times, breakdown diodes, Tunnel diodes, Photo diode LED.

Diode Applications - clipping circuits, comparators, Half wave rectifier, Full wave rectifier rectifier with capacitor filter.

UNIT- II

BJTs: Transistor characteristics: The junction transistor, transistor as an amplifier CB, CE, CC configurations. comparison of transistor configurations, the operating point, self-bias or Emitter bias, bias compensation, thermal runaway and stability transistor at low frequencies, CE amplifier response gain bandwidth product. Emitter follower, RC coupled amplifier, two cascaded CE and multistage CE amplifiers.

UNIT - III

FETs and Digital Circuits: FETs: JFET, V-l characteristics, MOSFET low frequency CS and CD amplifiers, CS and CD amplifiers.

Digital Circuits: Digital (binary) operations of a system, OR gate AND gate NOT EXCLUSIVE OR gate, De Morgan Laws, NAND and NOR DTL gates, modified DTL gates HTL and TTL gates. Output stages, RTL and DCTL, CMOS, Comparison of logic families.

UNIT - IV

Combinational Logic Circuits: Basic Theorems and Properties of Boolean Algebra, Canonical and Standard Forms, Digital Logic Gates The Map Method, Product-of-Sums Simplification, Don't-Care Conditions, NAND and NOR implementation. Exclusive-OR Function, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers.

UNIT - V

Sequential Logic Circuits: Sequential Circuits, Storage Elements: Latches and flip flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Shift Registers, Ripple Counters, Synchronous Counters, Random-Access Memory, Read-Only Memory.

TEXTBOOKS

1. Integrated Electronics: Analog and Digital Circuits and Systems,2/e Jaccob Millman, Christos Halkias and Chethan D. Parikh, Tata McGraw-Hill Education, India. 2010
2. Digital Design, 5/e, Morris Mano and Michael D. Cilette, Pearson, 2011

REFERENCE BOOKS

1. Electronic Devices and circuits Jimmy J Cathey, Schaum's outline series, 1988.
2. Digital Principles, 3/e, Roger L Tokheim, Schaum's outline series, 1994

CS302PC: COMPUTER ORGANIZATION AND ARCHITECTURE

(Common to CSE, IT, CSM and CSC Branches)

B.TECH. II Year I Sem. **L T P C**
3 0 0 3

Course Objectives

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

Course Outcomes

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

UNIT - I

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

UNIT - II

Micro programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

UNIT - III

Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

UNIT - IV

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

UNIT - V

Reduced Instruction Set Computer: CISC Characteristics, RISC Characteristics.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.

Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor arbitration, Inter-processor communication and synchronization, Cache Coherence.

TEXT BOOK
1.   Computer System Architecture – M. Moris Mano, Third Edition, Pearson/PHI.

REFERENCES
1.   Computer Organization – Car Hamacher, Zvonks Vranesic, SafeaZaky, V[th] Edition, McGraw Hill.
2.   Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
3.   Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

CS303PC: OPERATING SYSTEMS

(Common to CSE, IT, CSM, CSD and CSC Branches)

B.TECH. II Year I Sem.   **L T P C**
                                                                           3 0 0 3

Prerequisites

• A course on "Computer Programming and Data Structures".

Prerequisites:

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

Course Objectives

• Provide an introduction to operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)

• Introduce the issues to be considered in the design and development of operating system

• Introduce basic Unix commands, system call interface for process management, inter process communication and I/O in Unix

Course Outcomes

• Will be able to control access to a computer and the files that may be shared

• Demonstrate the knowledge of the components of computer and their respective roles in computing.

• Ability to recognize and resolve user problems with standard operating environments.

• Gain practical knowledge of how programming languages, operating systems, and architectures interact and how to use each effectively.

UNIT-I

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

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

UNIT-II

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

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

UNIT-III

Process Management and Synchronization-The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors

Inter process Communication Mechanisms: IPC between processes on a sing le computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

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

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

TEXTBOOKS
1. Operating System Principles-Abraham Silberchatz, PeterB.Galvin, Greg Gagne 7th Edition, John Wiley.
2. Advanced programming in the UNIX environment, W.R.Stevens, Pearson education.

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

CS304PC: OBJECT ORIENTED PROGRAMMING THROUGH JAVA
(Common for CSE, IT, CSM, CSD and CSC Branches)

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

Course Objectives

• To understand the basic object-oriented programming concepts and apply the min problem solving.
• To illustrate inheritance concepts for reusing the program.
• To Demonstrate multitasking by using multiple threads and event handling
• To Develop data-centric applications using JDBC.
• To Understand the basics of java console and GUI based programming

Course Outcomes

• Demonstrate the behaviour of programs involving the basic programming constructs like control structures, constructors, string handling and garbage collection.
• Demonstrate the implementation of inheritance(multilevel, hierarchical and multiple) by using extend and implement keywords
• Use multithreading concept sto develop inter process communication.
• Understand the process of graphical user interface design and implementation using AWT or swings.
• Develop applets that interact abundantly with the client environment and deploy on the server.

UNIT-I

Object oriented thinking and Java Basics- Need for OOP paradigm, summary of OOP concepts, coping with complexity, abstraction mechanisms. A way of viewing world – Agents, responsibility, messages, methods, 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 program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, method binding, inheritance, overriding and exceptions, parameter passing, recursion, nested and inner classes, exploring string class.

UNIT-II

Inheritance, Packages and Interfaces–Hierarchical abstractions, Base class object, subclass, sub-type, substitutability, forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism- method overriding, abstract classes, the Object class. Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Exploring java.io.

UNIT-III

Exception handling and Multithreading—Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. String handling, Exploring java.

util. Differences between multithreading and multitasking, thread lifecycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads. Enumerations, auto boxing, annotations, generics.

UNIT-IV
Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components-labels, button, canvas, scroll bars, text components, checkbox, check box groups, choices, lists panels– scroll pane, dialogs, menu bar, graphics, layout manager –layout manager types–border, grid, flow, card and grid bag.

UNIT-V
Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing-JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons–The JButton class, Checkboxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees and Tables.

TEXTBOOKS
1.   Java the complete reference,7ᵗʰ edition, Herbert schildt, TMH.
2.   Understanding OOP with Java, updated edition, T.Budd, Pearson education.

REFERENCEBOOKS
1.   An Introduction to programming and OO design usingJava, J.Nino and F.A.Hosch, John wiley & sons.
2.   An Introduction to OOP, third edition, T.Budd, Pearson education.
3.   Introduction to Java programming, Y.Daniel Liang, Pearson education.
4.   An introduction to Java programming and object-oriented application development, R.A.Johnson-Thomson.
5.   Core Java2, Vol1, Fundamentals, Cay. S.Horstmann and Gary Cornell, eighth Edition, Pearson Education.
6.   Core Java2, Vol2, Advanced Features, Cay. S.Horstmann and Gary Cornell, eighth Edition, Pearson Education
7.   Object Oriented Programming with Java, R.Buyya , S.T.Selvi, X.Chu, TMH.
8.   Java and Object Orientation, an introduction, JohnHunt, second edition, Springer.
9.   Maurach's Beginning Java 2JDK5, SPD

CS305PC: DISCRETE MATHEMATICS

(Common to CSE, IT, and CSM Branches)

B.TECH. II Year I Sem.   **L T P C**

                                                             3 0 0 3

Course Objectives

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

Course Outcomes

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

UNIT - I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

TEXT BOOKS

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

REFERENCE BOOKS

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

EC306ES: ANALOG & DIGITAL ELECTRONICS LAB
(Common to IT and CSM Branches)

B.TECH. II Year I Sem.   **L T P C**
                                                                                                       0 0 2 1

Course Objectives
- To introduce components such as diodes, BJTs and FETs.
- To know the applications of components.
- To give understanding of various types of amplifier circuits
- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand the concepts of combinational logic circuits and sequential circuits.

Course Outcomes: Upon completion of the Course, the students will be able to:
- Know the characteristics of various components.
- Understand the utilization of components.
- Design and analyze small signal amplifier circuits.
- Postulates of Boolean algebra and to minimize combinational functions
- Design and analyze combinational and sequential circuits
- Known about the logic families and realization of logic gates.

LIST OF EXPERIMENTS:
1.   Full Wave Rectifier with & without filters
2.   Common Emitter Amplifier Characteristics
3.   Common Base Amplifier Characteristics
4.   Common Source amplifier Characteristics
5.   Measurement of h-parameters of transistor in CB, CE, CC configurations
6.   Input and Output characteristics of FET in CS configuration
7.   Realization of Boolean Expressions using Gates
8.   Design and realization logic gates using universal gates
9.   Generation of clock using NAND / NOR gates
10. Design a 4 – bit Adder / Subtractor
11. Design and realization a Synchronous and Asynchronous counter using flip-flops
12. Realization of logic gates using DTL, TTL, ECL, etc.

CS307PC: OPERATING SYSTEMS LAB
(Common to CSE, IT, CSM, CSD and CSC Branches)

B.TECH. II Year I Sem.   **L T P C**
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Prerequisites: A course on "Programming for Problem Solving", A course on "Computer Organization and Architecture".

Co-requisite: A course on "Operating Systems".

Course Objectives

• To provide an understanding of the design aspects of operating system concepts through Simulation

• Introduce basic Unix commands, system call interface for process management, inter process communication and I/O in Unix

Course Outcomes

• Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.

• Able to implement C programs using Unix system calls

List of Experiments:

1. Write C programs to simulate the following CPU Scheduling algorithms a) FCFS b) SJF
   c) Round Robin d) priority

2. Write programs using the I/O system calls of UNIX/LINUX operating system (open, read, write, close, fcntl, seek, stat, opendir, readdir)

3. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance and Prevention.

4. Write a C program to implement the Producer – Consumer problem using semaphores using UNIX/LINUXsystem calls.

5. Write C programs to illustrate the following IPC mechanisms a) Pipes b) FIFOs c) Message Queues d) Shared Memory

6. Write C programs to simulate the following memory management techniques a) Paging
   b) Segmentation

7. Write C programs to simulate Page replacement policies a) FCFS b) LRU c) Optimal

TEXT BOOKS

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley

2. Advanced programming in the Unix environment, W.R.Stevens, Pearson education.

REFERENCE BOOKS

1. Operating Systems – Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI

2. Operating System - A Design Approach-Crowley, TMH.

3. Modern Operating Systems, Andrew S Tanenbaum, 2nd edition, Pearson/PHI

4. UNIX Programming Environment, Kernighan and Pike, PHI/Pearson Education

5. UNIX Internals: The New Frontiers, U. Vahalia, Pearson Education

CS308PC: JAVA PROGRAMMING LAB

(Common to CSE, IT, CSM, CSD and CSC Branches)

B.TECH. II Year I Sem.   **L T P C**

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Course Objectives:
- To write programs using abstract classes.
- To write programs for solving real world problems using the java collection framework.
- To write multithreaded programs.
- To write GUI programs using swing controls in Java.
- To introduce java compiler and eclipse platform.
- To impart hands-on experience with java programming.

Course Outcomes:
- Able to write programs for solving real world problems using the java collection framework.
- Able to write programs using abstract classes.
- Able to write multithreaded programs.
- Able to write GUI programs using swing controls in Java.

Note:
1. Use LINUX and MySQL for the Lab Experiments. Though not mandatory, encourage the useof the Eclipse platform.
2. The list suggests the minimum program set. Hence, the concerned staff is requested to add more problems to the list as needed.

List of Experiments:
1. Use Eclipse or Net bean platform and acquaint yourself with the various menus. Create a test project,add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for thedigits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
3. A) Develop an applet in Java that displays a simple message.

   B) Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked.
4. Write a Java program that creates a user interface to perform integer divisions. The user enters twonumbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Resultfield when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throwa Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.

5. Write a Java program that implements a multi-thread application that has three threads. First threadgenerates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.

6. Write a Java program for the following: Create a doubly linked list of elements.

    Delete a given element from the above list. Display the contents of the list after deletion.

7. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in the selected color. Initially, there is no message shown.

8. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle suchthat each one of the classes extends the class Shape. Each one of the classes contains only the methodprint Area () that prints the area of the given shape.

9. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, andthe remaining lines correspond to rows in the table. The elements are separated by commas.

    Write a java program to display the table using Labels in Grid Layout.

10. Write a Java program that handles all mouse events and shows the event name at the center of thewindow when a mouse event is fired (Use Adapter classes).

11. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint:use hash tables).

12. Write a Java program that correctly implements the producer – consumer problem using the concept of inter thread communication.

13. Write a Java program to list all the files in a directory including the files present in all itssubdirectories.

REFERENCE BOOKS

1. Java for Programmers, P. J. Deitel and H. M. Deitel, 10th Edition Pearson education.
2. Thinking in Java, Bruce Eckel, Pearson Education.
3. Java Programming, D. S. Malik and P. S. Nair, Cengage Learning.
4. Core Java, Volume 1, 9th edition, Cay S. Horstmann and G Cornell, Pearson.

SD310PC: SKILL DEVELOPMENT COURSE - III
(NODE JS/ REACT JS/ DJANGO)

B.Tech. II Year I Sem. **L T P C**

0 0 2 1

Prerequisites: Object Oriented Programming through Java, HTML Basics

Course Objectives
- To implement the static web pages using HTML and do client side validation using JavaScript.
- To design and work with databases using Java
- To develop an end to end application using java full stack.
- To introduce Node JS implementation for server side programming.
- To experiment with single page application development using React.

Course Outcomes: At the end of the course, the student will be able to,
- Build a custom website with HTML, CSS, and Bootstrap and little JavaScript.
- Demonstrate Advanced features of JavaScript and learn about JDBC
- Develop Server – side implementation using Java technologies like
- Develop the server – side implementation using Node JS.
- Design a Single Page Application using React.

Exercises
1. Build a responsive web application for shopping cart with registration, login, catalog and cart pages using CSS3 features, flex and grid.
2. Make the above web application responsive web application using Bootstrap framework.
3. Use JavaScript for doing client side validation of the pages implemented in experiment 1 and experiment 2.
4. Explore the features of ES6 like arrow functions, call backs, promises, async/await. Implement an application for reading the weather information from openweathermap.org and display the information in the form of a graph on the web page.
5. Develop a java stand alone application that connects with the database (Oracle / mySql) and perform the CRUD operation on the database tables.
6. Create an xml for the bookstore. Validate the same using both DTD and XSD.
7. Design a controller with servlet that provides the interaction with application developed in experiment 1and the database created in experiment 5.
8. Maintaining the transactional history of any user is very important. Explore the various session tracking mechanism (Cookies, HTTP Session)
9. Create a custom server using http module and explore the other modules of Node JS like OS, path, event.
10. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman)

11. For the above application create authorized end points using JWT (JSON Web Token).

12. Create a react application for the student management system having registration, login, contact, aboutpages and implement routing to navigate through these pages.

13. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation using chart.js

14. Create a TODO application in react with necessary components and deploy it into github.

REFERENCE BOOKS

1. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wrox Publications, 2010

2. Bryan Basham, Kathy Sierra and Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2nd Edition, 2008.

3. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, A Press.

*MC311: GENDER SENSITIZATION LAB
(Common to CSM, CSD and CSC Branches)

B.Tech. II Year I Sem.   **L T P C**

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Course Description

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts o impact of gender-based violence on education, health and development. gender, gender-based violence, sexuality, and rights. It will further explore the

Objectives of the Course:
- To develop students' sensibility with regard to issues of gender in contemporaryIndia.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects ofgenders.
- To expose the students to debates on the politics and economics ofwork.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes
- To develop a better understanding of important issues related to gender in contemporary
- To attain a finer grasp of how gender discrimination works in society and how to counter it through providing accounts of studies and movements in the past
- To acquire insight into the gender based division of labour, to develop a sense of appreciation of women at work and to have more productive work places
- To understand Physical Harassment and Domestic violence and the new laws that provide protection and relief to women
- To develop an understanding of Just personal relationships

Learning Outcomes
- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological

and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.

- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks office.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT - I

Understanding Gender

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.

UNIT -II

Gender Roles And Relations

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.

