FOREWORD

CMR Technical Campus, established in the year 2009, Approved by AICTE, New Delhi, Permanently Affiliated to JNTUH, twice Accredited by NBA and has been bestowedwith NAAC 'A' Grade of 3.12 score on 04 scale in February 2019 for its remarkable academic accomplishments accompanied by its unflinching spirit and dedication to impart quality technical education to the deserving aspirants. The institution has commenced functioning independently within the set norms prescribed by UGC and AICTE. The performance of the institution manifests the confidence that the prestigious monitoring body, the UGC has on it,in terms of upholding its spirit and sustenance of the expected standards of functioning on its own consequently facilitating the award of degrees for its students. Thus, an autonomous institution is provided with the necessary freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

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

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

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

DIRECTOR

CMR TECHNICAL CAMPUS

Vision:

To impart quality education in serene atmosphere thus strive for excellence in Technology and Research.

Mission:

- To create state of art facilities for effective Teaching – Learning process.
- Pursue and Disseminate knowledge based research to meet the needs of Industry & Society.
- Infuse Professional, Ethical and Societal values among Learning Community.

Quality Policy:

- The management is committed in assuring quality service to all its stakeholders like parents, students, alumni, employees, employers and the community.
- Continual quality improvement by establishing and implementing mechanisms and modalities.
- Transparency in procedures and access to information and actions.

Core Values:

The CMR Technical Campus is guided by the following core values in delivering its mission and pursuing its vision.

- **A**ccountability: Demonstrate responsibility for our actions; establish and communicate clearly defined and articulated goals and objectives.
- **B**enchmark: To develop and pursue high standards by encouraging skill development and entrepreneurship to meet industry and society needs.
- **C**ommitment: Focus on students and stakeholders needs; continuously evaluate and improve academics, research and infrastructure.
- **D**ignity: Recognize the expertise of all members of the institute and encourage individual contribution and also include stakeholders in the decisions that affect them.

CMR TECHNICAL CAMPUS

UGC AUTONOMOUS

Kandlakoya (V), Medchal Road, Hyderabad–501401, Telangana State (India)

Academic Regulations [R22]
B.Tech. - Regular Four Year Degree Programme
(For students admitted from the academic year 2022 - 23)

&

B.Tech. - Lateral Entry Scheme
(For students admitted from the academic year 2023 - 24)

CMR Technical Campus (CMRTC) offers a 4-year (8 semesters) Bachelor of Technology (B.Tech.) degree programme, under Choice Based Credit System (CBCS).

1. UNDER GRADUATE PROGRAMS OFFERED (Engineering & Technology)

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

S.No	Branch	Branch Code	Acronym
1	Computer Science and Engineering (CSE)	05	CSE
2	Computer Science and Engineering (AI & ML)	66	CSM
3	Artificial Intelligence and Machine Learning	73	AIM
4	Computer Science and Engineering (Data Science)	67	CSD
5	Computer Science and Engineering (Cyber Security)	62	CSC
6	Information Technology	12	IT
7	Electronics and Communication Engineering	04	ECE
8	Computer Science and Information Technology	33	CSI

2. ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION

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

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

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

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

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

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

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

2.2.1 Eligibility: A candidate seeking admission into the II year I Semester B. Tech. Regular Degree Programme under Lateral Entry Scheme (LES) should have passed the qualifying examination (B.Sc. Mathematics or Diploma in concerned course) and have secured a rank

at Engineering Common Entrance Test TSECET (FDH). Admissions are made in accordance with the instructions received from the Convenor, TSECET and Government of Telangana State.

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

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

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

3. B. Tech. PROGRAMME STRUCTURE

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

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

3.1.2 As per AICTE guidelines, a 3-week mandatory **"Induction Programme"** shall be offered toI - B.Tech newly admitted students to get acquainted with the professional environment and prepare them for the academic schedules ahead.

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

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

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

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

3.2.2 The student shall register and secure 120 credits (with CGPA ≥ 5) from II year to IV year B.Tech. programme (LES) for the award of B. Tech degree.

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

3.3.1 **Semester Scheme:**
The evaluation of course is on the basis of Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC while the course Curriculum / Course Structure is as suggested by AICTE.

- B.Tech. (Regular) Programme is of 4 Academic Years (8 Semesters)
- B.Tech. (LES) Programme is of 3 Academic Years (6 Semesters),
- Each academic year is divided into two semesters
- Each semester is of 22 weeks (≥ 90 Instructional days per semester)
- Each Semester is having - 'Continuous Internal Evaluation (CIE)' and 'End Semester Examination (ESE).

3.3.2 Credit Courses:

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

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

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

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

3.3.3 Subject / Course Classification:

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

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses	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	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses	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	PR- Project Work	B.Tech. project or UG project or UG major project or Project Stage I & II
8		Industrial training/ Mini- project	Industrial training/ Summer Internship Industrial Oriented Mini-project/ Mini-project
9		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)
12	Audit Courses	AC	

3.3.4 Subject Code Nomenclature:

1	2	3	4	5	6	7	8	9

1, 2 - Year of implementation of Regulation
3, 4 - Department Code (Course offering department)
5 - Serial No. of Semester (1 to 8)
6, 7 - Serial No. of Subject, Semester wise
8, 9 - Course Group/ Category

Example: - 19EC302PC

4. COURSE REGISTRATION

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

4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through online submission, ensuring '**date** and **time stamping**'. The online registration requests for any 'current semester' shall be completed **before the commencement of ESEs (End Semester Examinations) of the 'preceding semester'**.

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

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

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

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

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

4.8 **Open electives**: The students have to choose three Open Electives (OE-I, II & III) from the 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 not registered 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.

4.9 **Professional electives**: Students have to choose Professional Electives (PE-I to VI), wherever offered, from the list of professional electives given.

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

5. SUBJECTS / COURSES TO BE OFFERED

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

i) More than **one faculty member** may offer the **same subject** (lab / practical's may be included with the corresponding theory subject in the same semester) in any semester.

ii) 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).

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

6. ATTENDANCE REQUIREMENTS

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum 75% of attendance in aggregate of all the subjects / courses (including attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rig hts, 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 final attendance.***

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 towards condoning of shortage of attendance.

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

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

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

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

7. ACADEMIC REQUIREMENTS

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

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course, if student secures not less than 35% of marks (14 marks out of 40) in the Continuous Internal Evaluation (CIE), not less than 35% of marks (21 marks out of 60 marks) in the End Semester Examination (ESE), and a minimum of 40% of marks (40 marks out of 100 marks) in the sum total of the Continuous Internal Evaluation (CIE) and End Semester Examination (ESE) 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 is deemed 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 is scheduled.