UNIT - III

Women Protected Laws In India

The Dowry Prohibition Act, 1961 (28 of 1961) (Amended in 1986) , The Commission of Sati (Prevention) Act, 1987 (3 of 1988), Protection of Women from Domestic Violence Act, 2005, The Sexual Harassment of Women at Workplace (PREVENTION, PROHIBITION and REDRESSAL) Act, 2013,

UNIT - IV

Gender - Based Violence

"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".*

SPARSHA - A TELUGU STORY BY ABBURI CHAYA DEVI

WHAT IS MY NAME - A TEUGU SHORT STORY BY P,SATYAVATHI

UNIT –V

Gender And Culture

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 - Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

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".

ESSENTIAL READING: The Textbook, "*Towards a World of Equals: A Bilingual Textbook on Gender" written* by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

ASSESSMENT AND GRADING:

Discussion & Classroom Participation:20%

- Assignment:30%
- End Term Exam:50%

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MA401BS: MATHEMATICAL AND STATISTICAL FOUNDATIONS

II Year B.Tech. II Sem.

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Course Objectives: To learn
- Concepts of the probability, types of random variables and probability distributions.
- Sampling distributions and their properties, concepts on estimation.
- Concepts on testing the hypothesis concerning to large samples.
- The Number Theory basic concepts useful for cryptography etc

Course Outcomes: After learning the contents of this subject the student must be able to
- Understand the concepts of random variables.
- Discuss various probability distributions and Sampling Distributions.
- Test the hypothesis related to samples concerning to the means and proportions of large samples.
- Correlate the material of one unit to the material in other units.
- Apply the number theory concepts to cryptography domain.

UNIT-I

Random Variables : Sample Space, Events, Counting Sample Points, Probability of an Event, Additive rules, Conditional Probability, Independence, and the Product Rule, Baye's theorem. Random variables – Discrete and Continuous, Probability Mass and Density functions, Expectation and Variance.

UNIT-II

Probability Distributions : Binomial, Poisson and Normal Distributions. Populations and Samples, Sampling distribution of the Mean (- known and unknown), Central limit theorem.

UNIT-III

Estimation and Tests of Hypothesis for Large Samples : Estimation: Point Estimation and Interval Estimation concerning Means for Large Samples.

Tests of Hypothesis: Type - I and Type - II Errors, Hypothesis testing concerning single mean and difference of means and test of hypothesis concerning to single proportion and difference of proportions.

UNIT-IV

Simple Linear Regression and Correlation

Linear Regression: Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators.

Correlation: Types of correlation, coefficient of correlation, Properties. Methods of finding the coefficient of correlation, Spearman's rank correlation, Karl Pearson's formula.

UNIT- V

Greatest Common Divisors and Prime Factorization : Greatest common divisors, The Euclidean algorithm, The fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers.

Congruences: Introduction to congruences, Linear congruences, The Chinese remainder theorem, Systems of linear congruences.

TEXT BOOKS

1. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.
2. Kenneth H. Rosen, Elementary number theory & its applications, sixth edition, Addison Wesley, ISBN 978 0-321-50031-1.
3. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.

REFERENCE BOOK

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons Ltd, 2004.
2. Sheldon M Ross, Probability and statistics for Engineers and scientists, Academic Press.

AI402PC: ARTIFICIAL INTELLIGENCE

B.TECH. II Year II Sem.   **L T P C**
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Course Objectives

- To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning.
- Study of Markov Models enable the student ready to step into applied AI.

UNIT - I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents
Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First,A*), Constraint Satisfaction (Back tracking, Local Search)

UNIT - II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Mini-max Search, Alpha-Beta Pruning

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non-monotonic Reasoning, Other Knowledge Representation Schemes
Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOK

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall,2010.

REFERENCE BOOKS

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition,2009.
2. George F.Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed.,2009.

IT403PC: DATABASE MANAGEMENT SYSTEMS
(Common to IT and CSM Branches)

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

Prerequisites: A course on "Data Structures".

Course Objectives
- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

Course Outcomes
- Gain knowledge of fundamentals of DBMS, database design and normal forms
- Master the basics of SQL for retrieval and management of data.
- Be acquainted with the basics of transaction processing and concurrency control.
- Familiarity with database storage structures and access techniques

UNIT - I

Database System Applications: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model

UNIT - II

Introduction to the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views.

Relational Algebra, Tuple relational Calculus, Domain relational calculus.

UNIT - III

SQL: QUERIES, CONSTRAINTS, TRIGGERS: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases.

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

UNIT - IV

Transaction Concept: Transaction State, Implementation of Atomicity and Durability, Concurrent

Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

UNIT - V

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning, Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.

TEXT BOOKS

1. Database Management Systems, Raghu rama Krishnan, Johannes Gehrke, *Tata Mc GrawHill* 3rd Edition
2. Database System Concepts, Silber schatz, Korth, *Mc Graw hill*, Vedition.

REFERENCES

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

AI404PC: DESIGN AND ANALYSIS OF ALGORITHMS

B.TECH. II Year II Sem.   **L T P C**

       3 1 0 4

Prerequisites
- A course on "Computer Programming"
- A course on "Data Structures"

Course Objectives
- Introduces the notations for analysis of the performance of algorithms.
- Introduces the data structure disjoint sets.
- Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic programming, greedy, branch and bound methods) and mention problems for which each technique is appropriate;
- Describes how to evaluate and compare different algorithms using worst-, average-, and best-case analysis.
- Explains the difference between tractable and intractable problems, and introduces the problems that are P, NP and NP complete.

Course Outcomes
- Ability to analyze the performance of algorithms
- Ability to choose appropriate data structures and algorithm design methods for a specified application
- Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs

UNIT - I
Introduction: Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation and Little oh notation.

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

UNIT - II
Disjoint Sets: Disjoint set operations, union and find algorithms

Backtracking: General method, applications, n-queen's problem, sum of subsets problem, graph coloring

UNIT - III
Dynamic Programming: General method, applications- Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

UNIT - IV
Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT - V

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

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

TEXT BOOKS

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

REFERENCES

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

CS405PC: SOFTWARE ENGINEERING

(Common to CSE, IT, CSM, CSD and CSC Branches)

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

• The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.

• Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes

• Ability to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD).

• Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.

• Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

UNIT - I

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. **A Generic view of process**: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI).

Process models: The waterfall model, Spiral model and Agile methodology

UNIT - II

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

Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

UNIT - III

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

UNIT - IV

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

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

UNIT - V

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM. **Quality Management:** Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, softwarereliability, the ISO 9000 quality standards.

TEXT BOOKS

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.

2. Software Engineering- Sommerville, 7th edition, Pearson Education.

REFERENCE BOOKS

1. The unified modelling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

2. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.

3. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-HillCompanies.

4. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

IT406PC: DATABASE MANAGEMENT SYSTEMS LAB
(Common for IT and CSM Branches)

II Year B.TECH. II Sem.   **L T P C**
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Course Objectives
- Introduce ER data model, database design and normalization
- Learn SQL basics for data definition and data manipulation

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

LIST OF EXPERIMENTS
1. Concept design with E-R Model
2. Relational Model
3. Normalization
4. Practicing DDL commands
5. Practicing DML commands
6. Querying (using ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc.)
7. Queries using Aggregate functions, GROUP BY, HAVING and Creation and dropping of Views.
8. Triggers (Creation of insert trigger, delete trigger, update trigger)
9. Procedures
10. Usage of Cursors

TEXT BOOKS
1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill, 3rdEdition
2. Database System Concepts, Silberschatz, Korth, McGraw Hill, Vedition.

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

CS408PC: SOFTWARE ENGINEERING LAB
(Common to CSE, IT, CSM, CSD and CSC Branches)

II Year B.Tech II Sem

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Prerequisites

A course on "Programming for Problem Solving".

Co-requisite

• A Course on "Software Engineering".

Course Objectives:

• To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.

Course Outcomes:

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

List of Experiments

Do the following seven exercises for any two projects given in the list of sample projects or any otherProjects:

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

Sample Projects:

1. Passport automation System
2. Book Bank
3. Online Exam Registration
4. Stock Maintenance System
5. Online course reservation system
6. E-ticketing
7. Software Personnel Management System

8.   Credit Card Processing
9.   E-book management System.
10.   Recruitment system

TEXT BOOKS

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

REFERENCE BOOKS

1.   Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, JohnWiley.
2.   Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill

CS409PC: Real-Time Research Project/Field-Based Research Projects
(Common to CSE, IT, CSM, CSD and CSC Branches)

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

The guidelines will be followed as laid down by JNTUH

SD411PC: SKILL DEVELOPMENT COURSE (PROLOG/ LISP/ PYSWIP)

II Year B.Tech. II Sem.   **L T P C**

                                                                   0 0 2 1

List of Programs:

1.   Write simple fact for following:

   A. Ram likes mango.

   B. Seema is a girl.

   C. Bill likes Cindy.

   D. Rose is red.

   E. John owns gold

2.   Write predicates one converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.

3.   Write a program to solve the Monkey Banana problem

4.   WAP in turbo prolog for medical diagnosis and show the advantages and disadvantages of green and red cuts.

5.   Write a program to solve the 4-Queen problem.

6.   Write a program to solve travelling salesman problems.

7.   Write a program to solve water jug problems using Prolog.

8.   Write   simple Prolog functions such as the following. Take into account lists which are too short.

a.   remove the Nth item from the list. -- insert as the Nth item.

9.   Assume the prolog predicate gt(A, B) is true when A is greater than B. Use this predicate to define thepredicate addLeaf(Tree, X, NewTree) which is true if New Tree is the Tree produced by adding the item X in a leaf node. Tree and New Tree are binary search trees. The empty tree is represented by the atomnil.

11.   Write a Prolog predicate, count Lists(Alist, Ne, Nl), using accumulators, that is true when Nl is the number of items that are listed at the top level of Alist and Ne is the number of empty lists. Suggestion: First try to count the lists, or empty lists, then modify by adding the other counter.

12.   Define a predicate memCount(AList,Blist,Count) that is true if Alist occurs Count times within Blist. Define without using an accumulator. Use "not" as defined in utilities.pro, to make similar cases are unique, or else you may get more than one count as an answer.

2.   Examples:

   memCount(a,[b,a],N).N = 1 ;
   no memCount(a,[b,[a,a,[a],c],a],N).
   N= 4 ;
   no memCount([a],[b,[a,a,[a],c],a],N).
   N= 1 ;
   No

REFERENCE BOOK

1.   PROLOG: Programming for Artificial Intelligence, 3e, by BRATKO, WILEY

*MC412: ENVIRONMENTAL SCIENCE

(Common to CSM, CSD and CSC Branches)

II Year B.TECH II Sem.   **L T   P C**
                                                            2 0   0 0

COURSE OBJECTIVES

Understanding the importance of ecological balance for sustainable development.

- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations
- Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms
- Recognize the interconnectedness of multiple factors in environmental challenges

COURSE OUTCOMES

Relate the natural environment and its relationships with human activities.

- Characterize and analyze human impacts on the environment.
- Integrate facts, concepts, and methods from multiple disciplines and apply to
- environmental problems.
- Acquire practical skills for scientific problem-solving, including familiarity with
- laboratory and field instrumentation, computer applications, statistical a modeling techniques.
- Implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.
- Design and evaluate strategies, technologies, and methods for sustainable
- management of environmental systems and for the remediation or restoration ofdegraded e n n vironments.

UNIT-I

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

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non renewable energy sources.

UNIT-III

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

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards.   Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture. Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary.   Overview of air pollution control technologies. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT-V:

Environmental Policy, Legislation &amp EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP).

TEXT BOOKS

1   Textbook of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission.
2.   Environmental Studies by Anubha Kaushik, 4th Edition, New age international Publishers.
3.   Environmental Studies by R. Rajagopalan, Oxford University Press.
4.   Environmental Chemistry (Multi Colour Edition) by Anil Kumar De
5.   Text book of Environmental Science and Technology - Dr. M. Anji Reddy
6.   Text book of Ecology and Environment by PD SHARMA (Author)

REFERENCE BOOKS

1.   Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi
2.   Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela
      2008 PHI Learning Pvt. Ltd.
3.   Environmental Science by Daniel B.Botkin & amp; Edward A.Keller, Wiley INDIA edition.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

B.Tech. III Year Course Structure (R-22)Applicable From 2022-23 Admitted Batch

III YEAR - I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	AI501PC	Python Programming	3	0	0	3
2	CS502PC	Automata Theory and Compiler Design	3	1	0	4
3	SM503MS	Business Economics & Financial Analysis	3	0	0	3
4	AI504PC / CY512PE	Data Analytics using R	3	0	0	3
5		Professional Elective -I	3	0	0	3
6	AI505PC	Python Programming Lab	0	0	2	1
7	EN506HS	Advanced Communication skills Lab	0	0	2	1
8	AI507PC	Data Analytics Lab (R Programming)	0	0	2	1
9	SD512PC	Skill Development Course – V(UI Design – Flutter)	0	0	2	1
10	*MC510	Intellectual Property Rights	2	0	0	0
		Total Credits	**17**	**1**	**8**	**20**

III YEAR - II SEMESTER

S.No.	CourseCode	Course Title	L	T	P	Credits
1	CS601PC	Computer Networks	3	0	0	3
2	CS602PC	Machine Learning	3	0	0	3
3	AI603PC	Natural Language Processing	3	0	0	3
4		Professional Elective- II	3	0	0	3
5		Open Elective – I / MOOCs	3	0	0	3
6	CS604PC	Machine Learning Lab	0	0	2	1
7	AI605PC	Computer Networks Lab	0	0	2	1
8	AI606PC	Natural Language Processing Lab	0	0	2	1
9	AI608Proj	Industrial Oriented Mini Project	0	0	0	2
10	*MC609	Constitution of India	2	0	0	0
11	*MC610	Cyber Security	2	0	0	0
		Total Credits	**19**	**0**	**6**	**20**

MC is a mandatory course. The results is either Satisfactory or Not Satisfactory

Professional Electives

Professional Elective-I

1	AI511PE	Software Process & Project Management
2	CS504PC / IT512PE / AI512PE	Data Mining
3	AI513PE	Web Programming
4	CS511PE / AI514PE	Cryptography & Network Security

Professional Elective - II

1	AI621PE	Software Testing Methodologies
2	AI622PE	Pattern Recognition
3	AI623PE	Introduction to Data Science
4	AI624PE / ME611PE	Industrial Robotics

Professional Elective - III

1	AI731PE	Design Patterns
2	CS701PC / IT734PE / AI732PE	Big Data Analytics
3	AI733PE	Image Processing
4	AI734PE / ME831PE	Principles of Entrepreneurship

Professional Elective-IV

1	AI741PE	Object Oriented Analysis and Design
2	AI742PE	Data Analytics and Visualization
3	AI743PE	Speech Recognition
4	AI744PE	Computer Security & Audit Assurance

Professional Elective - V

1	AI851PE	Web Services and Service Oriented Architecture
2	AI852PE	Predictive Analytics

3	CS864PE / IT864PE / AI853PE	Computer Vision
4	AI854PE / Cy851PE	Quantum Computing

Professional Elective - VI

1	AI861PE / DS851PE	Design Thinking
2	AI862PE	Bioinformatics
3	AI863PE	Semantic Web and Social Networks
4	CS851PE / AI864PE / DS863PE	Block Chain Technologies

Open Elective – I

1	AI611OE	Database Management Systems
2	AI612OE	Information Retrieval System
3	AI613OE	Python Programming

Open Elective – II

1	AI721OE	Introduction to Machine Learning
2	AI722OE	Introduction to Natural Language Processing
3	AI723OE	Data Analytics

Open Elective – III

1	AI831OE	Semantic Web and Social Networks
2	AI832OE	Applications of Natural Language Processing
3	AI833OE	Data Visualization

AI501PC : PYTHON PROGRAMMING

(Common to CSM & CSC)

B.Tech. III Year I Sem.   **L T P C**
                                                                             3 1 0 3

Course Objectives:

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise.

UNIT - I

Introduction to Python, Installing Python. How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators.Type conversions, Expressions, Moreabout Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops. Data types and Expressions:Strings, Assignment and Comments, Numeric Data Types and Character Sets, Expressions, Functions and Modules.

UNIT - II

Control Statements: Definite Iteration, Formatting Text for Output, Selection, Conditional Iteration. File andExceptions: Introduction to File Input and Output, Using Loops to Process Files, **Processing Records, Exceptions. Functions**: 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.