7.3 Promotion Rules

7.3.1 B.Tech. (Regular):

S. No.	Promotion	Conditions to be fulfilled
1	First Semester to Second Semester	Regular course of study of First Semester
2	Second Semester to Third Semester	**(i).** Regular course of study of Second Semester **(ii).** Must have secured at least 50% credits (20 out of 40 credits) up to Second Semester from all the relevant regular and supplementary examinations whether the student takes those examinations or not.
3	Third Semester to Fourth Semester	Regular course of study of Third Semester
4	Fourth Semester to Fifth Semester	**(i)** Regular course of study of Fourth Semester **(ii).** Must have secured at least 60% credits (48 out of 80 credits) up to Fourth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fifth Semester to Sixth Semester	Regular course of study of Fifth Semester
6	Sixth Semester to Seventh Semester	**(i)** Regular course of study of Sixth Semester **(ii).** Must have secured at least 60% credits (72 out of 120 credits) up to Sixth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Seventh Semester to Eighth Semester	Regular course of study of Seventh Semester

7.3.2 B. Tech - Lateral Entry Scheme (LES):

S. No.	Promotion	Conditions to be fulfilled
1	Third Semester to Fourth Semester	Regular course of study of Third Semester
2	Fourth Semester to Fifth Semester	**(i)** Regular course of study of Fourth Semester **(ii)** Must have secured at least 50% credits (20 out of 40 credits) up to Fourth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Fifth Semester to Sixth Semester	Regular course of study of Fifth Semester

4	Sixth Semester to Seventh Semester	**(i)** Regular course of study of Sixth Semester **(ii).** Must have secured at least 60% credits (48 out of 80 credits) up to Sixth Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Seventh Semester to Eighth Semester	Regular course of study of Seventh Semester

7.4 A student (i) shall register for all courses/subjects covering 160 credits (120 credits in case of LES) as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits (120 credits in case of LES), (iii) earn all 160 credits (120 credits in case of LES) by securing SGPA ≥ 5.0 (in each semester), and CGPA ≥ 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 (120 credits in case of LES) 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 '**additional subjects'** (in the parent department or other departments / branches of engineering) other than those listed subjects totaling to 160 credits (120 creditsin case of LES) as specified in the course structure of parent department, the performances in those '**additional subjects**' (although evaluated and graded using the same procedure as thatofthe required 160 credits (120 credits in case of LES)) will not be taken into accountwhile calculating the SGPA and CGPA. For such '**additional subjects'** registered, % of marks and letter grade alone will be indicated in the grade card as a performance measure,subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1 to 7.4 above.

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

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

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

8. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

8.1 The performance of a student in every subject/course (including practicals 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 ESE (End Semester Examination).

8.2 Evaluation of Theory Subjects / Courses:

A) **Continuous Internal Evaluation (CIE):** For each theory subject, 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: Descriptive paper for Part-A (10 marks) Consists of one compulsory question with 5 sub questions (2, 2, 1 questions from Units I, II, III respectively in I Mid-Term and 1, 2, 2 questions from Units III, IV, V respectively in II Mid-Term) carrying 2 marks each.

   b. Part – B: Descriptive paper for Part-B (20 marks) consists of 3 questions (May contain sub questions) carrying 8 marks, 8 marks & 4 marks from Units I, II, III respectively in I Mid-Term and 4 marks, 8 marks & 8 marks from Units III, IV, V respectively in II Mid-Term with internal choice. The student has to answer all the questions.

The **average of the two Mid-Term examinations** (I Mid-Term & II Mid-Term) shall be taken as the final marks for Mid –Term examination (for 30 marks).

The remaining 10 marks of Continuous Internal Evaluation (out of 40) 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 shall be 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 ESE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and ESE marks put together.

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

In case, the student appears for End Semester Examination (ESE) 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 ESE shall stand cancelled inspite of appearing the ESE.

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

B) **End Semester Examinations:** The duration of End Semester Examination (ESE) is 3 hours. The details of the end semester question paper pattern are as follows:

The End Semester Examination (ESE), for theory subjects, will be conducted for 60 marks 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 (Two from each unit) carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 11) 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.

C) For the subject, **Computer Aided Engineering Graphics**, the Continuous Internal Evaluation (CIE) and Semester End Examinations (SEE) evaluation pattern is same as other theory subjects for **Non-Circuit Branches,** Practical subjects **for Circuit Branches Like ECE, CSE/IT and allied branches.**

8.3 **Evaluation of Practical Subjects / Courses:** In any semester, a student has to complete at least 08 to 10 experiments / exercises in each laboratory course and get the record certified by the Subject teacher and concerned Head of the Department to be eligible for End Semester Examination.

For practical subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 40 internal marks and 60 marks for End Semester Examination (ESE).

A) **Continuous Internal Evaluation (CIE):** 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 Report/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

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

In the End Semester 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 same laboratory course and10 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 ESE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and ESE marks put together.

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

In case, the student appears for End Semester Examination (ESE) 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 ESE shall stand cancelled inspite of appearing the ESE.

8.4 The evaluation of courses having ONLY internal marks in I-Year I Semester and II- Year II Semester is as follows:

1. I Year I Semester course (ex., Basic Elements of Engineering & Technology): The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

2. **For Circuit Branches Like ECE, CSE/IT and allied branches** the Continuous Internal Evaluation (CIE) will be for 50 marks. Each Mid-Term examination consists of two parts i) Part – A for 20 marks, ii) Part – B for 20 marks with a total duration of 2 hours.

   a. Part - A: Descriptive paper for Part-A (20 marks) Consists of one compulsory question with 10 sub questions (4, 4, 2 questions from Units I, II,III respectively in I Mid-Term and 2, 4, 4 questions from Units III, IV, V respectively in II Mid-Term) carrying 2 marks each.

   b. Part – B: Descriptive paper for Part-B (20 marks) consists of 3 questions (May contain sub questions) carrying 8 marks, 8 marks & 4 marks from Units I, II, III respectively in I Mid-Term and 4 marks, 8 marks & 8 marks from Units III, IV, V respectively in II Mid-Term with internal choice. The student has to answer all the questions.

   The remaining 10 marks of Continuous Internal Evaluation are for Assignment (5marks) and Subject Viva-Voce/PPT/Poster Presentation/ Case Study (5 marks) and the evaluation pattern will remain same as for other theory subjects.

   For all other branches, the Continuous Internal Evaluation (CIE) will be for 50

   marks. Out of the 50 marks for internal evaluation:

   a) 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

   b) 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.

   c) Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 15 marks.

   d) The remaining 15 marks are for Laboratory Report/Project and Presentation, which

   consists of the Design (or) Software / Hardware Model Presentation (or) AppDevelopment (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

3. II Year II Semester Real-Time (or) Field-based Research Project course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

8.5 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 (VI 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 Senior Faculty 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.

8.6 **Evaluation of Project work:** Student(s) shall start the Project Work during the VII Semester (IV- B.Tech.–I–Semester) as per the instructions of the Project Guide / Project Supervisor assigned by the Head of the Department. The topics for Industry Oriented Mini Project/Internship/SDC etc. and the main Project shall be different from one another.

a) The Project Work shall be carried out in two stages: Project Stage – I during VII Semester (IV-B.Tech.–I–Semester), and Project Stage – II during VIII Semester (IV- B.Tech.–II–Semester), and the student has to prepare two independent Project Work Reports – *one each during each stage*. First Report shall include the Project Work carried out under Project Stage – I, and the Second Report (Final Report) shall include the Project Work carried out under Project Stage – I and Project Stage – II put together. Project Stage – I and Project Stage – II of the Project Work shall be evaluated for 100 marks each.

b) Out of the total 100 marks allotted for each stage of the Project Work, 40 marks shall be for the Continuous Internal Evaluation(CIE), and 60 marks shall be for the End Semester Viva-voce Examination (ESE). The marks earned under CIE for both the stages of the Project shall be awarded by the Project Review Committee (PRC) comprising of the Head of the Department, one Senior Faculty member and Project Supervisor (based on the continuous evaluation of student's performance during the two Project Work stages); and the marks earned under ESE shall be awarded by the Project Viva-voce Committee / Board (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).

c) For the Project Stage - I, the Viva-voce shall be conducted at the end of the VII Semester, before the commencement of the End Semester Examinations, by the Project Review Committee (PRC) and the Project Stage – II Viva-voce shall be conducted by the Committee comprising of an External Examiner appointed by the Head of the Institution, Head of the Department and Project Supervisor at the end of the VIII Semester, before the commencement of the End Semester Examinations.

d) If a student does not appear (or fails) for any of the two Viva-voce examinations at the scheduled times as specified above, he may be permitted to reappear for Project Stage - I and/or Project Stage - II Viva-voce examinations, as and when they are scheduled again in that semester; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester(s), as and when they are scheduled, as supplementary candidate.

8.7 A student can re-register for subjects 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 descriptive Part-A & Part-B, Average of two Assignments & Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects. They may seek re-registration for all those subjects registered in that semester in which the student is failed. The student has to re-appear for CIE and SEE as and when offered.

- A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year by paying Rs. 3000 per subject. His Continuous Internal Evaluation marks for 40 obtained in the previous attempt stand cancelled. The student has to obtain fresh set of marks for 40 allotted for CIE (Sum of average of two mid-term examinations consisting of descriptive Part-A& Part-B, Average of two Assignments & Subject Viva-Voce/PPT/Poster Presentation/Case Study on a topic in the concerned subject) Head of the Department will take care of this.

8.8 **Evaluation of Mandatory Non-Credit Courses:** For mandatory courses of Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the 100 marks allotted) in the Continuous Internal Evaluation for passing the subject/course. These marks should also be uploaded along with the internal marks of other subjects. No marks or letter grades shall be allotted for mandatory/non-credit courses. Only Pass/Fail shall be indicated in Grade Card.

8.9 **MOOCs Courses through SWAYAM Portal:** The approved list of SWAYAM courses shall be notified and made available at the beginning of the semester. The students are given option to choose Professional Electives / Open Electives in the curriculum offered by the institute or from the notified list. The maximum number of transferable credits through SWAYAM Courses are capped at 18 (06 Courses).

9. GRADING PROCEDURE

9.1 Grades will be awarded to indicate the performance of the student in each theory subject, laboratory/practicals, Industry-Oriented Mini Project/Internship/SDC and Project-I & Project-II based on the percentage of marks obtained in Continuous Internal Evaluation plus End Semester Examination, both taken together, as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following letter grades (UGC/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
90% and above (≥ 90% , ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80% , <90%)	A^+ (Excellent)	9
Below 80% but not less than 70% (≥ 70% , <80%)	A (Very Good)	8
Below 70% but not less than 60% (≥ 60% , <70%)	B^+ (Good)	7
Below 60% but not less than 50% (≥ 50% , <60%)	B (Average)	6
Below 50% but not less than 40% (≥ 40% , <50%)	C (Pass)	5
Below 40% (< 40%)	F (Fail)	0
Absent	Ab	0

9.3 A student obtaining **F** grade or **AB** grade in any subject shall be considered **'failed**' in that subject and will be required to reappear in '**Supplementary Exam**' in the End Semester Examination (ESE), as and when offered. In such cases, Continuous Internal Examination (CIE) in those subject(s) will remain 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 remain the same as those obtained earlier.

9.5 A letter grade does not imply any specific % 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 obtained in that subject/course (excluding mandatory non-credit courses). Then the corresponding '**credit points**' (CP) are computed by multiplying the grade point with credits for that particular subject/course.

Credit Points (CP) = Grade Point (GP) x Credits……. For a course

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

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

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

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

9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses in **all** Semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year, I semester onwards, at the end of each semester,as per the formula:

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

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

Illustration of calculation of SGPA					Illustration of calculation of CGPA			
Course /Subject	Credits	Letter Grade	Grade Points	Credit Points	Sem.	Credits	SGPA	Credits x SGPA
Course 1	4	A	8	4 x 8 = 32	Sem I	20	7	20 x 7= 140
Course 2	4	O	10	4 x 10 = 40	Sem II	20	6	20 x 6= 120
Course 3	3	C	5	3 x 5 = 15	Sem III	20	6.5	20 x 6.5 =130
Course 4	3	B	6	3 x 6 = 18	Sem IV	20	6	20 x 6 = 120
Course 5	1.5	A+	9	1.5x9 = 13.5	Sem V	20	7.5	20 x 7.5 =150
Course 6	1.5	A	8	1.5x8 = 12	Sem VI	20	8	20 x 8 = 160
Course 7	1.5	B+	7	1.5x7 = 10.5	Sem VII	20	8.5	20 x 8.5 =170
Course 8	1.5	A+	9	1.5x9 = 13.5	Sem VIII	20	8	20 x 8 = 160
Total	**20**		**62**	**154.5**	**Total**	**160**		**1150**
SGPA = 154.5/20 = 7.72					**CGPA = 1150/160 = 7.18**			

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

9.11 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. PASSING STANDARDS

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

10.2 After the completion of semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned etc.), credits earned, SGPA, and CGPA. **There is NO exemption of credits in any case.**

11 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:

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

12 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.

1. 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'**.

However, he

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

(ii) Should 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'.**

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

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

4. 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**'.

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

12.3 Approved by the Academic Council to restore the addition of grace marks up to 0.15% of total marks (i.e., maximum of 9 grace marks for regular and 7 grace marks for lateral entry students) and applying up to 2(two) theory subjects, as per the university proceedings No. JNTUH/EB/Grace Marks/2023 dated: 23.02.2023 and applicable for all B. Tech R18 A. Y 2022-23 onward outgoing students to get degree only. For all other batch or regulations students to satisfy their applicable rules and norms as per their academic regulations for getting the degree.

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

12.5 **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 andawarded for 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 classwork 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).

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

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

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

13 WITHHOLDING OF RESULTS

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

14 SUPPLEMENTARY EXAMINATIONS

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

15. TRANSITORY REGULATIONS

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of any previous 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 any previous 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 any previous 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 (120 for LES) including Previous & 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 fromthe 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 R22 Regulations will be substituted byanother subject to be suggested by the CMRTC Academic Council.

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

16 STUDENT TRANSFERS

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

16.2 The students seeking transfer to CMRTC from various other institutions have to pass the failed subjects which are equivalent to the subjects of CMRTC, and also pass the subjects of CMRTC 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 CMRTC, the students have to study those subjects in CMRTC in spite of the fact that those subjects are repeated.

16.3 The transferred students from other Institutions to CMRTC who are on rolls shall be provided one chance to write the CBT (for internal marks) in the **equivalent subject(s)** as per the clearance letter issued bythe University.

16.4 One chance shall be provided to write the internal examinations in the **equivalent subject(s)** to the students transferred from other institutions to CMRTC asper the clearance (equivalence) letter issued by the University.

17 RULES OF DISCIPLINE

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

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

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

18. MALPRACTICE

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

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

18.2 Malpractice Rules: Disciplinary Action for Improper Conduct in Examinations

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

4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answerpaper 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 Controller of examinations / anyofficer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the addl. Controller of examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the addl. Controller of examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in theopinion of the officer on duty amounts to use of unfair meansor misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also aredebarred and forfeit their seats. In case ofoutsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examinationhall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8	Possess anylethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is nota candidate for the particular examination or any person not connected with the college indulgesin any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects ofthat semester/year. The candidate is alsodebarred and forfeits the seat. Person(s) who do not belong to the College will be handedover to police and, a police case will be registered against them.
10	Comes in a drunken condition tothe examination hall.	Expulsion from the examination hall and cancellation of the performance in thatsubject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Chief Superintendent for further action to award suitable punishment.	

19. SCOPE

i) Wherever the words 'he, him, his' occur in the regulations, they shall include 'she, her, hers'.

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

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

iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Committee is final.

20. REVISION AND AMENDMENTS TO REGULATIONS

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

Academic Regulations for *B. Tech. with Honors program*

1. Objectives

The key objectives of offering B. Tech. with Honors programare:

- To expand the domain knowledge of the students laterally and vertically.
- To increase the employability of undergraduate students with expanded knowledge in oneof the core Engineering disciplines.
- To provide an opportunity to students to pursue their higher studies in wider range of specialisations.