UNIT - III

Strings and Text Files: Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Text Files, Data Encryption, 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 Sequences, Tuples. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms

UNIT - IV

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.

UNIT - V

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 Dia-

log Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons. Simple Graphics and Image Processing: Over- view of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing.

TEXT BOOKS

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning.

2. Think Python First Edition, by Allen B. Downey, Orielly publishing

REFERENCE BOOKS

1. Introduction to Computation and Programming Using Python. John V. Guttag, The MITPress.

2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing

3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)

4. Charles Dierach, Introduction to Computer Science using Python

CS502PC: AUTOMATA THEORY AND COMPILER DESIGN
(Common to CSE, CSM & CSC branches)

B.Tech. III Year I Sem.   **L T P C**
                                                               3 1 0 4

Course Objectives:
- To introduce the fundamental concepts of formal languages, grammars andautomata theory.
- To understand deterministic and non-deterministic machines and the differencesbetween decidability and undesirability.
- Introduce the major concepts of language translation and compiler design andimpart the knowledge of practical skills necessary for constructing a compiler.
- Topics include phases of compiler, parsing, syntax directed translation, typechecking use of symbol tables, intermediate code generation.

Course Outcomes:
- Able to employ finite state machines for modeling and solving computingproblems.
- Able to design context free grammars for formal languages.
- Able to distinguish between decidability and undesirability.
- Demonstrate the knowledge of patterns, tokens & regular expressions for lexicalanalysis.
- Acquire skills in using lex tool and design LR parsers

UNIT - I

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central. Concepts of Automata Theory – Alphabets, Strings, Languages, Problems.

Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions.

Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with -transitions to NFA without -transitions. Conversion of NFA to DFA

UNIT - II

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions.

Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma.

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

UNIT - III

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state.

Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine.

Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines.

UNIT - IV

Introduction: The structure of a compiler, Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex,

Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom- Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers.

UNIT - V

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax- Directed Translation Schemes, Implementing L-Attributed SDD's.

Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code

Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management.

TEXT BOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.

2. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, 2nd Edition, Pearson.

3. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd Edition, PHI.

SM503MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

(Common to All Branches)

B.Tech. III Year I Sem.   **L T P C**
                                                                    3 0 0 3

Prerequisites: None

Course Objective:

• Understand the market dynamics namely demand and elasticity of demand and pricing indifferent market structures.

• Analyze a company's financial statements and come to a reasoned conclusion about thefinancial situation of the company.

• Acquire the basics of how to analyze and interpret the financial statements through ratioanalysis and fund and cash flow statements.

Course Outcome:

• Understand the concepts of managerial economics and concept organizations existing in the modernbusiness

• Understand microeconomic factors in related to demand and supply analysis and its forecasting

• Apply the theory of production function and Cost concepts to determine the Break Even Analysis and Remember different market structures, pricing strategies and different forms business organization

• Determine the financial statement by using Fundamental accounting

• Interpret the financial statement by using Ratio analysis, fund flow and cash flow statements.

UNIT-I

INTRODUCTION TO BUSINESS AND ECONOMICS

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Featuresand Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II

DEMAND AND SUPPLY ANALYSIS

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, **Demand Forecasting:** Characteristics of Good Demand Forecasting, Steps inDemand Forecasting, Methods of DemandForecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT - III

PRODUCTION, COST, MARKET STRUCTURES AND PRICING

Production Analysis: Factors of Production, Production Function, Production Function with onevariable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, andMonopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT - IV

FINANCIAL ACCOUNTING

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT - V

FINANCIAL ANALYSIS THROUGH RATIOS

Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems). Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS

1. D.D. Chaturvedi, S.L. Gupta, Business Economics - Theory and Applications, International BookHouse Pvt. Ltd. 2013.

2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.

3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw HillEducation Pvt. Ltd. 2012.

REFERENCE BOOKS

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.

2. S.N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5eVikasPublications, 2013.

AI504PC: DATA ANALYTICS USING R

B.Tech. III Year I Sem.
          L T P C
          3 0 0 3

PREREQUISITES:

1. A course on "Database Management Systems"

2. Knowledge of probability and statistics

COURSE OBJECTIVES: To explore the fundamental concepts of data analytics.

- To learn the principles and methods of statistical analysis

- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

- To understand the various search methods and visualization techniques.

COURSE OUTCOMES: After completion of this course students will be able to

- Understand the impact of data analytics for business decisions and strategy

- Carry out data analysis/statistical analysis

- To carry out standard data visualization and formal inference procedures

- Design Data Architecture

- Understand various Data Sources

UNIT - I

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality noise, outliers, missing values, duplicate data) and Data Processing & Processing.

UNIT - II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of Data and variables, Data Modelling Techniques, Missing Imputations etc. Need for Business Modelling.

UNIT - III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

UNIT - IV

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, over fitting, Pruning and Complexity, Multiple Decision Trees etc.

Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

UNIT - V

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

Student's Handbook for Associate Analytics – II,III.

Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, MorganKaufmann Publishers.

REFERENCE BOOKS:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, AddisionWisley,2006.

2. Data Mining Analysis and Concepts, M. Zaki and W.Meira

3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand RajaramanMilliway Labs Jeffrey D Ullman Stanford University.

AI511PE: SOFTWARE PROCESS & PROJECT MANAGEMENT

(Professional Elective – I)

B.Tech. III Year I Sem.   **L T P C**
                                                                                     3 0 0 3

Course Objectives:

- To acquire knowledge on software process management
- To acquire managerial skills for software project development
- To understand software economics

Course Outcomes:

- Gain knowledge of software economics, phases in the life cycle of software development, project organization, project control and process instrumentation
- Analyze the major and minor milestones, artifacts and metrics from management and technical perspective
- Design and develop software product using conventional and modern principles of software project management

UNIT - I

Software Process Maturity: Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process.

Process Reference Models: Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).

UNIT - II

Software Project Management Renaissance: Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

Life-Cycle Phases and Process artifacts: Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic arti- facts, model-based software architectures.

UNIT - III

Workflows and Checkpoints of process: Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments.

Process Planning: Work breakdown structures, Planning guidelines, cost and schedule estimating process, itera-tion planning process, Pragmatic planning.

UNIT - IV

Project Organizations: Line-of- business organizations, project organizations, evolution of organizations, process automation.

Project Control and process instrumentation: The seven-core metrics, management indicators, quality indicators, life-cycle expectations,Pragmatic software metrics, metrics automation.

UNIT - V

CCPDS-R Case Study and Future Software Project Management Practices: Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

TEXT BOOKS:

1. Managing the Software Process, Watts S. Humphrey, Pearson Education

2. Software Project Management, Walker Royce, Pearson Education

REFERENCE BOOKS:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education,2000

2. Process Improvement essentials, James R. Persse, O'Reilly, 2006

3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006

4. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.

5. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007

6. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.

7. Agile Project Management, Jim Highsmith, Pearson education, 2004.

AI512PE / CS504PC / IT512PE: DATA MINING (Professional Elective - I)
(Common to CSE, IT & CSM)

B.Tech. III Year I Sem.   **L T P C**
                                                                        3 0 0 3

Pre-Requisites:

1. Database Management System

2. Probability and Statistics

Course Objectives:

Studentswillbecomeacquaintedwithboththestrengthsandlimitationsofvariousdatami   ning tech-niques like Association, Classification, Cluster and Outlier analysis.

Course Outcomes:

• Understand the need of data mining and pre-processing techniques.

• Perform market basket analysis using association rule mining.

• Utilize classification techniques for analysis and interpretation of data.

• Identify appropriate clustering and outlier detection techniques to handle complex data.

• Understand the mining of data from web, text and time series data.

UNIT-I

Introduction to Data Mining: What Data mining? Kinds of Data, Knowledge Discovery process, Data Mining Functionalities, Kinds of Patterns, Major Issues in Data Mining. Data Objects and At-t tribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity, Data Pre-processing: Major Tasks in Data Pre- processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT- II

Association Analysis: Basic Concepts, Market Basket Analysis, Apriori Algorithm, FP- growth, From Association Analysis to Correlation Analysis, Pattern Mining in Multilevel Associations and Multidimensional Associations.

UNIT- III

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule- Based Classification, Metrics for Evaluating Classifier Performance, Ensemble Methods, Multilayer Feed-Forward Neural Network, Support Vector Machines, k-Nearest-Neighbor Classifiers.

UNIT-IV

Cluster Analysis: Requirements for Cluster Analysis, Overview of Basic Clustering Methods, Parti-tioning Methods-k-Means, k-Medoids, Hierarchical Methods-AGENES, DIANA, BIRCH, Density-Based Method-DBSCAN, Outlier Analysis: Types of Outliers, Challenges of Outlier Detection, and Overview of Outlier Detection Methods

UNIT-V

Advanced Concepts: Web Mining- Web Content Mining, Web Structure Mining, Web Usage

Mining, Spatial Mining- Spatial Data Overview, Spatial Data Mining Primitives, Spatial Rules, Spatial Classification Algorithm, Spatial Clustering Algorithms, Temporal Mining- Modeling Temporal Events, Time Series, Pattern Detection, Sequences, Temporal Association Rules.

TEXTBOOKS:

1. Jiawei Han, Micheline Kamber,JianPei., DataMining:ConceptsandTechniques,3rdEdition, Morgan Kaufmann/Elsevier, 2012.
2. Margaret H Dunham, Data Mining Introductory and Advanced Topics, 2nd Edition, Pearson Education, India, 2006.

REFERENCEBOOKS:

1. Data Mining Techniques, Arun K Pujari,3rd Edition, Universities Press. Pang- NingTan, Michael Steinbach, Anuj Karpatne and Vipin Kumar, Introduction to Data Mining, 2nd Edition, Pearson Education India, 2021.
2. Amitesh Sinha, DataWare housing, Thomson Learning, India, 2007.

AI513PE: Web Programming (Professional Elective - I)

B.Tech. III Year I Sem.   **L T P C**

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Course Objectives: The student should be able to:

- Understand the technologies used in Web Programming.
- Know the importance of object-oriented aspects of Scripting.
- Understand creating database connectivity using JDBC.
- Learn the concepts of web-based application using sockets.

Course Outcomes: Upon Completion of the course, the students will be able to

- Design web pages.
- Use technologies of Web Programming.
- Apply object-oriented aspects to Scripting.
- Create databases with connectivity using JDBC.
- Build web-based application using sockets.

UNIT - I

SCRIPTING: Web page Designing using HTML, Scripting basics- Client side and server-side script-n ing.Java Script-Object, names, literals, operators and expressions- statements and features- events - windows -documents - frames - data types - built-in functions- Browser object model - Verifying forms -HTML5-CSS3- HTML 5 canvas - Web site creation using tools.

UNIT – II

JAVA: Introduction to object-oriented programming-Features of Java – Data types, variables and arrays

– Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces

– Exception Handling – Multithreaded Programming – Input/ Output – Files – Utility Classes – String Handling.

UNIT – III

JDBC: JDBC Overview – JDBC implementation – Connection class – Statements - Catching Data-baseResults, handling database Queries. Networking– Inet Address class – URL class- TCP sockets – UDPsockets, Java Beans –RMI.

UNIT – IV

APPLETS: Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling. Introducing AWT: Working with Windows

Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.

UNIT – V

XML AND WEB SERVICES: Xml – Introduction-Form Navigation-XML Documents- XSL

XSLT- Webservices-UDDI-WSDL-Java web services – Web resources.

TEXT BOOKS:

1. Harvey Deitel, Abbey Deitel, Internet and World Wide Web: How To Program 5th Edition.

2. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.

3. Michael Morrison XML Unleashed Tech media SAMS.

REFERENCE BOOKS:

1. John Pollock, Java script - A Beginners Guide, 3rd Edition –- Tata McGraw-Hill Edition.

2. Keyur Shah, Gateway to Java Programmer Sun Certification, Tata McGraw Hill, 2002.

AI514PE / CS511PE: CRYPTOGRAPHY & NETWORK SECURITY

(Professional Elective - I) (Common to CSE & CSM)

B.Tech. III Year I Sem.   **L T P C**

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Course Objectives:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks
- Describe public-key cryptosystem.
- Describe the enhancements made to IPv4 by IPSec
- Understand Intrusions and intrusion detection
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encryptedemail message.
- Discuss Web security and Firewalls

Course Outcomes:

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

UNIT - I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security **Cryptography Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT - II

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT - III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure

UNIT - IV

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer

Security, HTTPS, Secure Shell (SSH)

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security

UNIT - V

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange

Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

TEXT BOOKS

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition

2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

REFERENCE BOOKS

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, WileyIndia, 1st Edition.

2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition

3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.

4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH

5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning

6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

AI505PC : PYTHON PROGRAMMING LAB
(Common to CSM & CSC)

B.Tech. III Year I Sem.   **L T P C**
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Prerequisites: Students should install Python on Linux platform.

Course Objectives:

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and in-formation processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise.

Course Outcomes:

- Student should be able to understand the basic concepts scripting and the contributions of scripting language
- Ability to explore python especially the object oriented concepts, and the built in objects of Python.
- Ability to create practical and contemporary applications such as TCP/IP network pro gaming, Web applications, discrete event simulations

List of Programs:

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
4. Write a python script to print the current date in the following format "Sun May 29 02:26:23IST 2017"
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to convert temperatures to and from Celsius, Fahrenheit.[Formu la : c/5 = f-32/9]
10. Write a Python program to construct the following pattern, using a nested for loop

```
*
*
* *
* * *
* * * *
* * *
* *
*
*
```

11. Write a Python script that prints prime numbers less than 20.

12. Write a python program to find factorial of a number using Recursion.

13. Write a program that accepts the lengths of three sides of a triangle as inputs. The pro- gram output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of thesquares of the other two sides).

14. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.

15. Write a python program to define a module and import a specific function in that module to another pro- gram.

16. Write a script named copyfile.py. This script should prompt the user for the names of two textfiles. The contents of the first file should be input and written to the second file.

17. Write a program that inputs a text file. The program should print all of the unique words in thefile in alpha- betical order.

18. Write a Python class to convert an integer to a roman numeral.

19. Write a Python class to implement pow(x, n)

20. Write a Python class to reverse a string word by word.

EN506HS: ADVANCED COMMUNICATION SKILLS LAB
(Common to All Branches)

B.Tech. III Year I Sem.   **L T P C**
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INTRODUCTION:

- The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their interpersonal and professional communication in the globalized context.

- The proposed course should be a laboratory course to enable students to use English effectively and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.

- Engaging in debates.

- Participating in group discussions.

- Facing interviews.

- Writing project/research reports/technical reports.

- Making oral presentations.

- Writing formal letters.

- Transferring information from non-verbal to verbal texts and vice-versa.

- Taking part in social and professional communication.

Course Objectives:

- This Lab focuses on using multi-media instruction for language development to meet thefollowing targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enablethem to listen to English spoken at normal conversational speed and respond ap- propriately in different socio-cultural and professional contexts.

- Further, they would be required to communicate their ideas relevantly and coherently inwriting.

- To prepare all the students for their placements.

Course Outcomes: Students will be able to:

- Acquire vocabulary and use it contextually

- Listen and speak effectively

- Develop proficiency in academic reading and writing

- Increase possibilities of job prospects

- Communicate confidently in formal and informal contexts

SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced EnglishCommunication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabu-lary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one- word substitutes, prefixes and suffixes, study of word or- igin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, criticalreading& effective googling.

3. **Activities on Writing Skills** – Structure and presentation of different types of writing – letter Writing/resume writing/ e-correspondence/technical report writing/ planning for writing – improving students' writing skills.

4. **Activities on Presentation Skills and Team Building** – Oral presentations (individual and group) through JAM

Sessions/Seminars/PPTs and written presentations through posters/projects/reports/ emails/assignments etc. Activities on Presentation Skills, Team Building and Leadership Skills through Problem solving and Team Development Exercises.

Activities on Group Discussion and Interview Skills – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation

Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

MINIMUM REQUIREMENT:

The Advanced Communication Skills (ACS) Laboratory shall have the following infrastructuralfacilities to accommodate at least 35 students in the lab:

• Spacious room with appropriate acoustics.

• Round Tables with movable chairs

• Audio-visual aids

• LCD Projector

• Public Address system

• P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ

• T. V, a digital stereo & Camcorder

• Headphones of High quality

SUGGESTED SOFTWARE:

- The software consisting of the prescribed topics elaborated above should be procured andused.

- Oxford Advanced Learner's Compass, 7th Edition

- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.

- Lingua TOEFL CBT Insider, by Dream tech

- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt.Ltd.2nd Edition

2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge,5thEdition.

REFERENCES:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumarand Hemalatha Nagarajan. Pearson 2007

2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd,2016.

3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford UniversityPress 2009.

4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. NewDelhi.

5. English Vocabulary in Use series, Cambridge University Press 2008.

6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012.Cengage Learning.

7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.

8. Job Hunting by Colm Downes, Cambridge University Press 2008.

9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, TataMc Graw-Hill 2009.

AI507PC: DATA ANALTICS LAB (R Programming)

B.TECH III Year I Sem.   **L   T P C**

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Course Objectives:
- To explore the fundamental concepts of data analytics.
- To learn the principles and methods of statistical analysis
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the
- accuracy of the algorithms.
- To understand the various search methods and visualization techniques.

Course Outcomes:
- Understand linear regression and logistic regression
- Understand the functionality of different classifiers
- Implement visualization techniques using different graphs
- Apply descriptive and predictive analytics for different types of data

List of Experiments:
1. Data Preprocessing
        a. Handling missing values
        b. Noise detection removal
        c. Identifying data redundancy and elimination
2. Implement any one imputation model
3. Implement Linear Regression
4. Implement Logistic Regression
5. Implement Decision Tree Induction for classification
6. Implement Random Forest Classifier
7. Implement ARIMA on Time Series data
8. Object segmentation using hierarchical based methods
9. Perform Visualization techniques (types of maps - Bar, Colum, Line, Scatter, 3D Cubesetc)
10. Perform Descriptive analytics on healthcare data
11. Perform Predictive analytics on Product Sales data
12. Apply Predictive analytics for Weather forecasting.

TEXT BOOKS:

1. Student's Handbook for Associate Analytics – II, III.

2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan KaufmannPublishers.

REFERENCE BOOKS:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006.

2. Data Mining Analysis and Concepts, M. Zaki and W. Meira

3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman MilliwayLabs Jeffrey D Ullman Stanford Univ.

SD512PC: SKILL DEVELOPMENT COURSE - V
(UI Design - Flutter)

B.Tech. III Year I Sem.   **L T P C**
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Course Objectives:

- Learns to Implement Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on Widges and customize widgets for specific UI elements, Themes
- Understand to include animation apart from fetching data

Course Outcomes:

- Implements Flutter Widgets and Layouts
- Responsive UI Design and with Navigation in Flutter
- Create custom widgets for specific UI elements and also Apply styling using themes andcustom styles.
- Design a form with various input fields, along with validation and error handling
- Fetches data and write code for unit Test for UI components and also animation

List of Experiments:

1. Students need to implement the following experiments

    a) Install Flutter and Dart SDK.

    b) Write a simple Dart program to understand the language basics.

2. a) Explore various Flutter widgets (Text, Image, Container, etc.).

    b) Implement different layout structures using Row, Column, and Stack widgets.

3. a) Design a responsive UI that adapts to different screen sizes.

    b) Implement media queries and breakpoints for responsiveness.

4. a) Set up navigation between different screens using Navigator.

    b) Implement navigation with named routes.

5. a) Learn about stateful and stateless widgets.

    b)   Implement state management using set State and Provider.

6. a) Create custom widgets for specific UI elements.

   b) Apply styling using themes and custom styles.

7. a) Design a form with various input fields.

   b) Implement form validation and error handling.

8. a) Add animations to UI elements using Flutter's animation framework.

   b) Experiment with different types of animations (fade, slide, etc.).

9. a) Fetch data from a REST API.

   b) Display the fetched data in a meaningful way in the UI.

10. a) Write unit tests for UI components.

   b) Use Flutter's debugging tools to identify and fix issues.

TEXT BOOK:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.

*MC510: INTELLECTUAL PROPERTY RIGHTS

(Common to CSE, IT, CSM, ME and ECE branches)

B.Tech. III Year II Sem.   **L T P C**
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Course Objective:

- Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.

- Understanding the Framework of Strategic Management of Intellectual Property (IP).

- Appreciating and appraising different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs,

- Explaining how to derive value from IP and leverage its value in new product and service

- Development Exposing to the Legal management of IP and understanding of real life practice of IPM

Course Outcome:

- Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.

- Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.

- Identify activities and constitute IP infringements and the remedies available to the IP own- er and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.

- Be familiar with the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing and explain how IP can be managedas a strategic resource and suggest IPM strategy.

- Be able to anticipate and subject to critical analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.

- Be able to demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing;

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to performthe work publicly, copy right ownership issues, copy right registration, notice of copy right, International copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international

trade mark law, copy right law, International patent law, and international development in tradesecrets law.

TEXT & REFERENCE BOOKS:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

2. Intellectual property right – Unleashing the knowledge economy, prabuddhaganguli, Tata McGraw Hill Publishing company ltd.

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CS502PC/ CS601PC: COMPUTER NETWORKS
(Common to CSE & CSM)

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

- A course on "Programming for problem solving"
- A course on "Data Structures"

Course Objectives:

- The objective of the course is to equip the students with a general overview of theconcepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Course Outcomes:

- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP referencemodel.
- Obtain the skills of subneting and routing mechanisms.
- Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

UNIT – I

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

Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission: Microwaves Transmission, Radio Transmission, Infrared Transmission and Light Trans-m mission.

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

UNIT - II

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

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

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

UNIT - III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Link State routing, Congestion Control Algo-trithms, Quality of Service, Internetworking, The Network layer in the internet.

UNIT - IV

Transport Layer: Transport Services: services provided to the upper layers, Transport service Primiptives Elements of Transport protocols, TCP and UDP protocols.

UNIT - V

Application Layer –Domain name system, SNMP, Electronic Mail; the WORLD WIDE WEB: Architec-ntural over view, Static web pages, Dynamic web pages and Web Applications,HTTP, Streaming audio and video.

TEXT BOOKS:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition.Pearson Education/ PHI

REFERENCE BOOKS:

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

CS602PC: MACHINE LEARNING
(Common to CSE, IT, CSM, CSD & CSC branches)

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

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learningtechniques
- To study the various probability-based learning techniques

Course Outcomes:

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Understand algorithms for building classifiers applied on datasets of non-linearly separable classes
- Understand the principles of evolutionary computing algorithms
- Design an ensemble to increase the classification accuracy

UNIT-I

Learning–Types of Machine Learning–Supervised Learning–The Brain and the Neuron–Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search–Finding a Maximally Specific Hypothesis–Version Spaces and the Candidate Elimination Algorithm–Linear Discriminants:–Perceptron–Linear Separability–Linear Regression.

UNIT- II

Multi layer Perceptron– Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice– Examples of using the MLP –Overview – Deriving Back-Propagation– Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines

UNIT- III

Learning with Trees–Decision Trees–Constructing Decision Trees–Classification and Regression Trees–Ensemble Learning–Boosting–Bagging–Different ways to Combine Classifiers–Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms

UNIT-IV

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis–Independent Component Analysis–Locally Linear

Embedding–Isomap–Least Squares Optimization

Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms

UNIT-V

Reinforcement Learning–Overview–Getting Lost Example, Markov Chain Monte Carlo Methods–Sampling–Proposal Distribution–Markov Chain Monte Carlo– Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

TEXTBOOKS:

1. Stephen Marsland,—Machine Learning – An Algorithmic Perspective, Second Edition, Chap-manandHall/CRCMachineLearningandPatternRecognitionSeries,2014.

REFERENCEBOOKS:

1. Tom M Mitchell,—Machine Learning, First Edition, McGraw Hill Education, 2013.

2. PeterFlach,—Machine Learning: The Art and Science of Algorithms that MakeSense of Data First Edition, Cambridge University Press, 2012.

3. JasonBell,—Machine learning–Hands on for Developers and Technical Professionals, First Edition, Wiley, 2014

4. Ethem Alpaydin, —Introduction to Machine Learning 3e (AdaptiveComputation and Machine Learning Series), Third Edition, MIT Press, 2014

AI603PC: NATURAL LANGUAGE PROCESSING

B.Tech. III Year II Sem.   **L T P C**

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Prerequisites:

1. Data structures and compiler design

Course Objectives:

• Introduction to some of the problems and solutions of NLP and their relation to linguistics and statistics.

• Course Outcomes:

• Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.

• Understand and carry out proper experimental methodology for training and evaluating empirical NLPsystems

• Manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.

• Design, implement, and analyze NLP algorithms; and design different language modeling Techniques.

UNIT - I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches, Features

UNIT - II

Syntax I: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms

UNIT – III

Syntax II: Models for Ambiguity Resolution in Parsing, Multilingual Issues

Semantic Parsing I: Introduction, Semantic Interpretation, System Paradigms, Word Sense

UNIT - IV

Semantic Parsing II: Predicate-Argument Structure, Meaning Representation Systems

UNIT - V

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Bayesian parameter estimation,Language Model Adaptation, Language Models- class based, variable length, Bayesian topic based, Multilingual and Cross Lingual Language Modeling

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zi-touni, Pearson Publication.

REFERENCE BOOK:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

AI621PE: SOFTWARE TESTING METHODOLOGIES

(Professional Elective - II)

B.Tech. III Year II Sem.   **L T P C**
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Prerequisites:

• A course on "Software Engineering"

Course Objectives:

• To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.

• To develop skills in software test automation and management using latest tools.

Course Outcomes:

• Design and develop the best test strategies in accordance to the development model.

UNIT - I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.

Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates andachievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II

Transaction Flow Testing: transaction flows, transaction flow testing techniques. Dataflow testing:Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing. Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT - III

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection. Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT - IV

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

UNIT - V

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of amatrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win- runner).

TEXT BOOKS:

1. Software Testing techniques - Baris Beizer, Dreamtech, second edition.

2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

REFERENCE BOOKS:

1. The craft of software testing - Brian Marick, Pearson Education.

2. Software Testing Techniques – SPD(Oreille)

3. Software Testing in the Real World – Edward Kit, Pearson.

4. Effective methods of Software Testing, Perry, John Wiley.

5. Art of Software Testing – Meyers, John Wiley.

AI622PE: PATTERN RECOGNITION (Professional Elective - II)

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

Prerequisites

- Students are expected to have knowledge basic linear algebra, basic probability theory and basic programming techniques;
- A course on "Computational Mathematics"
- A course on "Computer Oriented Statistical Methods"

Course Objectives:

- This course introduces fundamental concepts, theories, and algorithms for pattern recognition and machine learning.
- Topics include: Pattern Representation, Nearest Neighbour Based Classifier, Bayes Classifier, Hidden Markov Models, Decision Trees, Support Vector Machines, Clustering, and anapplication of hand-written digit recognition.
- Course Outcomes:
- Understand the theory, benefits, inadequacies and possible applications of various ma- chine learning and pattern recognition algorithms
- Identify and employ suitable machine learning techniques in classification, pattern recognition, clustering and decision problems.

UNIT - I: Introduction: What is Pattern Recognition, Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition. Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature Extraction, Feature Selection, Evaluation of Classifier, Evaluation of Clustering.

UNIT - II: Nearest Neighbor Based Classifier: Nearest Neighbor Algorithm, Variants of the NN Algorithm use of the Nearest Neighbor Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection. Bayes Classifier: Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with the NNC, Naïve Bayes Classifier, Bayesian Belief Network.

UNIT - III: Hidden Markov Models: Markov Models for Classification, Hidden Morkov Models, Classification using HMMs. Decision Trees: Introduction, Decision Tree for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Overfitting and Pruning, Examples of Decision Tree Induction.

UNIT - IV: Support Vector Machines: Introduction, Learning the Linear Discriminant Functions, Neural Networks, SVM for Classification. Combination of Classifiers: Introduction, Methods for Constructing EnSem.bles of Classifiers, Methods for Combining Classifiers.

UNIT - V: Clustering: Why is Clustering Important, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets. An Application-Hand Written Digit Recognition: Description of the Digit
Data, Preprocessing of Data, Classification Algorithms, Selection of Representative Patterns, results.

TEXT BOOK:

1.   Pattern Recognition: An Algorithmic Approach: Murty, M. Narasimha, Devi, V. Susheela, Spinger Pub,1st Ed.

REFERENCE BOOKS:

1.   Machine Learning - Mc Graw Hill, Tom M. Mitchell.
2.   Fundamentals of Speech Recognition: Lawrence Rabiner and Biing- Hwang Juang. Prentice Hall Pub.

AI623PE: INTRODUCTION TO DATA SCIENCE

(Professional Elective - II)

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

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

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

- Understand basic terms what Statistical Inference means.
- Identify probability distributions commonly used as foundations for statistical modelling. Fit a model to data
- describe the data using various statistical measures
- utilize R elements for data handling
- perform data reduction and apply visualization techniques.

UNIT - I

Introduction: Definition of Data Science- Big Data and Data Science hype – and getting past the hype - Datafication - Current landscape of perspectives - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model – Over fitting. **Basics of R:** Introduction, R-Environment Setup, Programming with R, Basic Data Types.

UNIT - II

Data Types & Statistical Description

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

UNIT - III

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

UNIT - IV

Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements. **Iterative Programming in R:** Introduction, While Loop, For Loop, Looping Over List. **Functions in R:** Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Func tions in R.

UNIT - V

Data Reduction: Overview of Data Reduction Strategies, Wavelet Transforms, Principal Componens Analysis, Attribute Subset Selection, Regression and Log-Linear Models: Parametric Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation.
Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014

2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.

3. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, PearsonEducation.

2. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.

3. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.

4. Paul Teetor, "R Cookbook", O'Reilly, 2011.

AI624PE / ME611PE: INDUSTRIAL ROBOTICS

(Professional Elective - II) (Common to CSM & ME)

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

Pre-requisites: Basic principles of Kinematics and mechanics

Course Objectives: The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics andcontrol, chose, and incor-porate robotic technology in engineering systems.

• Make the students acquainted with the theoretical aspects of Robotics

• Enable the students to acquire practical experience in the field of Robotics through designprojects and case studies.

• Make the students to understand the importance of robots in various fields of engineering.

• Expose the students to various robots and their operational details.

Course Outcomes: At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot toperform tasks in industrial applications. Design intelligent robots using sensors.

UNIT – I

Introduction: Automation and Robotics – An over view of Robotics – present and future applications. **Components of the Industrial Robotics:** common types of arms. Components, Architecture, num- ber of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Car- rying Capacity.

UNIT – II

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Ro- tation Matrices. Homogeneous transformations as applicable to rotation and translation – problems. **Manipulator Kinematics**-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulators.

UNIT – III

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler andNewton – Euler formations – Problems.
Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated mo- tion – straight linemotion.

UNIT - IV

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric& stepper motors, comparison of Actuators, Feedback components: position sensors – potentiom- eters, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors
– End Effectors and Tools

UNIT V

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection. Robotic Programming Methods – Languages: Lead Through Programming, Textual Robotic Languages such as APT, MCL.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Mc Graw Hill

2. Introduction to Industrial Robotics / Ramachandran Nagarajan / Pearson

REFERENCE BOOKS:

1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley

2. Robot Analysis and control / Asada, Slotine / Wiley Inter-Science

3. Robotics – Fu et al / TMH Publications.

CS604PC: MACHINE LEARNING LAB

(Common to CSE,IT, CSM,CSD & CSC branches)

B.Tech. III Year II Sem. **L T P C**
0 0 2 1

Course Objective:

- The objective of this lab is to get an overview of the various machine learning techniques and can demonstrate them using python.

Course Outcomes:

- Understand modern notions in predictive data analysis

- Select data, model selection, model complexity and identify the trends

- Understand a range of machine learning algorithms along with their strengths and weaknesses

- Build predictive models from data and analyze their performance

List of Experiments

1. Write a python program to compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation

2. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy

3. Study of Python Libraries for ML application such as Pandas and Matplotlib

4. Write a Python program to implement Simple Linear Regression

5. Implementation of Multiple Linear Regression for House Price Prediction using sklearn

6. Implementation of Decision tree using sklearn and its parameter tuning

7. Implementation of KNN using sklearn

8. Implementation of Logistic Regression using sklearn

9. Implementation of K-Means Clustering

10. Performance analysis of Classification Algorithms on a specific dataset (Mini Project)

TEXT BOOK:

1. Machine Learning – Tom M. Mitchell, - MGH.

REFERENCE BOOK:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.