2. Academic Regulations for B. Tech. Honors degree

1) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.
2) For B. Tech with Honors program, a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). The broad guidelines for the courses of Honors program, their respective credits weightage and semester-wise break-up of thecourse are enclosed as Annexure. All these 20 credits need to be completed in III year andIV year only.
3) After registering for the Honors programme, if a student is unable to pass all courses in first attempt and earn the required 20 credits, he/she shall not be awarded Honors degree.However, if the student earns all the required 160 credits of B. Tech., he/she will be awarded only B. Tech degree in the concerned branch.
4) There is no transfer of credits from courses of Honors program to regular B. Tech. degree course & vice versa.
5) These 20 credits are to be earned from the additional courses offered by the hostdepartment in the college or from a closely related department in the college as well as from the MOOCS platform.
6) For the courses selected under MOOCS platformfollowing guidelines may be followed:
   a) Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
   b) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Honors course structure provided by the University.
   c) Only Pass-grade/marks or above shall be considered for inclusion of grades in the Honors grade memo.
   d) Any expenses incurred for the MOOCS courses are to be met by the students only.

7) The choice to opt/take the Honors program is purely on the choice of the students.
8) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Honors program at any time; and in that case the student will be awardedonly B. Tech. degree in the concerned branch on earning the required credits of 160.
9) The students of every branch can choose Honors program in their respective branches if they are eligible for the Honors program. A student who chooses an Honors program isnot eligible to choose a Minor program and vice-versa.
10) The B. Tech. with Honors program shall be offered from the AY 2021-22 onwards. The students who are pursuing their III year I semester in the current academic year can registerfor the Honors program if they fulfil the eligibility criteria.
11) A student can graduate with Honors if he/she fulfils the requirements for his/her regular B. Tech. programas well as fulfils the requirements for Honors program.
12) The institute shall maintain a record of students registered and pursuing their Honors programs branch-wise. The same report needs to be sent to the University once the enrolment process is complete.
13) The department shall prepare the time-tables for each Honors program offered at their respective departments without any overlap/clash with other courses of study in therespective semesters.

3. Eligibility conditions of the students for the Honors degree

a) A student can opt for B. Tech. degree with Honors, if she/he passed all subjects in first attempt in all the semesterstill the results announced and maintaining 7.5 or moreCGPA.
b) If a student fails in any registered course of either B. Tech. or Honors in any semesterof four years program, he/she will not be eligible for obtaining Honors degree. He willbe eligible for only B. Tech. degree.
c) Prior approval of mentor and Head of the Department for the enrolment into Honors program, before commencement of III year ISemester (V Semester), is mandatory.
d) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 30%. The criteriatobe followed for choosing 30% candidates in a branch may be the CGPA secured bythe students till II year Isemester.
e) The department concerned should be preferably NBA accredited and shall offer at least one M. Tech. Program.
f) Successful completion of 20 credits earmarked for honors program with at least 7.5 CGPA along with successful completion of 160 credits earmarked for regular B. Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Honors) degree.
g) For CGPA calculation of B. Tech. course, the 20 credits of Honors program will notbe considered.

4. Registration for the course in Honors program

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Honors course structure) other than the courses they have studied/registered for regular B.Tech. programme. No course should be identical to that of the regular B. Tech. course. The students should take the advice of faculty mentors while registering for a course atthe beginning of semester.

c) The maximum No. of courses for the Honors is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

Academic Regulations for *B. Tech. with Minor* program

1. Objectives

The key objectives of offering B. Tech. with Minor program are:

- To expand the domain knowledge of the students in one of the other branches of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in interdisciplinary areas of engineering & technology.
- Toprovide an opportunityto students to pursue their higher studies in the inter-disciplinaryareas in addition to their own branch of study.
- To offer the knowledge in the areas which are identified as emerging technologies/thrustareas of Engineering.

2. Minor courses and the offering departments

S. No.	Minor Program	Eligible branch of students	@Offering Department	Award of Degree
1.	Artificial Intelligence& Machine Learning	All branches, except B. Tech. in CSE (AI&ML) /B. Tech. (AI&ML)/ B. Tech. (AI)/ B. Tech. CSE(AI)	CSE	"B. Tech. in branch name with Minor in Artificial Intelligence & Machine Learning"
2.	Cyber Security	All branches, except B. Tech. in CSE (Cyber Security)/ B. Tech. (Cyber Security)	CSE	"B. Tech. in branch name with Minor in Cyber Security"
3.	Data Science	All branches, except B. Tech. in CSE (Data Science)/ B.Tech. (Data Science)	CSE	"B. Tech. in branch name with Minor in Data Science"
4.	IOT	All branches, except B. Tech.in CSE (IOT) / B. Tech. (IOT)	ECE	"B. Tech. in branch name with Minor in IOT"
5.	Innovation and Entrepreneurship	All branches.	Management Science / MBA	"B. Tech. in branch name with Minor in Innovation and Entrepreneurship"

Note: @ As per AICTE guide lines.

3. Academic Regulations for B. Tech. Degree with Minor programs

1. The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.
2. For B. Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B. Tech degree). The list of courses of each Minor program, their respective credits weightage and semester-wise break-up of the courses are enclosedas Annexure. All these 18 credits need to be completed in III year and IV year only.

3. After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), he/she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech., he/she will be awarded only B. Tech degree in the concerned branch.
4. There is no transfer of credits from Minor program courses to regular B. Tech. degree course & vice versa.
5. These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as fromthe MOOCS platform.
6. For the course selected under MOOCS platformfollowing guidelines may be followed:
    a) Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
    b) Minimum credits for MOOCS course must be equal to or more than the credits specified in the Minor course structure provided by the University.
    c) Only Pass-grade/marks or above shall be considered for inclusion of grades in minorgrade memo.
    d) Any expenses incurred for the MOOCS courses are to be met by the students only.
7. The choice to opt/take a Minor program is purely on the choice of the students.
8. The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor program at any time; and in that case the student will be awardedonly B. Tech. degree in the concerned branch on earning the required credits of 160.
9. The student can choose only one Minor program along with his/her basic engineering degree. A student who chooses an Honours program is not eligible to choose a Minor programand vice-versa.
10. The B. Tech. with a Minor program shall be offered from the AY 2021-22 onwards. Thestudents who are pursuing their III year I semester in the current academic year can register for the Minor program if they fulfil the eligibility criteria.
11. A student can graduate with a Minor if he/she fulfils the requirements for his/her regular B. Tech. programas well as fulfils the requirements for Minor program.

12. The institute shall maintain a record of students registered and pursuing their Minor programs, minor program-wise and parent branch-wise. The same report needs to be sentto the University once the enrolment process is complete.
13. The institute / department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

4. Eligibility conditions for the student to register for Minor course

a) A student can opt for B.Tech. degree with Minor program if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor program, before commencement of III year ISemester (V Semester), is mandatory

c) If more than 50% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

5. Registration for the courses in Minor Program

d) At the beginning of each semester, just before the commencement of classes, studentsshall register for the courses which they wish to take in the that semester.

e) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech.programme. No course should be identical to that of the regular BTech course. The students should take the advice of faculty mentors while registering for a course at thebeginning of semester.

f) The maximum No. of courses for the Minor is limited to two (three in case of inclusionof lab) in a semester along with regular semester courses.

g) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

h) A fee for late registration may be imposed as per the norms.