AI605PC: COMPUTER NETWORKS LAB

B.Tech. III Year II Sem.   **L T P C**
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Course Objectives:
- To understand the working principle of various communication protocols.
- To understand the network simulator environment and visualize a network topology and
- observe its performance
- To analyze the traffic flow and the contents of protocol frames

Course Outcomes:
- Implement data link layer farming methods
- Analyze error detection and error correction codes.
- Implement and analyze routing and congestion issues in network design.
- Implement Encoding and Decoding techniques used in presentation layer
- To be able to work with different network tools.

List of Experiments:
1. Implement the data link layer framing methods such as character, character stuffing andbitstuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRCCCIP
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4. Implement Dijsktra's algorithm to compute the shortest path through a network
5. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
6. Implement distance vector routing algorithm for obtaining routing tables at each node.
7. Implement data encryption and data decryption
8. Write a program for congestion control using Leaky bucket algorithm.
9. Write a program for frame sorting technique used in buffers.
10. Write a program for Wireshark
    - Packet Capture Using Wire shark
    - Starting Wire shark
    - Viewing Captured Traffic
    - Analysis and Statistics & Filters.
11. How to run Nmap scan
12. Operating System Detection using Nmap

13. Do the following using NS2 Simulator

- NS2 Simulator-Introduction
- Simulate to Find the Number of Packets Dropped
- Simulate to Find the Number of Packets Dropped by TCP/UDP
- Simulate to Find the Number of Packets Dropped due to Congestion
- Simulate to Compare Data Rate& Throughput.
- Simulate to Plot Congestion for Different Source/Destination
- Simulate to Determine the Performance with respect to Transmission of Packets

AI606PC: NATURAL LANGUAGE PROCESSING LAB

B.Tech. III Year II Sem.   **L T P C**

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Prerequisites:

1. Data structures, finite automata and probability theory.

Course Objectives:

1. To Develop and explore the problems and solutions of NLP

Course Outcomes:

- Show sensitivity to linguistic phenomena and an ability to model them with formalgrammars.

- Knowledge on NLTK Library implementation

- Work on strings and trees, and estimate parameters using supervised andunsupervised training methods.

List of Experiments

1. Write a Python Program to perform following tasks on text

    a) Tokenization   b) Stop word Removal

2. Write a Python program to implement Porter stemmer algorithm for stemming

3. Write Python Program for a) Word Analysis b) Word Generation

4. Create a Sample list for at least 5 words with ambiguous sense and Write aPython program to implement WSD

5. Install NLTK tool kit and perform stemming

6. Create Sample list of at least 10 words POS tagging and find the POS for any givenword

7. Write a Python program to

    a) Perform Morphological Analysis using NLTK library

    b) Generate n-grams using NLTK N-Grams library

    c) Implement N-Grams Smoothing

8. Using NLTK package to convert audio file to text and text file to audio files.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory toPractice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.

2. Oreilly Practical natural Language Processing, A Comprehensive Guide toBuilding Real World NLP Systems.

3. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

REFERENCE BOOKS:

1. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, O'Reilly Media, 2009.

AI608PC: INDUSTRIAL ORIENTED MINI PROJECT

B.Tech. III Year II Sem.　　　　　　　　　　　　　　　　　　**L T P C**
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*MC609: CONSTITUTION OF INDIA
(Common to CSE, IT, CSM, ME and ECE branches)

B.Tech. III Year II Sem.   **L T P C**
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Course objective:

- To enable the student to understand the importance of constitution

- To understand the structure of executive, legislature and judiciary

- To understand philosophy of fundamental rights and duties

- To understand the autonomous nature of constitutional bodies like Supreme Court andhighcourt, controller and auditor general of India and election commission of India.

- To understand the central and state relation, financial and administrative.

Course outcome :

- Able to understand historical background of the constitutional making and its importancefor building a democratic India, the structure of Indian government, the structure of state government, the local Administration,

- Able to apply the knowledge on directive principle of state policy, the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSCfor sustaining democracy

- Able to analyze the History, features of Indian constitution, the role Governor and ChiefMinister, role of state election commission, the decentralization of power between central, state and local self- government.

- Able to evaluate Preamble, Fundamental Rights and Duties, Zilla Panchayat, block level organization, various commissions of viz SC/ST/OBC and women.

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution.The Parliamentof India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, whichhas been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognizedas one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom andAmerica.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic

contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

TEXT BOOKS

1. V.N. Shukla's Constitution of India By Prof (Dr.) Mahendra Pal Singh
2. CONSTITUTION OF INDIA 2021 EDITION BY VN SHUKLA

REFERENCE BOOKS

1. CONSTITUTION OF INDIA By P K AGRAWAL

*MC610: CYBER SECURITY

B.Tech. III Year II Sem.   **L T P C**

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UNIT - I

Introduction to Cybercrime: Introduction, Cyber crime and Information Security, Who are Cyber criminals, Classifications of Cybercrimes, Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT - II

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authenticationservice Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies anMeasures in Mobile Computing Era, Laptops.

UNIT - IV

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors,Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - V

Cyber Security: Organizational Implications, Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perilsfor Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOK:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives,Nina Godbole and Sunil Belapure, Wiley INDIA.

REFERENCE BOOKS:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan-Hwa (john) Wu, J. David Irwin. CRC Press T&FGroup

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

B.Tech. IV Year Course Structure (R-20)

Applicable from 2022-23 Admitted BatchIV YEAR - I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	AI701PC / CS732PE / IT732PE	Deep Learning	3	0	0	3
2	AI702PC	Nature Inspired Computing	3	0	0	3
3		Professional Elective course - III	3	0	0	3
4		Professional Elective course -IV	3	0	0	3
5		Open Elective-II / MOOCs	3	0	0	3
6	AI703PC	Cloud Computing Lab	0	0	4	2
7	AI704PC	Deep Learning Lab	0	0	2	1
8	AI706PROJ	Project-I	0	0	6	3
		Total Credits	**15**	**0**	**12**	**21**

IV YEAR - II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1		Professional Elective course -V	3	0	0	3
2		Professional Elective course -VI	3	0	0	3
3		Open Elective-III / MOOCs	3	0	0	3
4	AI801PROJ	Seminar	0	0	2	1
5	AI802PROJ	Project-II	0	0	18	9
		Total Credits	**9**	**0**	**20**	**19**

Professional Electives

Professional Elective-I

1	AI511PE	Software Process & Project Management
2	CS504PC / IT512PE / AI512PE	Data Mining
3	AI513PE	Web Programming
4	CS511PE / AI514PE	Cryptography & Network Security

Professional Elective - II

1	AI621PE	Software Testing Methodologies
2	AI622PE	Pattern Recognition
3	AI623PE	Introduction to Data Science
4	AI624PE / ME611PE	Industrial Robotics

Professional Elective - III

1	AI731PE	Design Patterns
2	CS701PC / IT734PE / AI732PE	Big Data Analytics
3	AI733PE	Image Processing
4	AI734PE / ME831PE	Principles of Entrepreneurship

Professional Elective-IV

1	AI741PE	Object Oriented Analysis and Design
2	AI742PE	Data Analytics and Visualization
3	AI743PE	Speech Recognition
4	AI744PE	Computer Security & Audit Assurance

Professional Elective - V

1	AI851PE	Web Services and Service Oriented Architecture
2	AI852PE	Predictive Analytics

3	CS864PE / IT864PE / AI853PE	Computer Vision
4	AI854PE / Cy851PE	Quantum Computing

Professional Elective - VI

1	AI861PE / DS851PE	Design Thinking
2	AI862PE	Bioinformatics
3	AI863PE	Semantic Web and Social Networks
4	CS851PE / AI864PE / DS863PE	Block Chain Technologies

Open Elective – I

1	AI611OE	Database Management Systems
2	AI612OE	Information Retrieval System
3	AI613OE	Python Programming

Open Elective – II

1	AI721OE	Introduction to Machine Learning
2	AI722OE	Introduction to Natural Language Processing
3	AI723OE	Data Analytics

Open Elective – III

1	AI831OE	Semantic Web and Social Networks
2	AI832OE	Applications of Natural Language Processing
3	AI833OE	Data Visualization

AI701PC / CY732PE: DEEP LEARNING
(Common to CSM & CSC)

B.Tech. IV Year I Sem.   **L T P C**
                                                                   3 0 0 3

Course Objectives:

- To understand deep Learning algorithms and their applications in real-world data

Course Outcomes:
- Understand machine learning basics and neural networks
- Understand optimal usage of data for training deep models
- Apply CNN and RNN models for real-world data
- Evaluate deep models
- Develop deep models for real-world problems

UNIT - I

Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, ChallengesMotivating Deep Learning

Deep Feedforward Networks Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

UNIT - II

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under- Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi- Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout,Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier, Optimization for Training Deep Models, Learning vs Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates

UNIT - III

Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution andPooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features

UNIT - IV

Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks,Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent

Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long- Term Dependencies, Explicit Memory

UNIT - V

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, NaturalLanguage Processing, Other Applications.

TEXT BOOK:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.

REFERENCE BOOKS:

1. The Elements of Statistical Learning. Hastie, R. Tibshirani, and J. Friedman, Springer.

2. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

3. Bishop. C.M., Pattern Recognition and Machine Learning, Springer, 2006.

4. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.

5. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press, 2013.

6. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education,2004

AI702PC: NATURE INSPIRED COMPUTING

B.Tech. IV Year I Sem.   **L T P C**

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Course Objectives:

- Knowledge on significance of evolutionary computing, neurocomputing and swarm intelligence

Course Outcomes:

- Familiar with Evolutionary Computing algorithms
- Understand scope of neuro computing
- Compare different Ant Colony Optimization algorithmic models.
- Understand the scope of artificial immune systems
- Tackle different real world problems

UNIT - I

Evolutionary Computing

Problem Solving as a Search Task, Hill Climbing and Simulated Annealing, EvolutionaryBiology, Evolutionary Computing, The Other Main Evolutionary Algorithms, From Evolutionary Biology to Computing, Scope of Evolutionary Computing

UNIT - II

Neuro-computing

The Nervous System, Artificial Neural Networks, Typical ANNS and Learning Algorithms, From Natural to Artificial Neural Networks, Scope of Neurocomputing

UNIT - III

Swarm Intelligence

Ant Colonies, Swarm Robotics, Social Adaptation of Knowledge

UNIT - IV

Immunocomputing:

The Immune System, Artificial Immune Systems, Bone Marrow Models, Negative SelectionAlgorithms, Clonal Selection and Affinity Maturation, Artificial Immune Networks, From Natural to Artificial Immune Systems, Scope of Artificial Immune Systems

UNIT - V

Case Studies- Bioinformatics, Information Display

TEXT BOOKS:

1. Leandro Nunes de Castro - " Fundamentals of Natural Computing, Basic Concepts,

2. Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group,2007

3. Albert Y.Zomaya - "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006

REFERENCE BOOKS:

1. Floreano, D. and C. Mattiussi -"Bio-Inspired Artificial Intelligence: Theoriesethods, and Technologies" IT Press, 2008

2. Marco Dorrigo, Thomas Stutzle -" Ant Colony Optimization", Prentice Hallof India, New Delhi, 2005

3. Vinod Chandra S S, Anand H S - "Machine Learning: A Practitioner'sApproach", Prentice Hall of India, New Delhi, 2020

AI731PE: DESIGN PATTERNS

(Professional Elective – IV)

B.Tech. IV Year I Sem. **L T P C**
3 0 0 3

Prerequisites:

1.   A Course on Software Engineering"
2.   A Course on "Object Oriented Programming Through Java"

Course Objectives:

- The aim of the course is to appreciate the idea behind Design Patterns in handling common problems faced during building an application
- This course covers all pattern types from creational to structural, behavioural to concurrency and highlights the scenarios when one pattern must be chosen over others.

Course Outcomes:

- Create software designs that are scalable and easily maintainable
- Understand the best use of Object Oriented concepts for creating truly OOP programs
- Use creational design patterns in software design for class instantiation
- Use structural design patterns for better class and object composition
- Use behavioural patterns for better organization and communication between the objects
- Use refactoring to compose the methods for proper code packaging
- Use refactoring to better organize the class responsibilities of current code

UNIT - I

Introduction: What is a design pattern? design patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

UNIT - II

Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary.

UNIT - III

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

UNIT - IV

Structural Pattern: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy.

UNIT - V

Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor.

TEXT BOOK:

1.   Design Patterns, Erich Gamma, Pearson Education

REFERENCE BOOKS:

1.   Pattern's in Java, Vol –I, Mark Grand, Wiley Dream Tech.
2.   Patterns in Java, Vol-II, Mark Grand, Wiley Dream Tech.
3.   Java Enterprise Design Patterns Vol-III, Mark Grand, Wiley Dream Tech.
4.   Head First Design Patterns, Eric Freeman, O'reily publications

AI732PE/CS701PC/IT734PE: BIG DATA ANALYTICS

(Professional Elective – III) (Common to CSM & CSC)

B.Tech. IV Year I Sem. **L T P C**
3 0 0 3

Course Objectives:
- To introduce the terminology, technology and its applications
- To introduce the concept of Analytics for Business
- To introduce the tools, technologies & programming languages which is used in day today analytics cycle

UNIT - I

Data Management (NOS 2101): Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/signal/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Preprocessing. Export all the data onto Cloud ex. AWS/Rackspaceetc.

Maintain Healthy, Safe & Secure Working Environment (NOS 9003): Introduction, workplace safety, Report Accidents & Emergencies, Protect health & safety as your work, course conclusion, assessment.

UNIT – II

Big Data Tools (NOS 2101): Introduction to Big Data tools like Hadoop, Spark, Impala etc.,Data ETL process, Identify gaps in the data and follow-up for decision making.

Provide Data/Information in Standard Formats (NOS 9004): Introduction, Knowledge Management, Standardized reporting & compliances, Decision Models, course conclusion. Assessment

UNIT - III

Big Data Analytics: Run descriptive to understand the nature of the available data, collate allthe data sources to suffice business requirement, Run descriptive statistics for all the variables and observer the data ranges, Outlier detection and elimination.

UNIT - IV

Machine Learning Algorithms (NOS 9003): Hypothesis testing and determining the multiple analytical methodologies, Train Model on 2/3 sample data using various Statistical/Machine learning algorithms, Test model on 1/3 sample for prediction etc.

UNIT - V (NOS 9004)

Data Visualization (NOS 2101): Prepare the data for Visualization, Use tools like Tableau, Qlick View and D3, Draw insights out of Visualization tool. Product Implementation

TEXT BOOK:

1. Student's Handbook for Associate Analytics.

REFERENCE BOOKS:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006

2. Data Mining Analysis and Concepts, M. Zaki and W. Meira (the authors have kindly madean online version available): http://www.dataminingbook.info/uploads/book.pdf

3. Mining of Massive Datasets Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D. Ullman, Stanford Univ.

   (http://www.vistrails.org/index.php/Course:_Big_Data_Analysis)

AI733PE / IT734PE: IMAGE PROCESSING (Professional Elective –III)
(Common to IT & CSM branches)

B.Tech. IV Year I Sem.   **L T P C**

3 0 0 3

Prerequisites

Students are expected to have knowledge in linear signals and systems, Fourier Transform, basic linear algebra, basic probability theory and basic programming techniques; knowledge of Digital Signal Processing is desirable.

- A course on "Computational Mathematics"

- A course on "Computer Oriented Statistical Methods"

Course Objectives:

- Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts.

- The topics include image acquisition; sampling and quantization; pre-processing; enhancement; restoration; segmentation; and compression.

Course Outcomes:

- Demonstrate the knowledge of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.

- Demonstrate the knowledge of filtering techniques.

- Demonstrate the knowledge of 2D transformation techniques.

- Demonstrate the knowledge of image enhancement, segmentation, restoration and compression techniques.

UNIT - I

Digital Image Fundamentals: Digital Image through Scanner, Digital Camera. Concept of GrayLevels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

UNIT - II

Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

UNIT - III

Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT - IV

Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

UNIT - V

Image Compression Redundancies and their Removal Methods, Fidelity Criteria, ImageCompression Models,

Source Encoder and Decoder, Error Free Compression, Lossy Compression.