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CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B. Tech. I Year Syllabus

Common for ECE, CSE[AIML] & CSE[DS]

I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	22MA101BS	Matrices and Calculus	3	1	0	4
2	22PH102BS	Applied Physics	3	1	0	4
3	22CS103ES	Programming for Problem Solving	3	0	0	3
4	22EN104HS	English for Skill Enhancement	3	0	0	3
5	22CS105ES	IT Workshop	0	0	3	1.5
6	22PH106BS	Applied Physics Laboratory	0	0	3	1.5
7	22CS107ES	Programming for Problem Solving Laboratory	0	0	2	1
8	22EN108HS	English Language and Communication Skills Laboratory	0	0	2	1
9	22CS109ES	Basic Elements of Engineering and Technology	0	0	2	1
		Induction Programme				
Total			**12**	**2**	**12**	**20**

II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	22MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2	22CH202BS	Engineering Chemistry	3	1	0	4
3	22CS203ES	Data Structures	3	0	0	3
4	22EC204ES	Basic Electrical and Electronics Engineering	3	1	0	4
5	22ME205ES	Computer Aided Engineering Graphics	1	0	2	2
6	22CH206BS	Engineering Chemistry Laboratory	0	0	2	1
7	22CS207ES	Data Structures Laboratory	0	0	2	1
8	22EC208ES	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1
9	22CH209MC	Environmental Science	3	0	0	0
Total			**16**	**3**	**8**	**20**

CMRTECHNICAL CAMPUS

UGC AUTONOMOUS

B.Tech. II Year Syllabus

Computer Science and Engineering (AI&ML)

III SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	22AM301PC	Discrete Mathematics	3	0	0	3
2	22AM302PC	Software Engineering	3	0	0	3
3	22AM303PC	Programming with Python	3	0	0	3
4	22AM304PC	Computer Organization and Architecture	3	0	0	3
5	22AM305PC	Operating Systems	3	0	0	3
6	22AM306PC	Python Lab	0	0	3	1.5
7	22AM307PC	Software Engineering Lab	0	0	2	1
8	22AM308PC	Operating Systems Lab	0	0	3	1.5
9	22AM309PC	Node JS/ React JS/Django	0	0	2	1
10	22EN310MC	Constitution of India	3	0	0	0
		Total	**18**	**0**	**10**	**20**

IV SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	22AM401PC	Automata Theory and Compiler Design	3	0	0	3
2	22AM402PC	Database Management Systems	3	0	0	3
3	22MA403BS	Mathematical and Statistical Foundations	3	0	0	3
4	22AM404PC	Introduction to Artificial Intelligence	3	0	0	3
5	22AM405PC	Object Oriented Programming through Java	3	0	0	3
6	22AM406PC	Database Management Systems Lab	0	0	2	1
7	22AM407PC	Java Programming Lab	0	0	2	1
8	22EN408MC	Gender Sensitization Lab	0	0	2	0
9	22AM409PC	Prolog/ Lisp/ Pyswip	0	0	2	1
10	22AM410PC	Real-time Research Project/Field-Based Research Project	0	0	4	2
		Total	**15**	**0**	**12**	**20**

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B. Tech. III Year Syllabus

V SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1	22AM501PC	Design and Analysis of Algorithms	3	1	0	4
2	22AM502PC	Machine Learning	3	0	0	3
3	22AM503PC	Computer Networks	3	0	0	3
4	22MB504HS	Business Economics & Financial Analysis	3	0	0	3
5		Professional Elective-I	3	0	0	3
6	22AM505PC	Machine Learning Lab	0	0	3	1.5
7	22AM506PC	Computer Networks Lab	0	0	3	1.5
8	22AM507PC	UI design-Flutter	0	0	2	1
9	22AM508MC	Intellectual Property Rights	3	0	0	0
		Total	**18**	**1**	**8**	**20**

VI SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	22AM601PC	Knowledge Representation and Reasoning	3	0	0	3
2	22AM602PC	Data Analytics	3	0	0	3
3	22AM603PC	Natural Language Processing	3	0	0	3
4		Professional Elective–II	3	0	0	3
5		Open Elective-I	3	0	0	3
6	22AM604PC	Data Analytics Lab	0	0	2	1
7	22EN605HS	Advanced English Communication Skill lab	0	0	2	1
8	22AM606PC	Natural Language Processing Lab	0	0	2	1
9	22CH607MC	Environmental Science*	3	0	0	0
10	22AM608PC	Industrial Oriented Mini Project/ Internship/ Skill Development Course(DevOps)	0	0	4	2
		Total	**18**	**0**	**10**	**20**

***Environmental Science III Yr. II Sem should be Registered by Lateral Entry Students Only.**

CMR TECHNICAL CAMPUS
UGC AUTONOMOUS
B. Tech. IV Year Syllabus

VII SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1	22MB701HS	Professional Practice, Law & Ethics	3	0	0	3
2	22AM702PC	Deep Learning	3	0	0	3
3		Professional Elective-III	3	0	0	3
4		Professional Elective-IV	3	0	0	3
5		Open Elective-II	3	0	0	3
6	22AM703PC	Deep Learning lab	0	0	2	1
7		Professional Elective-III Lab	0	0	2	1
8	22AM704PC	Project Stage-I	0	0	6	3
		Total	**15**	**0**	**10**	**20**

VIII SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1		Professional Elective-V	3	0	0	3
2		Professional Elective–VI	3	0	0	3
3		Open Elective–III	3	0	0	3
4	22AM801PC	Project Stage– II including Seminar	0	0	2	11
		Total	**9**	**0**	**2**	**20**

***MC–pass/fail**

#SkillCourse-1 credit with 2 Practical Hours

Professional Elective-I

22AM511PE	Graph Theory
22AM512PE	Introduction to Data Science
22AM513PE	Web Programming
22AM514PE	Image Processing
22AM515PE	Computer Graphics

Professional Elective-II

22AM621PE	Software Testing Methodologies
22AM622PE	Information Retrieval Systems
22AM623PE	Pattern Recognition
22AM624PE	Computer Vision and Robotics
22AM625PE	Data Warehousing and Business Intelligence

Professional Elective-III

22AM731PE	Internet of Things
22AM732PE	Data Mining
22AM733PE	Go Programming
22AM734PE	Mobile Application Development
22AM735PE	Cloud Computing

#Courses in PE–III and PE-III Lab must be 1-1 correspondence.

Professional Elective-III Lab

22AM731PL	Internet of Things Lab
22AM732PL	Data Mining Lab
22AM733PL	Go Programming Lab
22AM734PL	Mobile Application Development Lab
22AM735PL	Cloud Computing Lab

Professional Elective-IV

22AM741PE	Quantum Computing
22AM742PE	Generative AI
22AM743PE	Semantic Web
22AM744PE	Nature Inspired Computing
22AM745PE	Mobile Computing

Professional Elective-V

22AM851PE	Social Network Analysis
22AM852PE	Federated Machine Learning
22AM853PE	Augmented Reality & Virtual Reality
22AM854PE	Web Security
22AM855PE	Ad-hoc & Sensor Networks

Professional Elective–VI

22AM861PE	Speech and Video Processing
22AM862PE	Robotic Process Automation
22AM863PE	Randomized Algorithms
22AM864PE	Cognitive Computing
22AM865PE	Conversational AI

The following Open Electives are offered by department of CSE(AI&ML).

Open Elective-I

22AM611OE	Fundamentals of AI
22AM612OE	Machine Learning Basics

Open Elective-II

22AM721OE	Introduction to Natural Language Processing
22AM722OE	AI applications

Open Elective-III

22AM831OE	Introduction to Deep Learning
22AM832OE	Introduction to Generative AI

Matrices and Calculus

B. Tech. I Semester **L T P C**
Subject Code: 22MA101BS **3 1 0 4**

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn

1. Types of matrices, their properties and concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
2. Concept of eigen values and eigenvectors and to reduce the quadratic form to canonical form.
3. Apply geometrical approach to the mean value theorems and their application to the mathematical problems and evaluation of improper integrals using Beta and Gamma functions.
4. Utilize partial differentiation, concept of total derivative and finding maxima and minima of function of two and three variables.
5. Evaluation of multiple integrals and their applications.

Course Outcomes: After completion of this course, the students will be able to:

1. Use the matrix representation of a set of linear equations and analyze the solution of the system of equations.
2. Find the Eigen values and Eigenvectors and reduce the quadratic form to canonical form using orthogonal transformation.
3. Solve the applications on the mean value theorems and evaluate the improper integrals using Beta and Gamma functions.
4. Apply the extreme values of functions of two variables with/ without constraints.
5. Compute multiple integrals and apply the concept to find areas, volumes.

UNIT-I: Matrices [10 Lectures]

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

UNIT-II: Eigen values and Eigen vectors [10 Lectures]

Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors and their properties: 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: Calculus [10 Lectures]

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem (without proof) with their Geometrical Interpretation and applications, Cauchy's Mean Value Theorem (without proof), Taylor's series for single variable.

Definition of improper integral: Definition of Beta and Gamma functions, properties, other forms of Beta functions, Relation between Beta and Gamma functions and their applications.

UNIT-IV: Multivariable Calculus (Partial Differentiation and Applications)

[9 Lectures]

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

UNIT-V: Multivariable Calculus (Integration) [9 Lectures]

Evaluation of Double integrals (Cartesian and Polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple integrals: Change of variables (Cartesian to polar) for double integrals.

Applications: Areas and volumes by double integrals.

TEXT BOOKS:

1. T.K.V.Iyengar, B.Krishna Gandhi, Engineering Mathematics, S.Chand Publishers, 19th edition,2020
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition,2018.
3. R.K. Jain and S.R.K. Iyengar, Advanced Engineering mathematics, Narosa Publications, 6th Edition, 2020.

REFERENCE BOOKS:

1. Erwin kreyzig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint,2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi publications, Reprint,2008.
4. H.K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S.Chand publishers, 2014.

Web Links:

1. https://www.mooc-list.com/tags/matrix
2. https://www.mooc-list.com/tags/mean-value-theorem

Applied Physics

B. Tech. I Semester **L T P C**
Subjects Code: 22PH102BS **3 1 0 4**

Prerequisites: 10 + 2 physics

Course Objectives: The objectives of this course for the student are to:

1. Understand the basic principles of quantum physics and band theory of solids.
2. Summarize the underlying mechanism involved in construction and working principles of various semiconductor devices.
3. Study the fundamental concepts related to the dielectric and magnetic materials.
4. Identify the importance of nano scale, quantum confinement and various fabrications techniques.
5. Explain the characteristics of lasers and optical fibres.

Course Outcomes: After completion of this course, the students will be able to:

1. Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
2. Identify the role of semiconductor devices in science and engineering Applications.
3. Explore the fundamental properties of dielectric and magnetic materials for their applications.
4. Interpret the features and applications of nanomaterials.
5. Relate various aspects of Lasers and Optical fibres and their applications in diverse fields.

UNIT-I: QUANTUM PHYSICS AND SOLIDS [12 Lectures]

Quantum Mechanics: Introduction to quantum physics, Blackbody radiation, Planck's radiation law, Wein's and Rayleigh-Jean's law, Stefan-Boltzmann's law, Photo electric 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: Free electron theory (Drude and Lorentz, Sommerfield - qualitative), Fermi-Dirac distribution, Periodic potentials - Bloch's theorem, Kronig-Penney model (qualitative), E-K diagram, Effective mass of electron, Origin of energy bands- classification of solids.

UNIT-II: SEMICONDUCTORS AND DEVICES [10 Lectures]

Introduction to semiconductors, Intrinsic and extrinsic semiconductors - carrier concentration, Direct and indirect band gap semiconductors, Hall effect, Construction, Principle of operation and characteristics of P-N Junction diode, Zener diode, Bipolar junction transistor (BJT), LED, PIN diode, Avalanche photodiode (APD) and Solar cells.

UNIT-III: DIELECTRIC AND MAGNETIC MATERIALS [10 Lectures]

Dielectric Materials: Basic definitions, Electronic and ionic polarizations, Ferroelectric, Piezoelectric and Pyroelectric materials - applications.

Magnetic Materials: Hysteresis - soft and hard magnetic materials, Magnetostriction, Magneto resistance, Bubble memory devices, Magnetic field sensors and Multiferroics, Applications of magnetic materials.

UNIT-IV: NANO TECHNOLOGY [8 Lectures]

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), XRD, SEM & TEM, Applications of nanomaterials.

UNIT-V: LASER AND FIBER OPTICS [8 Lectures]

Lasers: Laser beam characteristics, three quantum processes, Einstein coefficients and their relations, Lasing action, Pumping methods, Ruby laser, Nd-YAG laser, He-Ne laser, Semiconductor laser, Applications of laser.

Fiber Optics: Introduction to optical fibers, Total internal reflection, Construction of optical fiber, Numerical aperture, Acceptance angle, Classification of optical fibers, Losses in optical fiber, Optical fiber for communication system, Applications of optical fibers.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. H.C.Verma, QuantumPhysics, TBS Publication, 2ndEdition2012.
2. Halliday, Resnickand Walker, John Wiley & Sons, Fundamentals of Physics 11thEdition, 2018.
3. Charles Kittel, Introduction to Solid State Physics, Wiley Eastern, 2019.
4. S.L.Gupta and V.Kumar, Elementary Solid State Physics, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhya – Nano Materials, New Age International, 1stEdition, 2007.

Web Links:

1. https://youtu.be/TcmGYe39XG0
2. https://youtu.be/JA3sCmrv11M
3. https://youtu.be/qUEbxTkPIWI

Programming for Problem Solving

B. Tech. I Semester **L T P C**
Subject Code: 22CS103ES **3 0 0 3**

Prerequisites:

1. Basic knowledge on Mathematics & Problem solving skills.

Course Objectives:

1. Design solutions to simple engineering problem by applying the basic programming principles of C language and basic mathematical knowledge.
2. Implement the programs using conditional statements and loops.
3. Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.
4. Develop & implement the program using recursion and dynamic memory allocation.
5. Develop the programs of searching and sorting techniques using Arrays.

Course Outcomes: After completion of this course, the students will be able to:

1. Illustrate and explain the basic computer concepts, algorithms, flowcharts and programming principles of C Language.
2. Develop C programs to solve simple mathematical and decision making problems.
3. Understand, distinguish and implement arrays, strings and structures to write C programs.
4. Understand the concepts of pointers and files using C programs.
5. Decompose a problem into functions and to develop modular reusable code.
6. Understand the Searching and sorting problems.

UNIT – I: **[10 Lectures]**

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, types of computer languages, compilers, creating, compiling and executing a program etc., Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart with examples.

Introduction to C Programming Language: History, Basic Structure of a C program, variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, type conversion, Bitwise operations: Bitwise AND, OR, XOR and NOT operators. I/O: Simple input and output with scanf and printf.

UNIT - II: **[12 Lectures]**

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

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 handling functions available in C .

Structures: Defining structures, initializing structures, Nested structures, Array of structures

Unions: Defining Unions, initializing unions, basic program on union. Enumeration data type.

UNIT - III: **[10 Lectures]**

Pointers: Idea of pointers, defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self-referential structures in linked list (no implementation).

Pre-processor: Commonly used Pre-processor commands like include, define, undef, if, ifdef , fndef Files: Text and Binary files, Creating and Reading and writing text and binary files, appending data to existing files, Random access using fseek, ftell and rewind functions.