TEXT BOOK:

1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2nd Ed, 2004.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing: A. K. Jain, PHI.

2. Digital Image Processing using MAT LAB: Rafael C. Gonzalez, Richard E. Woods, Steven

3. L. Eddins: Pearson Education India, 2004.

4. Digital Image Processing: William K. Pratt, John Wilely, 3rd Edition, 2004.

AI734PE / ME831PE: PRINCIPLES OF ENTREPRENEURSHIP
(Professional Elective –III)
(Common to CSM & ME)

B.Tech. IV Year I Sem.   **L T P C**
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UNIT - I

Introduction to Entrepreneurship: Definition of Entrepreneur Entrepreneurial Traits. Entrepreneur vs Manager, creating and starting the venture: sources of new ideas, method of generating ideas, cre - ative problem solving – writing business plan, evaluating business plans. Launching formalities.

UNIT - II

Financing and Managing the new ventures: sources of capital, record keeping, recruitment, motivat- ingand leading teams, financial controls. Marketing and sales controls. E commerce and Entrepre- neurship, internetadvertising – new venture expansion strategies and issues.

UNIT - III

Industrial Financial Support: schemes and functions of directorate of industries, District industries centre (DICs) Industrial development corporation (IDC), State Financial corporation (SFCs), small scale industries development corporation (SSIDCs) Khadhi and village industries commission (KVIC) Technical Consultancy organisation (TCO), Small industries service institute (SISI), national small industries corporation (NSIC), small industries development bank of india (SIDBI).

UNIT - IV

Production and marketing management: Thrust areas of production management, selection of pro- duction techniques, plant utilisation and maintenance, designing the work place, inventory control, material handling and quality control. Marketing functions, market segmentation market research and channels of distribution, sales promotion and product pricing.

UNIT - V

Labour legislation, salient provision of health, safety, and welfare under Indian factories Act, Industrial dispute act, employees state insurance act, workmen's compensation act and payment of bonus act .

TEXT BOOKS:

1. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 2009.

2. Dollinger: Entrepreneurship, Pearson, 2009.

REFERENCE BOOKS:

1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publish-ing House, 2009.

2. Harvard Business Review on Entrepreneurship, HBR Paper Back.

3. Robert J. Calvin: Entrepreneurial Management, TMH, 2009.

4. Gurmeet Naroola: The entrepreneurial Connection, TMH, 2009.

5. Bolton & Thompson: Entrepreneurs—Talent, Temperament and Techniques, ButterworthHeine- mann, 2009.

6. Agarwal: Indian Economy, Wishwa Prakashan 2009.

7. Dutt & Sundaram: Indian Economy, S. Chand, 2009.

8. B D Singh.: Industrial Relations & Labour Laws, Excel, 2009.

9. Aruna Kaulgud: Entrepreneurship Management by, Vikas publishing house, 2009.

10. Essential of entrepreneurship and small business management by Thomas W. Zimmerer & Norman M. Searborough, PHI-2009.

11. ND Kapoor: Industrial Law, Sultan Chand & Sons, 2009.

AI741PE: OBJECT ORIENTED ANALYSIS AND DESIGN

(Professional Elective – V)

B.Tech. IV Year II Sem.   **L T P C**

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Course Objectives:

• Concisely define the following key terms: class, object, state, behaviour, object class, class di-agram, object diagram, operation, encapsulation, constructor operation, query operation, up-date operation, scope operation, association, association role, multiplicity, association class, abstract class, concrete class, class-scope attribute, abstract operation, method, polymor-phism, overriding, multiple classification, aggregation, and composition.

• Describe the activities in the different phases of the object-oriented development life cycle.

• State the advantages of object-oriented modelling vis-à-vis structured approaches.

• Compare and contrast the object-oriented model with the E-R and EER models.

• Model a real-world application by using a UML class diagram.

• Provide a snapshot of the detailed state of a system at a point in time using a UML(Unified Modeling Language) object diagram.

• Recognize when to use generalization, aggregation, and composition relationships.

• Specify different types of business rules in a class diagram.

Course Outcomes: Graduate can able to take up the case studies and model it in different views with respect user requirement such as use case, logical, component and deployment and etc, and preparation of document of the project for the unified Library application.

UNIT - I

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT - II

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Pack-ages.

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams.

UNIT - III

Basic Behavioral Modeling-I: Interactions, Interaction diagrams.
Basic Behavioral Modeling-II: Use cases, Use case Diagrams, Activity Diagrams

UNIT - IV

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

UNIT - V

Patterns and Frameworks, Artifact Diagrams. Case Study: The Unified Library application.

TEXT BOOKS:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education 2nd Edition.

2. Object-Oriented Analysis and Design with the Unified Process By John W. Satzinger, Robert B Jackson and Stephen D Burd, Cengage Learning.

REFERENCE BOOKS:

1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.

2. Pascal Roques: Modeling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.

3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.

4. Mark Priestley: Practical Object-Oriented Design with UML, TMH.

5. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

6. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY Dreamtech India Pvt. Ltd.

7. UML and C++, R. C. Lee, and W. M. Tepfenhart, PHI.

8. Object Oriented Analysis, Design and Implementation, B. Dathan, S. Ramnath, Universities Press.

9. OODesign with UML and Java, K. Barclay, J. Savage, Elsevier.

10. Learning UML 2.0, Russ Miles and Kim Hamilton, O'Reilly, SPD.

AI742PE: DATA ANALYTICS AND VISUALIZATION
(Professional Elective – IV)

B.Tech. IV Year I Sem.   **L T P C**
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Prerequisites:

- A course on "Database Management Systems".
- Knowledge of probability and statistics.

Course Objectives:

- To explore the fundamental concepts of data analytics.
- To learn the principles and methods of statistical analysis
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
- To understand the various search methods and visualization techniques.

Course Outcomes: After completion of this course students will be able to

- Understand the impact of data analytics for business decisions and strategy
- Carry out data analysis/statistical analysis
- To carry out standard data visualization and formal inference procedures
- Design Data Architecture
- Understand various Data Sources

UNIT - I

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality(noise,outliers, missing values, duplicate data) and Data Processing & Processing.

UNIT - II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

UNIT - III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

UNIT - IV

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning,
Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc.
Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

UNIT - V

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

1. Student's Handbook for Associate Analytics – II, III.

2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.

2. Data Mining Analysis and Concepts, M. Zaki and W. Meira

3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.

AI743PE / DS742PE: SPEECH RECOGNITION

(Professional Elective – IV)

(Common to CSM & DS)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Objectives: The student should be made:

• To understand the speech production mechanism and the various speech analysis techniques and speech models

• To understand the speech compression techniques

• To understand the speech recognition techniques

• To know the speaker recognition and text to speech synthesis techniques

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

• Design speech compression techniques

• Configure speech recognition techniques

• Design speaker recognition systems

• Design text to speech synthesis systems

UNIT I
SPEECH SIGNAL CHARACTERISTICS & ANALYSIS

• Speech production process - speech sounds and features- Phonetic Representation of Speech

• -- representing speech in time and frequency domains - Short-Time Analysis of Speech - Short- Time Energy and Zero-Crossing Rate - Short-Time Autocorrelation Function - Short-Time Fourier Transform (STFT)

• Speech Spectrum - Cepstrum - Mel-Frequency Cepstrum Coefficients

• Hearing and Auditory Perception - Perception of Loudness - Critical Bands - Pitch Perception

UNIT II
SPEECH COMPRESSION

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP)

UNIT III
SPEECH RECOGNITION

LPC for speech recognition- Hidden Markov Model (HMM)- training procedure for HMM- sub-word unit model based on HMM- language models for large vocabulary speech recognition
Overall recognition system based on subword units - Context dependent subword units- Sem.antic post processor for speech recognition

UNIT IV

SPEAKER RECOGNITION

Acoustic parameters for speaker verification- Feature space for speaker recognition-similaritymeasures- Text dependent speaker verification-Text independent speaker verification techniques

UNIT V

SPEAKER RECOGNITION AND TEXT TO SPEECH SYNTHESIS

Text to speech synthesis (TTS)-Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness role of prosody

TEXT BOOKS:

1. L. R. Rabiner and R. W. Schafer, Introduction to Digital Signal Processing, Foundationsand Trendsin Signal Processing Vol. 1, Nos. 1–2 (2007) 1–194

2. Ben Gold and Nelson Morgan ―Speech and Audio signal processing- processing and perception of speech and music‖, John Wiley and sons 2006

REFERENCES

1. Lawrence Rabiner, Biiing and– Hwang Juang and B.Yegnanarayana ―Fundamentals of

2. Speech Recognition‖, Pearson Education, 2009

3. Claudio Becchetti and Lucio Prina Ricotti, ―Speech Recognition‖, John Wiley and Sons, 1999

4. Donglos O shanhnessy ―Speech Communication: Human and Machine ―, 2nd Ed. Unipress 2001.

AI744PE : COMPUTER SECURITY & AUDIT ASSURANCE

(Professional Elective – IV) (Common to CSM & CSC)

B.Tech. IV Year I Sem.   **L T P C**
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Course Objectives:

- State the basic concepts in information systems security, including security technology andprinciples, software security and trusted systems, and IT security management.

- Explain concepts related to various cryptographic tools.

Course Outcomes:

- State the requirements and mechanisms for identification and authentication.

- Explain and compare the various access control policies and models as well as the assuranceof these models.

- Understand various standard practices and policies in conducting audits.

- Understand and analyze the significance of Network Security and Control, Internet BankingRisks and Control.

UNIT - I

System Audit and Assurance – Characteristics of Assurance services, Types of Assurances services,Certified Information system auditor, Benefits of Audits for Organization, COBIT.

UNIT - II

Internal Control and Information system Audit - Internal Control, Detective control, Corrective Control,Computer Assisted Audit Tools and Techniques.

UNIT - III

Conducting Audit – Standard practices, policies, Audit planning, Risk Assessment, Informationgathering techniques, Vulnerabilities, System security testing, conducting Audits for Banks.

UNIT - IV

Network Security and Control, Internet Banking Risks and Control, Operating System Risks and Control,Operational Control Overview.

UNIT - V

Business Continuity and Disaster Recovery Planning Control – Data backup/storage, Developing appropriate Disaster recovering strategy, Business Impact analysis.

TEXT BOOK:

Information System Audit and Assurance; D. P. Dube, Ved Prakash Gulati; Tata McGraw- HillEducation, 01 Jan 2005.

REFERENCE BOOKS:

1. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearsoneducation

2. Martin Weiss and Michael G. Solomon, Auditing IT Infrastructures For Compliance (InformationSystems Security & Assurance), Jones and Bartlett Publishers, Inc.

AI851PE: WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE

(Professional Elective –V)

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

Course Objectives:
- To understand the details of web services technologies like WSDL, UDDI, SOAP
- To learn how to implement and deploy web service client and server
- To explore interoperability between different frameworks

Course Outcomes:
- Basic details of WSDL, UDDI, SOAP
- Implement WS client and server with interoperable systems

UNIT - I
Evolution and Emergence of Web Services - Evolution of distributed computing, Core distributed computing technologies – client/server, CORBA, JAVA RMI, Microsoft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence ofWeb Services and Service Oriented Architecture (SOA).

Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using webservices.

Web Services Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication models, basic steps of implementing web services.

UNIT - II
Fundamentals of SOAP – SOAP Message Structure, SOAP encoding, Encoding of differentdata types, SOAP message exchange models, SOAP communication and messaging, Java and Axis, limitations of SOAP.

UNIT - III
Describing Web Services – WSDL – WSDL in the world of Web Services, Web Services life

cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL.

UNIT - IV
Discovering Web Services – Service discovery, role of service discovery in a SOA, servicediscovery mechanisms, UDDI – UDDI registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, Publishing API, Publishing, searching and deleting information in a UDDI Registry, limitations of UDDI.

UNIT - V
Web Services Interoperability – Means of ensuring Interoperability, Overview of .NET, Creatinga .NET client for an Axis Web Service, creating Java client for a Web service, Challenges in Web Services Interoperability.

Web Services Security – XML security frame work, Goals of Cryptography, Digital signature, Digital

Certificate, XML Encryption.

TEXT BOOK:

1. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.

REFERENCE BOOKS:

1. Java Web Service Architecture, James McGovern, Sameer Tyagi et al., Elsevier

2. Building Web Services with Java, 2nd Edition, S. Graham and others, Pearson Edn.

3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly,SPD.

4. Web Services, G. Alonso, F. Casati and others, Springer.

AI852PE: PREDICTIVE ANALYTICS

(Professional Elective –V)

B.Tech. IV Year II Sem.   L T P C

                                                              3 0 0 3

Course Objectives:

- To introduce the terminology, technology and its applications
- To introduce the concept of Analytics for Business
- To introduce the tools, technologies & programming languages which is used in day today analytics cycle

UNIT - I
Introduction to Predictive Analytics & Linear Regression (NOS 2101)

What and Why Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of data and variables, Data Modelling Techniques, Missing imputations etc.

Need for Business Modelling, Regression – Concepts, Blue property-assumptions-Least SquareEstimation, Variable Rationalization, and Model Building etc.

UNIT - II
Logistic Regression (NOS 2101): Model Theory, Model fit Statistics, Model Conclusion,

Analytics applications to various Business Domains etc.

Prediction vs Regression, Linear regression and multiple regression

UNIT – III
Objective Segmentation (NOS 2101): Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Over fitting, Pruning and complexity, Multiple Decision Trees etc.

Develop Knowledge, Skill, and Competences (NOS 9005): Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping,etc.

UNIT - IV
Time Series Methods /Forecasting, Feature Extraction (NOS 2101): Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average,Energy etc and Analyze for prediction. Project

UNIT - V
Applications: Working with Documents (NOS 0703) - Standard Operating Procedures for documentation and knowledge sharing, Defining purpose and scope documents, Understanding structure of documents – case studies, articles, white papers, technical reports, minutes of meeting etc., Style and format, Intellectual Property and Copyright, Document preparationtools – Visio, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.

TEXT BOOKS:
1.   Student's Handbook for Associate Analytics - III.

REFERENCE BOOKS:
1.   Gareth James • Daniela Witten • Trevor Hastie Robert Tibshirani. An Introduction to Statistical Learning with Applications in R

AI853PE / CS864PE / IT864PE: COMPUTER VISION
(Professional Elective –V)
(Common to CSE, IT & CSM)

B.Tech. IV Year I Sem. **L T P C**
3 0 0 3

Course Objectives:
- Learn basic principles of image formation, image processing algorithms and different algorithms for recognition from single or multiple images (video).
- Understand the core vision tasks of scene understanding and recognition.
- Applications to 3D modelling, video analysis, video surveillance, object recognition

Course outcomes:
- Implement fundamental image processing techniques required for computer vision
- Understand Image formation process
- Perform shape analysis
- Develop applications using computer vision techniques
- Understand video processing and motion computation

UNIT-I
Introduction and Image Formation: What is computer vision? A brief history, Geometric primitives and transformations, Photometric image formation, The digital camera. Pinhole Perspective, Weak Perspective, Cameras with Lenses, The Human Eye, Intrinsic Parameters and Extrinsic Parameters, Geometric Camera Calibration

UNIT-II
Early Vision – One Image: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Local ImageFeatures, Texture

UNIT-III
Early Vision – Multiple Images: Stereopsis and Structure from Motion

UNIT-IV
Mid-level Vision: Segmentation by Clustering, Grouping and Model fitting, Tracking

UNIT-V
High-level Vision: Registration, Smooth Surface and their Outlines, Range Data DetectingObjects in Images, Recognition

TEXT BOOKS:
1. Computer Vision: Algorithms and Applications (CVAA), Richard Szeliski, Springer, 2nd edition, 2020, http://szeliski.org/Book/
2. Computer Vision – A modern approach, by D. Forsyth and J. Ponce, Prentice Hall, 2nd edition, 2012

REFERENCE BOOKS:
1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
3. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
4. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University, Press, 2012
5. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher:

Prentice Hall.