UNIT - IV: **[8 Lectures]**

Functions: Designing structured programs, declaring a function, Signature of a function, Parameters and return type of a function, categories of functions, passing parameters to functions, call by value, Passing arrays 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, Storage classes (auto, extern, static and register), The main method and command line arguments.

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

UNIT - V: **[8 Lectures]**

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).

TEXT BOOKS:

1. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, 3rd edition,2006.
2. Jeri R. Hanlyand Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson,2006.

REFERENCE BOOKS:

1. W. Kernighan and Dennis M. Ritchie, The C Programming Language,Prentice Hall of India
2. R.G. Dromey, how to solve it by Computer, Pearson(16thImpression)
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. Herbert Schildt, C: The Complete Reference, Mc Graw Hill,4thEdition

Web Links:

1. https://nptel.ac.in/courses/106104074
2. https://onlinecourses.nptel.ac.in/noc21_cs01/preview
3. https://www.includehelp.com/c-programming-examples-solved-c-programs.aspx
4. https://www.programiz.com/c-programming.

English for Skill Enhancement

B. Tech. I Semester **L T P C**
Subject Code: 22EN104HS **3 0 0 3**

Prerequisites: Basic knowledge in Grammar as well as in prose

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.
4. Learn technical communication and effective report writing.
5. Enhance applied grammar, technical vocabulary, and presentation skills.

Course Outcomes:

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

1. Understand the importance of vocabulary and sentence structures.
2. Demonstrate their understanding of the rules of functional grammar.
3. Take an active part in drafting paragraphs, letters, essays, abstracts, precise and reports in various contexts.
4. Develop comprehension skills from the known and unknown passages.
5. Acquire basic proficiency in reading and writing modules of English.

UNIT – I **[10Lectures]**

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 -Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives- 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 -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT – II **[10 Lectures]**

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 – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT – III **[10 Lectures]**

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 - Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.
Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

UNIT – IV **[9 Lectures]**

Chapter entitled 'Art and Literature' by Abdul Kalam from *"English: Language, Context and Culture"* published by Orient BlackSwan, Hyderabad.
Vocabulary: Standard Abbreviations and Acronyms in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice
Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

UNIT – V **[9 Lectures]**

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: Common Errors in English
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

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

- **Note: 1**. As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech. First Year is* ***Open-ended***, besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.
- **Note**: **2**. Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents. They are advised to teach 40 percent of each topic from the syllabus in blended mode.

TEXTBOOK:

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. Interchange Series. Introduction, 1,2,3. Cambridge University Press. (2022)
3. Wood, F.T. Remedial English Grammar. Macmillan. (2007).

4. Chaudhuri, Santanu Sinha. Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd. (2018). Technical Communication. Wiley India Pvt. Ltd. (2019).
5. Vishwamohan, Aysha. English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd. (2013).
6. Swan, Michael. Practical English Usage. Oxford University Press. Fourth Edition. (2016).

Web Links:

UNIT I

Vocabulary - Prefixes and Suffixes

WL1:https://nptel.ac.in/courses/109106094/23

WL2:http://teacher.scholastic.com/reading/bestpractices/vocabulary/pdf/prefixes_suffixes.pdf

Synonyms and Antonyms

WL3:https://www.google.com/search?q=Synonyms+an+Antonyms+-+nptel+videos&nfpr=1&sa=X&ved=0ahUKEwi7pbzfluXfAhXBEbwKHXOqC4oQvgUILCgB&biw=1024&bih=657

WL4:https://scoop.eduncle.com/synonyms-antonyms-for-competitive-exams

GRAMMAR - Common errors in Prepositions

WL5:https://nptel.ac.in/courses/109104030/Module12/Lecture39.pdf

WL6:https://nptel.ac.in/courses/109104030/Module12/Lecture38.pdf

WL7:https://www.englishpractice.com/common-mistakes/common-errors-prepositions-3

Techniques of Effective reading

WL8:https://nptel.ac.in/courses/109106129/5

WL9:https://nptel.ac.in/courses/109106129/15

WL10:https://www.howtolearn.com/2012/08/different-reading-techniques-and-when-to-use-them/

UNIT II

GRAMMAR - Common errors in Noun and Pronoun agreement

WL11:https://nptel.ac.in/courses/109104030/Module12/Lecture39.pdf

common errors and Rules of Subject-verb agreement

WL12:https://nptel.ac.in/courses/109106094/8

https://www.grammarbook.com/grammar/subjectVerbAgree.asp

Techniques for improving comprehension skills

WL13:https://nptel.ac.in/courses/109106129/5

WL14:https://joshkaufman.net/3-simple-techniques-to-optimize-your-reading-comprehension-and-retention/

UNIT III

English Language Vocabulary-Affixes

WL15:http://www.prefixsuffix.com/rootchart.php

English words from Foreign languages

WL16:https://www.fluentu.com/blog/english/english-words-from-other-languages/

WL17:https://en.oxforddictionaries.com/explore/foreign-words-and-phrases/ Misplaced modifiers

WL18:https://www.grammar-monster.com/glossary/misplaced_modifier.htm

Reading

WL19:http://www.bbc.co.uk/skillswise/topic/skimming-and-scanning

WL20:http://www.bbc.co.uk/skillswise/video/skimming-and-scanning

Writing
WL21:https://writeshop.com/choosing-vocabulary-to-describe-a-place/
Writing formal letters
WL22:https://nptel.ac.in/courses/109104031/14

UNIT IV
Vocabulary
WL23:https://www-pub.iaea.org/MTCD/DSS/OASISGlossary.pdf
WL24: https://nptel.ac.in/courses/Webcoursecontents/IIScBANG/Composite%20Materials/pdf/Glossory.pdf
WL25:https://nptel.ac.in/courses/117105083/pdf/ssg_m2l2.pdf

Reading
WL26:https://nptel.ac.in/courses/109106066/module6/lecture12/lecture12.pdf

Writing
WL27:https://nptel.ac.in/courses/109106094/29
WL28:https://nptel.ac.in/courses/109106066/module3/lecture6/lecture6.pdf

UNIT - V
Vocabulary
WL29:https://nptel.ac.in/courses/109106066/module1/lecture1/lecture1.pdf

Grammar - Common errors
WL30:https://www.engvid.com/english-resource/50-common-grammar-mistakes-in-english/

Reading
WL31:https://nptel.ac.in/courses/109106066/module6/lecture12/lecture12.pdf

Writing
WL32:https://nptel.ac.in/courses/109104031/17
WL33:https://nptel.ac.in/courses/109107121/31

IT Workshop

B. Tech. I SEM **L T P C**
Subject Code: 22CS105ES **0 0 3 1.5**

Course Objectives:

1. The IT Workshop is a training lab course to get training on PC Hardware, Internet &Worldwide Web and Productivity tools for documentation, Spreadsheet computations and Presentation.
2. To introduce to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers, hardware and software level troubleshooting process.
3. To introduce connecting the PC on to the internet from home and workplace and effectively usage of the internet, Usage of web browsers, email, newsgroups and discussion forums.
4. To get knowledge in awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber-attacks.
5. To introduce the usage of Productivity tools in crafting professional word documents, excel spreadsheets and power point presentations using open office tools.

Course Outcomes: After completion of this course, the students will be able to:

1. Apply knowledge for PC hardware and computer parts.
2. Apply knowledge for computer assembling and software installation.
3. Ability how to solve the trouble shooting problems.
4. Apply the tools for preparation of project certificate, Creating a Newsletter.
5. Apply the tools for preparation of PPT, Documentation and budget sheet etc.