6. Building Computer Vision Applications Using Artificial Neural Networks - With Step-by-step Examples in OpencvAndTensorflow With Python, Shamshad Ansari,Apress, 2020

AI854PE / CY851PE: QUANTUM COMPUTING
(Professional Elective –V) (Common to CSM & CSC)

B.Tech. IV Year I Sem.　　　　　　　　　　　　　　　　　　　**L T P C**
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Course Objectives:

1. To introduce the fundamentals of quantum computing
2. The problem-solving approach using finite dimensional mathematics

Course Outcomes:

1. Understand basics of quantum computing
2. Understand physical implementation of Qubit
3. Understand Quantum algorithms and their implementation
4. Understand the Impact of Quantum Computing on Cryptography

UNIT - I

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. **Complex Numbers:** Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice,Transcendental Numbers.

UNIT - II

Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.

Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

UNIT - III

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, TheD-Wave Quantum Architecture. **Quantum Hardware:** Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

UNIT - IV

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

UNIT - V

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve. **The Impact of Quantum Computing on Cryptography:** Asymmetric Cryptography, Specific Algorithms, Specific Applications.

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol.Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

AI861PE/ DS 851PE: Design Thinking (Professional Elective –VI)

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

Prerequisites: NIL

Course Objectives:

- To inculcate core design principles and applied creativity to develop innovative strategies that better connect engineers with their end users
- To build mindset leading to flow of creative ideas, validating those ideas and prioritizing the best ones
- To incorporate tools that designers need to take a design project from inspiration and insights to ideation and implementation
- To instill full scope of organizational innovation and strategy through knowledge, insight and analytical skills

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

- Use design thinking and hypothesis-driven innovation processes to develop viable solutions to user challenges.
- Use multiple brainstorming techniques to find innovative solutions.
- Develop and test a business model or business case to support the viability of the solution.
- Prototype a solution to a user challenge.
- Investigate the cultural, emotional, technological and business factors relevant to developing new product or service design concept.

UNIT - I

Revisiting Design Thinking: Creative thinking as basis of innovation; Empathy process for deep understanding of challenge with practical ingenuity; Making sense of observations and insights; Defining a point of view and context Design thinking skills for Problem Discovery, Definition, and Ideation – Identifying problems in daily lives and in the world at large, Understanding user and customer perspectives, Thinking from the problem before thinking of a solution.

UNIT - II

Ideation Process: Clear Articulation of problem statement with focus on latent needs; Brainstorming potential solutions; Ideation methods with case-study based approach to using Systematic Inventive Thinking (SIT) Methods such as Addition, Subtraction, Multiplication, Division and Task Unification Strategic Innovation for competition in future: Linear Innovation vs. non-linear innovation, Understanding and identifying weak signals, 3-box thinking, 3-Box framework and Box-3 ideation

UNIT - III

Designing Customer Experience: Understanding Innovation through Design Thinking; Enhancing Customer Experience; Service Design and Development Process and Case Studies; Service Experience Cycle and Case Studies.

UNIT - IV

Sustainable Design Approaches: Concern for Environment and Sustainability in Design, Case Studies to understand good Design For Environment (DFE) Decisions; Design Considerations in the five stages of the Product Life Cycle.

UNIT - V

Integrative Engineering Design Solutions: Identifying and resolving issues with working in diverse teams, Modularising, prototype building by different engineering disciplines within the team, validated learning with accessible metrics

Capstone Project (Interdisciplinary)

Applying Design Thinking Principles and Methods for Ideation and Prototyping, Testing Solution, Refining Solution, and Taking the Solution to the Users

TEXT BOOKS:

1. Design Methods: A Structured Approach for Driving Innovation in Your Organization, Vijay Kumar, John Wiley & Sons, ISBN: 978-1118083468, 2012.

2. Living with Complexity, Donald A Norman, MIT Press, ISBN: 978-0262528948, 2016.

3. Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work,

4. Beverly Rudkin Ingle, A Press, ISBN: 978-1430261810, 2013.

REFERENCE BOOKS:

1. Emotionally Durable Design: Objects, Experiences and Empathy, Jonathan Chapman, 2nd Edition, Routledge, ISBN: 978-0415732161, 2015.

2. Innovation Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions, Thomas Lockwood, Edgar Papke, New Page Books, ISBN: 978-1632651167, 2017.

3. Design Thinking Business Analysis: Business Concept Mapping Applied, Thomas Frisendal, Springer, ISBN: 978-3642434822, 2012.

4. Chapter 1: A Simple Framework for Leading Innovation, The Three Box Solution, HBR Press, 2016.

5. Design a Better Business: New Tools, Skills and Mindset for Strategy and Innovation, Patrick Van Der Pijl, Justin Lokitz, Lisa Kay Solomon, Erik van der Pluijm, Maarten van Lieshout, Wiley, ISBN: 978-8126565085, 2016.

AI862PE: BIOINFORMATICS (Professional Elective –VI)

B.Tech. IV Year II Sem.   **L T P C**
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Unit- I

Introduction to Bioinformatics: Definition, concepts, History, Overview of molecular biology, the cell as basic unit of life- Prokaryotic cell and Eukaryotic cell - Central Dogma: DNA-RNA-Protein, Introduction to DNA and Protein sequencing, Human Genome Project, SNP, Future and scope of Bioinformatics

Unit- II

Bioinformatics databases - Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, GeneBank, DDBJ; Secondary nucleotide sequence databases; Protein databases- UniProt, Protein Data Bank

Unit- III

Sequence Analysis-Basic concepts, Alignment of pairs of sequence: Homologous, Analogue, Orhtologous, paralogous, Xenologous (Need for sequence alignment, Local and Global alignment, Scoring matrices- PAM and BLOSUM matrices

Unit-IV

Pairwise sequence alignments: BLAST, Multiple sequence alignments (MSA) BLAST:- Nucleotide BLAST, Protein BLAST, PSI-BLAST, Analysis of BLAST results, E Value, sensitivity and specificity of BLAST, FASTA Structure analysis tools and softwares

Unit- V

Dynamic Programming, Needleman-Wunsch algorithm for global alignment, SmithWaterman algorithm for local alignment, Introduction to RASMOL, SWISS-PDB Viewer, ARGUS LAB

TEXT BOOK:

1.   P. Narayanan, Bioinformatics: A Primer, New Age International Publishers.

2.   Harshawardhan P. Bal, Bioinformatics Principles and Applications, Tata McGraw-Hill Pub lishing Company Ltd.

REFERENCE BOOKS:

1.   Marketa Zvelebil and Jeremy O. Baum, Understanding Bioinformatics, Garland Science

2.   Rastogiet. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

3.   Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education.

4.   Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd.

AI863PE: SEMANTIC WEB AND SOCIAL NETWORKS
(Professional Elective – VI)
(Common to CSM & CSC)
B.Tech. IV Year II Sem.   **L T P C**
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Course Objectives:
- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology
- To learn Social Network Analysis and semantic web

Course Outcomes:
- Ability to understand and knowledge representation for the semantic web.
- Ability to create ontology.
- Ability to build a blogs and social networks

UNIT - I

Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limita-tions of Today's Web, The Next Generation Web.

Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Bern-ers-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT - II

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web

–Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL),UM- L,XML/XML Schema.

Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Meth-ods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping.

UNIT - III

Logic, Rule and Inference Engines. Semantic Web applications and services, Semantic Search,e-learning,   Semantic Bioinformatics, Knowledge Base.

UNIT - IV

XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

What is social Networks analysis, development of the social networks analysis, Electronic Sourc- es for Network Analysis – Electronic Discussion networks.

UNIT - V

Blogs and Online Communities, Web Based Networks. Building Semantic Web Applicationswith social network features.

TEXT BOOKS:
1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley interscience.

2. Social Networks and the Semantic Web, Peter Mika, Springer.

REFERENCE BOOKS:
1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies,Rudi   Studer, Paul Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publish- ers,(Taylor & Francis Group)
3. Information sharing on the semantic Web - Heiner Stucken schmidt; Frank Van Harmelen, Springer Publications.
4. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

AI864PE / CS851PE / DS863PE: BLOCKCHAIN TECHNOLOGIES
(Professional Elective –VI)
(Common to CSE, CSM & CSD)

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

- Define and Explain the fundamentals of Blockchain
- Illustrate the technologies of blockchain
- Describe the models of blockchain
- Analyze and demonstrate the Ethereum

Course outcomes:

- Define and Explain the fundamentals of Blockchain
- Illustrate the technologies of blockchain
- Describe the models of blockchain
- Analyze and demonstrate the Ethereum
- Analyze and demonstrate Hyperledger fabric

UNIT-I
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

UNIT-II
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and privatekeys

UNIT-III

Bitcoin and Alternative Coins

A: Bitcoin, Transactions, Blockchain, Bitcoin payments B:

Alternative Coins

Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

UNIT-IV
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain,Precompiled contracts.

UNIT-V

Alternative Blockchains: Blockchains

Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media

TEXT BOOK:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017

REFERENCE BOOKS:

1. Blockchain Technology (Concepts and applications), Kumar saurabh, Ashutosh saxena, Wiley, 2020

2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten,2016

3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress,First Edition, 2017

4. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

AI703PC: CLOUD COMPUTING LAB

B.Tech. IV Year I Sem.   **L T P C**
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COURSE OBJECTIVES:

• This course provides an insight into cloud computing

• Topics covered include- distributed system models, different cloud service models, service-oriented architectures, cloud programming and software environments, resource management.

COURSE OUTCOMES:

• Understand various service types, delivery models and technologies of a cloud computing environment.

• Understand the ways in which the cloud can be programmed and deployed.

• Understand cloud service providers like Cloudsim, Globus Toolkit etc.

• Examine various programming paradigms suitable to solve real world and scientific problems using cloud services.

PART-A

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quan-t tum Computing, Optical Computing, Nano computing.

PART-B

LIST OF EXPERIMENTS:

1. Install Virtualbox/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8.

2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

3. Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance.

4. Install Google App Engine. Create a hello world app and other simple web applications using python/java.

5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

6. Find a procedure to transfer the files from one virtual machine to another virtual machine.

7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

8. Install Hadoop single node cluster and run simple applications like word count.

9. Create a database instance in the cloud using Amazon RDS.

10. Create a database instance in the cloud using Google Cloud SQL

TEXT BOOK:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej, M. Goscinski, Wiley, 2011.

2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

AI704PC: DEEP LEARNING LAB
(Common to CSM & CSC)

B.Tech. IV Year I Sem.   **L T P C**
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Prerequisite:

Any programming language Python/R/Matlab

Course Objectives:
To implement ANN and Deep Learning concepts

List of Experiments:
- Implementation of MP model
- Implementation of feed forward neural network
- Implementation of back propagation neural network
- Implement all activation function of neural network for any pattern recognition application
- Implement any one of ImageNet or GoogleNet
- Implement a system to recognize hand written character using CNN
- Classify images appropriately using CNN
- Implement LSTM Neural Network for Time Series Prediction

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AI861PE / DS851PE: WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE

(Professional Elective –VI)

B.Tech. IV Year II Sem.   **L T P C**

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Course Objectives:

- To understand the details of web services technologies like WSDL, UDDI, SOAP
- To learn how to implement and deploy web service client and server
- To explore interoperability between different frameworks

Course Outcomes:

- Basic details of WSDL, UDDI, SOAP
- Implement WS client and server with interoperable systems

UNIT - I

Evolution and Emergence of Web Services - Evolution of distributed computing, Core distributed computing technologies – client/server, CORBA, JAVA RMI, Microsoft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA).

Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

Web Services Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication models, basic steps of implementing web services.

UNIT - II

Fundamentals of SOAP – SOAP Message Structure, SOAP encoding, Encoding of different data types, SOAP message exchange models, SOAP communication and messaging, Java and Axis, limitations of SOAP.

UNIT - III

Describing Web Services – WSDL – WSDL in the world of Web Services, Web Services life

cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL.

UNIT - IV

Discovering Web Services – Service discovery, role of service discovery in a SOA, service discovery mechanisms, UDDI – UDDI registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, Publishing API, Publishing, searching and deleting information in a UDDI Registry, limitations of UDDI.

UNIT - V

Web Services Interoperability – Means of ensuring Interoperability, Overview of .NET, Creating a .NET client for an Axis Web Service, creating Java client for a Web service, Challenges in Web Services Interoperability.

Web Services Security – XML security frame work, Goals of Cryptography, Digital signature,

Digital Certificate, XML Encryption.

TEXT BOOK:

1.   Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.

REFERENCE BOOKS:

1.   Java Web Service Architecture, James McGovern, Sameer Tyagi et al., Elsevier
2.   Building Web Services with Java, 2nd Edition, S. Graham and others, Pearson Edn.
3.   Java Web Services, D.A. Chappell & T. Jewell, O'Reilly,SPD.
4.   Web Services, G. Alonso, F. Casati and others, Springer.

AI852PE: PREDICTIVE ANALYTICS
(Professional Elective –V)

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

Course Objectives:

- To introduce the terminology, technology and its applications
- To introduce the concept of Analytics for Business
- To introduce the tools, technologies & programming languages which is used in day today analytics cycle

UNIT - I

- Introduction to Predictive Analytics & Linear Regression (NOS 2101)
- What and Why Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Data-bases & Types of data and variables, Data Modelling Techniques, Missing imputations etc.
- Need for Business Modelling, Regression – Concepts, Blue property-assumptions-Least Squa-reEstimation, Variable Rationalization, and Model Building etc.

UNIT - II

Logistic Regression (NOS 2101): Model Theory, Model fit Statistics, Model Conclusion,
Analytics applications to various Business Domains etc.
Prediction vs Regression, Linear regression and multiple regression

UNIT – III

Objective Segmentation (NOS 2101): Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Over fitting, Pruning and complexity, Multiple Decision Trees etc.
Develop Knowledge, Skill, and Competences (NOS 9005): Introduction to Knowledge skills & compe-tences, Training & Development, Learning & Development, Policies and Record keeping,etc.

UNIT - IV

Time Series Methods /Forecasting, Feature Extraction (NOS 2101): Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average,Energy etc and Analyze for prediction. Project

UNIT - V

Applications: Working with Documents (NOS 0703) - Standard Operating Procedures for docu-mentation and knowledge sharing, Defining purpose and scope documents, Understanding structure of docu-ments – case studies, articles, white papers, technical reports, minutes of meeting etc., Style and format, Intel-lectual Property and Copyright, Document preparationtools – Visio, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.

TEXT BOOKS:

1.   Student's Handbook for Associate Analytics - III.

REFERENCE BOOKS:

1. Gareth James • Daniela Witten • Trevor Hastie Robert Tibshirani. An Introduction to Statistical Learning with Applications in R

AI853PE / CS864PE / IT864PE: COMPUTER VISION

(Professional Elective –V) (Common to CSE, IT & CSM)

B.Tech. IV Year I Sem.   **L T P C**

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Course Objectives:

- Learn basic principles of image formation, image processing algorithms and different algorithms for recognition from single or multiple images (video).

- Understand the core vision tasks of scene understanding and recognition.

- Applications to 3D modelling, video analysis, video surveillance, object recognition

Course outcomes:

- Implement fundamental image processing techniques required for computer vision

- Understand Image formation process

- Perform shape analysis

- Develop applications using computer vision techniques

- Understand video processing and motion computation

UNIT-I

Introduction and Image Formation: What is computer vision? A brief history, Geometric primitives and transformations, Photometric image formation, The digital camera. Pinhole Perspective, Weak Perspective, Cameras with Lenses, The Human Eye, Intrinsic Parameters and Extrinsic Parameters, Geometric Camera Calibration

UNIT-II

Early Vision – One Image: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Local ImageFeatures, Texture

UNIT-III

Early Vision – Multiple Images: Stereopsis and Structure from Motion

UNIT-IV

Mid-level Vision: Segmentation by Clustering, Grouping and Model fitting, Tracking

UNIT-V

High-level Vision: Registration, Smooth Surface and their Outlines, Range Data DetectingObjects in Images, Recognition

TEXT BOOKS:

Computer Vision: Algorithms and Applications (CVAA), Richard Szeliski, Springer, 2nd edition, 2020, http://szeliski.org/Book/

Computer Vision – A modern approach, by D. Forsyth and J. Ponce, Prentice Hall, 2nd edition, 2012

REFERENCE BOOKS:

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.

2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.

3. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.

4. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University, Press, 2012

5. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

6. Building Computer Vision Applications Using Artificial Neural Networks - With Step-by-step Examples in OpencvAndTensorflow With Python, Shamshad Ansari,Apress, 2020

AI854PE / CY851PE: QUANTUM COMPUTING
(Professional Elective –V) (Common to CSM & CSC)

B.Tech. IV Year I Sem.   **L T P C**
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Course Objectives:

- To introduce the fundamentals of quantum computing
- The problem-solving approach using finite dimensional mathematics

Course Outcomes:

- Understand basics of quantum computing
- Understand physical implementation of Qubit
- Understand Quantum algorithms and their implementation
- Understand the Impact of Quantum Computing on Cryptography

UNIT - I

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. **Complex Numbers:** Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice,Transcendental Numbers.

UNIT - II

Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.

Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

UNIT - III

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, TheD-Wave Quantum Architecture. **Quantum Hardware:** Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

UNIT - IV

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

UNIT - V

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve. **The Impact of Quantum Computing on Cryptography:** Asymmetric Cryptography, Specific Algorithms, Specific Applications.

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press

2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

REFERENCE BOOKS:

2. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci

3. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific.

4. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

AI862PE: BIOINFORMATICS (Professional Elective –VI)

B.Tech. IV Year II Sem.   **L T P C**

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Unit- I

Introduction to Bioinformatics: Definition, concepts, History, Overview of molecular biology, the cell as basic unit of life-Prokaryotic cell and Eukaryotic cell - Central Dogma: DNA-RNA-Protein, Introduction to DNA and Protein sequencing, Human Genome Project, SNP, Future and scope of Bioinformatics

Unit- II

Bioinformatics databases - Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, Gene-Bank, DDBJ; Secondary nucleotide sequence databases; Protein databases- UniProt, Protein Data Bank

Unit- III

Sequence Analysis-Basic concepts, Alignment of pairs of sequence: Homologous, Analogue, Orhtologous, paralogous, Xenologous (Need for sequence alignment, Local and Global alignment, Scoring matrices- PAM and BLOSUM matrices

Unit-IV

Pairwise sequence alignments: BLAST, Multiple sequence alignments (MSA) BLAST:- Nucleotide BLAST, Protein BLAST, PSI-BLAST, Analysis of BLAST results, E Value, sensitivity and specificity of BLAST, FASTA Structure analysis tools and softwares

Unit- V

Dynamic Programming, Needleman-Wunsch algorithm for global alignment, SmithWaterman algorithm for local alignment, Introduction to RASMOL, SWISS-PDB Viewer, ARGUS LAB

TEXT BOOK:

1. P. Narayanan, Bioinformatics: A Primer, New Age International Publishers.

2. Harshawardhan P. Bal, Bioinformatics Principles and Applications, Tata McGraw-Hill Pub lishing Company Ltd.

REFERENCE BOOKS:

1. Marketa Zvelebil and Jeremy O. Baum, Understanding Bioinformatics, Garland Science

2. Rastogiet. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

3. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education.

4. Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd.

AI734PE: SEMANTIC WEB AND SOCIAL NETWORKS
(Professional Elective – VI) (Common to CSM & CSC)

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

Course Objectives:

• To learn Web Intelligence

• To learn Knowledge Representation for the Semantic Web

• To learn Ontology Engineering

• To learn Semantic Web Applications, Services and Technology

• To learn Social Network Analysis and semantic web

Course Outcomes:

• Ability to understand and knowledge representation for the semantic web.

• Ability to create ontology.

• Ability to build a blogs and social networks

UNIT - I

Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limita-tions of Today's Web, The Next Generation Web.

Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Bern-ers-Lee www, Seman-tic Road Map, Logic on the semantic Web.

UNIT - II

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web

–Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL),UM- L,XML/XML Schema.

Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Meth-ods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping.

UNIT - III
Logic, Rule and Inference Engines. Semantic Web applications and services, Semantic Search,e-learning,   Semantic Bioinformatics, Knowledge Base.

UNIT - IV

XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technol-ogy, Web Search Agents and Semantic Methods,

What is social Networks analysis, development of the social networks analysis, Electronic Sourc- es for Network Anal-ysis – Electronic Discussion networks.

UNIT - V

Blogs and Online Communities, Web Based Networks. Building Semantic Web Applicationswith social network features.

TEXT BOOKS:

1. **Thinking on the Web - Berners Lee, Godel and Turing, Wiley interscience.**
2. **Social Networks and the Semantic Web, Peter Mika, Springer.**

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies,Rudi Studer, Paul Warren, John Wiley & Sons.

2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publish- ers,(Taylor & Francis Group)

3. Information sharing on the semantic Web - Heiner Stucken schmidt; Frank Van Harmelen, Springer Publications.

4. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

AI864PE / CS851PE / DS863PE: BLOCKCHAIN TECHNOLOGIES
(Professional Elective –VI) (Common to CSE, CSM & CSD)

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

- Define and Explain the fundamentals of Blockchain

- Illustrate the technologies of blockchain

- Describe the models of blockchain

- Analyze and demonstrate the Ethereum

- Course outcomes:

- Define and Explain the fundamentals of Blockchain

- Illustrate the technologies of blockchain

- Describe the models of blockchain

- Analyze and demonstrate the Ethereum

- Analyze and demonstrate Hyperledger fabric

UNIT-I

Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

UNIT-II

Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and privatekeys

UNIT-III

Bitcoin and Alternative Coins
A: Bitcoin, Transactions, Blockchain, Bitcoin payments B:
Alternative Coins
Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

UNIT-IV

Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain,Precompiled contracts.

UNIT-V

Alternative Blockchains: Blockchains
Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media

TEXT BOOK:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017

REFERENCE BOOKS:

1. Blockchain Technology (Concepts and applications), Kumar saurabh, Ashutosh saxena, Wiley, 2020

2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten,2016

3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress,First Edition, 2017

4. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

Open Electives

Open Elective – I

1	AI611OE	Database Management Systems
2	AI612OE	Information Retrieval System
3	AI613OE	Python Programming

Open Elective – II

1	AI721OE	Introduction to Machine Learning
2	AI722OE	Introduction to Natural Language Processing
3	AI723OE	Data Analytics

Open Elective – III

1	AI831OE	Semantic Web and Social Networks
2	AI832OE	Applications of Natural Language Processing
3	AI833OE	Data Visualization

AI611OE: DATABASE MANAGEMENT SYSTEMS (OPEN ELECTIVE-I)

B.Tech. III Year II Sem.   **L T P C**
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Prerequisites: A course on "Data Structures".

Course Objectives:

- To understand the basic concepts and the applications of database systems.

- To master the basics of SQL and construct queries using SQL.

- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

Course Outcomes:

- Gain knowledge of fundamentals of DBMS, database design and normal forms

- Master the basics of SQL for retrieval and management of data.

- Be acquainted with the basics of transaction processing and concurrency control.

- Familiarity with database storage structures and access techniques

UNIT - I

Database System Applications: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS

Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model

UNIT - II

Introduction to the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views.

UNIT – III

Relational Algebra, Tuple relational Calculus (TRC), Domain Relational Calculus (DRC).

UNIT – IV

SQL: QUERIES, CONSTRAINTS, TRIGGERS: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases.

UNIT – V

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

TEXT BOOKS

1. Database Management Systems, Raghu rama Krishnan, Johannes Gehrke, *Tata Mc GrawHill*

2. 3rd Edition

3. Database System Concepts, Silber schatz, Korth, *Mc Graw hill*, Vedition.

REFERENCES

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.

2. Fundamentals of Database Systems, Elmasri Navrate, *Pearson Education*

3. Introduction to Database Systems, C. J. Date, *Pearson Education*

4. Oracle for Professionals, The X Team, S.Shah and V. Shah,*SPD*.

5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL,Shah,*PHI*.

6. Fundamentals of Database Management Systems, M. L. Gillenson, *Wiley Student*Edition.

AI612OE: INFORMATION RETRIEVAL SYSTEM

(Open Elective- I)

B.Tech. III Year II Sem.   **L T P C**

                                                                     3 0 0 3

Prerequisites:
Data Structures

Course Objectives:

• To learn the important concepts and algorithms in IRS

• To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

Course Outcomes:

• Ability to apply IR principles to locate relevant information large collections of data

• Ability to design different document clustering algorithms

• Implement retrieval systems for web search tasks.

• Design an Information Retrieval System for web search tasks.

UNIT - I

• Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems,

• Digital Libraries and Data Warehouses

• Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

UNIT - II

• Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction

• Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram

• Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

UNIT - III

• Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language,Concept Indexing, Hypertext Linkages

• Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

UNIT - IV

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance

Feedback, Selective Disseminations of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext.

Information Visualization: Introduction to Information Visualization, Cognition and Perception,Information Visualization Technologies

UNIT - V

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval

TEXT BOOK:

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer

REFERENCE BOOKS:

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.

2. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.

3. Modern Information Retrieval By Yates and Neto Pearson Education

AI613OE: PYTHON PROGRAMMING
(Open Elective- I)

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

Course Objectives:

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise.

UNIT - I

Introduction to Python, Installing Python. How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function,Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop,Calculating a Running Total, Input Validation Loops, Nested Loops. Data types and Expressions:Strings, Assignment and Comments, Numeric Data Types and Character Sets, Expressions, Functions and Modules.

UNIT - II

Control Statements: Definite Iteration, Formatting Text for Output, Selection, Conditional Iteration. File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions. Functions: 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.

UNIT - III

Strings and Text Files: Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Text Files, Data Encryption, 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 Sequences, Tuples. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms

UNIT - IV

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.

UNIT - V

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. Simple Graphics and Image Processing: Over- view of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing.

TEXT BOOKS:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning.

2. Think Python First Edition, by Allen B. Downey, Orielly publishing

REFERENCE BOOKS:

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

3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)

4. Charles Dierach, Introduction to Computer Science using Python

AI721OE: INTRODUCTION TO MACHINE LEARNING

(Open Elective- II)

B.Tech. IV Year I Sem.   L T P C
                                                                                          3 0 0 3

Prerequisites

- Data Structures
- Knowledge on statistical methods

Course Objectives

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

Course Outcomes

- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
- Understand the Neural Networks and its usage in machine learning application.

UNIT - I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning ,Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimina-n tion, inductive bias.

Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT - II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT - III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text,

Bayesian belief networks, the EM algorithm.

Instance-Based Learning- Introduction, k-nearest neighbor algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT – IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: sum-c mary, learning First-Order rules, learning sets of First-Order rules: FOIL

Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic pro-e gramming.

UNIT - V

Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOGEBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

TEXT BOOKS:

1.   Machine Learning – Tom M. Mitchell, - MGH

REFERENCE BOOK:

1.   Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

AI722OE: INTRODUCTION TO NATURAL LANGUAGE PROCESSING
(Open Elective- II)

B.Tech. IV Year I Sem.   **L T P C**

                                                                             3 0 0 3

Prerequisites: Data structures, finite automata and probability theory

Course Objectives:

- Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.
- Course Outcomes:
- Show sensitivity to linguistic phenomena and an ability to model them with formal gram-mars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to manipulate probabilities, construct statistical models over strings and trees, andestimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms
- Able to design different language modeling Techniques.

UNIT – I
Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphoe logical Models Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches.

UNIT – II
Syntax Analysis: Parsing Natural Language, Tree banks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

UNIT – III
Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

UNIT – IV
Predicate- Argument Structure, Meaning Representation Systems, Software.

UNIT – V
Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M.Bikel and Imed Zitouni, Pearson Publication

2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOKS:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publi-n cations

AI723OE: DATA ANALYTICS
(Open Elective- II)

B.Tech. IV Year I Sem.

L T P C
3 0 0 3

Prerequisites:

1. A course on "Database Management Systems".

2. Knowledge of probability and statistics.

Course Objectives:

- To explore the fundamental concepts of data analytics.

- To learn the principles and methods of statistical analysis

- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

- To understand the various search methods and visualization techniques.

Course Outcomes: After completion of this course students will be able to

- Understand the impact of data analytics for business decisions and strategy

- Carry out data analysis/statistical analysis

- To carry out standard data visualization and formal inference procedures

- Design Data Architecture

- Understand various Data Sources

UNIT - I

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality(noise, outliers, misseing values, duplicate data) and Data Processing & Processing.

UNIT - II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and Variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

UNIT - III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

UNIT - IV

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree

Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. **Time Series Methods:** Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

UNIT - V

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

1. Student's Handbook for Associate Analytics – II, III.

2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.

2. Data Mining Analysis and Concepts, M. Zaki and W. Meira

3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.

AI831OE: SEMANTIC WEB AND SOCIAL NETWORKS

(Open Elective- III)

B.Tech. IV Year II Sem.   **L T P C**

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Course Objectives:

- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology
- To learn Social Network Analysis and semantic web

Course Outcomes:

- Ability to understand and knowledge representation for the semantic web.
- Ability to create ontology.
- Ability to build a blogs and social networks

UNIT - I

Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limita-tions of Today's Web, The Next Generation Web.

Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Bern-ers-Lee www, Seman-tic Road Map, Logic on the semantic Web.

UNIT - II

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web

–Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL),UM- L,XML/XML Schema.

Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Meth-ods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping.

UNIT - III

Logic, Rule and Inference Engines. Semantic Web applications and services, Semantic Search,e-learning,   Semantic Bioinformatics, Knowledge Base.

UNIT - IV

XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technol-ogy, Web Search Agents and Semantic Methods,

What is social Networks analysis, development of the social networks analysis, Electronic Sourc- es for Network Anal-ysis – Electronic Discussion networks.

UNIT - V

Blogs and Online Communities, Web Based Networks. Building Semantic Web Applicationswith social network features.

TEXT BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley interscience.

2. Social Networks and the Semantic Web, Peter Mika, Springer.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies,Rudi Studer, Paul Warren, John Wiley & Sons.

2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publish- ers,(Taylor & Francis Group)

3. Information sharing on the semantic Web - Heiner Stucken schmidt; Frank Van Harmelen, Springer Publications.

4. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

AI832OE: APPLICATIONS OF NATURAL LANGUAGE PROCESSING (OPEN ELECTIVE - III)

B.Tech. IV Year II Sem.

L T P C
3 0 0 3

Prerequisites: Data structures, finite automata and probability theory

Course Objectives:

Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

Course Outcomes:

- Show sensitivity to linguistic phenomena and an ability to model them with formal gram-mars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to manipulate probabilities, construct statistical models over strings and trees, andestimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms
- Able to design different language modelling Techniques.

UNIT - I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Mor- pho-logical Models.

UNIT - II

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Perfor-mances of the Approaches

UNIT - III

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Rep-resentation of Syntactic Structure.

UNIT - IV

Parsing Algorithms, Models for Ambiguity Resolution inParsing, Multilingual Issues.

UNIT - V

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense, Sys- tems, Soft-ware.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel
2. M. Bikel and Imed Zitouni, Pearson Publication
3. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOK:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

AI833OE: DATA VISUALIZATION (OPEN ELECTIVE– III)

B.Tech. IV Year II Sem.   **L T P C**
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Course Objective:

To understand various data visualization techniques.

Course Outcomes:

- Visualize the objects in different dimensions.

- Design and process the data for Virtualization.

- Apply the visualization techniques in physical sciences, computer science, applied mathematicsand medical science.

- Apply the virtualization techniques for research projects. (K1, K3).

UNIT - I

Introduction and Data Foundation: Basics - Relationship between Visualization and Other Fields - The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets

UNIT - II

Foundations for Visualization: Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson's Affordance theory – A Model of Perceptual Processing.

UNIT - III

Visualization Techniques: Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three- Dimensional Data - Dynamic Data - Combining Techniques. **Geospatial Data:** Visualizing Spatial Data

- Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization **Multivariate Data:** Point-Based Techniques - Line- Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures –Graphics and Networks- Displaying Arbitrary Graphs/Networks.

UNIT - IV

Interaction Concepts and Techniques: Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualization

UNIT – V

Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. **Interaction Techniques**: Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - AnimatingTransformations -Interaction Control

TEXT BOOKS:

1. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data VisualizationFoundations, Techniques, Applications", 2010.

2. Colin Ware, "Information Visualization Perception for Design", 2nd edition, Margon Kaufmann-Publishers, 2004.

REFERENCE BOOKS:

1. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2ndEdition, 2007.

2. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008.

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