PC Hardware: The students should work on working PC to disassemble and assemble to working condition and install operating system like Linux or any other on the same PC. Students are suggested to work similar tasks in the laptop scenario wherever possible.

Problem 1: Every student should 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. Every student should disassemble and assemble the PC back to working condition.

Problem 2: Every student should individually install operating system like Linux or MS windows on the personal computer. The system should be configured as dual boot with both windows and Linux.

Problem 3: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fixit to get the computer back to working condition.

Problem 4: Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. Internet & World Wide Web.

Problem 5: 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 how to access the websites and email.

Problem 6: Web Browsers, Surfing the Web: Students customize their web browsers with

the LAN proxy settings, bookmarks, search toolbars and popup blockers. Also, plug- ins like Macro Media Flash and JRE for applets should be configured

Problem 7: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. Usage of search engines like Google, Yahoo, ask.com and others should be demonstrated by student.

Problem 8: Cyber Hygiene: Students should learn about viruses on the internet and install antivirus software. Student should learn to customize the browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

Problem 9: Develop home page: Student should learn to develop his/her home page using HTML consisting of his/her photo, name, address and education details as a table and his/her skill set as a list. Productivity tools: Word Orientation: An overview of Microsoft (MS) office /equivalent (FOSS) tool word should be learned: Importance of MS office / equivalent (FOSS) tool Word as word Processors, Details of the three tasks and features that should be covered in each, using and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.

Problem 10: Using and Word to create 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 Word.

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 in word.

Problem 11-Spreadsheet Orientation: Accessing, overview of toolbars, saving spreadsheet files, Using help and resources. Creating a Scheduler: - Gridlines, Format Cells, Summation, auto fill, Formatting Text.

Calculating GPA - Features to be covered: - Cell Referencing, Formulae in spread sheet – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyperlinking, Count function, Sorting, Conditional formatting.

Problem 12: Creating Power Point: Student should work on basic power point utilities and tools in Latex and MS Office/equivalent (FOSS) which help them create basic power point presentation. PPT Orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting Images, Tables and Charts.

REFERENCE BOOKS:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education. LaTeX Companion – Leslie Lamport, PHI/Pearson.
2. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
3. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
   PC Hardware and A+ Handbook – Kate J. Chase PHI (Microsoft)

Applied Physics Laboratory

B. Tech I Semester **L T P C**
Subject Code: 22PH106BS **0 0 3 1.5**

Prerequisites: Practical physics at basic level.

Co-Prerequisite: A course on 'Applied physics laboratory'.

Course Objectives: The objectives of this course for the student to

1. Capable of handling instruments related to photoelectric effect experiments and their measurements.
2. Understand the characteristics of various devices such as PN junction diode, BJT, LED, solar cell, Hall effect and measurement of energy gap and resistivity of semiconductor materials.
3. To understand the characteristics of dielectric constant of a given material and study the behavior of B-H curve of ferromagnetic materials.
4. Understand the Characteristics of Laser and optical fiber measurements.
5. Understanding the method of Mechanical oscillator (Torsional) and electrical oscillator (LCR).

Course Outcomes: After completion of this course, the students will be able to:

1. Know the determination of the Planck's constant using Photoelectric effect.
2. Appreciate quantum physics in semiconductor devices, optoelectronics and identify the material whether it is n-type or p-type by Hall experiment.
3. Gain the knowledge of applications of dielectric constant and understand the variation of magnetic field and behavior of hysteresis curve.
4. Gain the knowledge of Characteristics of Laser and optical fiber measurements.
5. Carried out data analysis.

LIST OF EXPERIMENTS:

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

Note: *Any 8 experiments are to be performed.*

REFERENCE BOOK:

1. S. Balasubramanian, M.N.Srinivasan "A Textbook of Practical Physics"-S Chand Publishers, 2017.

Programming for Problem Solving Laboratory

B. Tech. I Semester **L T P C**
Subject Code: 22CS107ES **0 0 2 1**

Co-requisites: A course on Programming for problem solving.

Pre-requisites: Basic knowledge on mathematics & problem solving skills.

Course Objectives: The students will learn the following:

1. To work with an IDE to create, edit, compile, run and debug programs
2. To analyze the various steps in program development.
3. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
4. To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
5. To implement programs using file handling, strings, sorting, searching

Course Outcomes: After completion of this course, the students will be able to:

1. Develop C programs for simple numerical problems.
2. Apply the knowledge of conditional statements and loops in programs.
3. Implement the programs using the concepts of arrays, structures, pointers and files.
4. Create the programs using functions and recursive functions.
5. Implement searching and sorting algorithms.

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 C program for binary equivalent to a positive number 0 to 255.

Expression Evaluation:

a) 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)

b) Write a program that finds if a given number is a prime number

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

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

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

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

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) Transposeofamatrixwithmemorydynamicallyallocatedforthenewmatrixasrowandcolumn 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

Files:

a) Write a C program to displaythe contents of a file to standard output device.

b) Write a C program which copies one file to another file..

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

Strings:

a) Write a C program to implement string handling functions.

b) Write a C Program to find the length of a given string without using strlen() function.

c) Write a C Program to concatenate two string without using a function.

Miscellaneous:

a) 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 Keyvalue in a given List of integers using linear search method.

b) Write a C program that uses non-recursive function to search for a Keyvalue in a given Sorted list of integers using binary search method.

c) Write a C program that implements the Bubble sort method to sort a given list of Integers in ascending order.

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

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

TEXT BOOKS:

1. Jeri R. Hanlyand Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson,2013.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition),2006.

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.

English Language and Communication Skills Lab

B. Tech. I Semester **L T P C**
Subject Code: 22EN108HS **0 0 2 1**

Prerequisites: Basic Knowledge in speech sounds as well as formal and informal communication

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:

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

Course Outcomes: After completion of this course, the students will be able to:

1. Pronounce English sounds according to standard pronunciation.
2. Understand the nuances of English language through audio- visual experience and practice.
3. Speak with clarity and confidence which in turn enhances their employability skills.
4. Neutralize their accent for intelligibility.
5. Participate in discussion and presentation effectively and confidently.

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

a) Computer Assisted Language Learning (CALL) Lab
b) Interactive Communication Skills (ICS) Lab

Listening Skills:

Objectives:

1. To enable students to develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
   - Oral practice
   - Describing objects/situations/people
   - Role play– Individual/Group activities
   - Just A Minute (JAM) Sessions

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

Exercise – I CALL Lab:

Understand*:* Listening Skill- Its importance – Purpose- Process- Types

Practice**:** Introduction to Phonetics – Speech Sounds – Vowels and Consonants

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English**.**

Practice: **Ice-**Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave –Introducing Oneself and Others.

Exercise – II CALL Lab:

Understand: Listening Skills: Barriers- Effective Listening.

Practice: Minimal Pairs-Consonant Clusters- Past Tense Marker and Plural Marker- *Testing Exercises*

ICS Lab:

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

Exercise-III CALL Lab:

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - *Testing Exercises*

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IV CALL Lab:

Understand: Errors in Pronunciation-Neutralization of Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -*Testing Exercises*

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication- Presentation Skills.

Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V CALL Lab:

Understand: Listening for General and Specific Details.

Practice: Listening Comprehension Tests -*Testing Exercises*

ICS Lab:

Understand: Introduction to Group Discussion

Practice: 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.

Source of Material (Master Copy):

- *Exercises in Spoken English. Part 1,2,3*. CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor- made to suit the contents of the syllabus.

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easyby Darling Kindersley.
- Punctuation Made Easyby Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:

1. *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd. (2022).
2. Shobha, KN & Rayen, J. Lourdes. *Communicative English – A workbook.* Cambridge University Press. (2019).
3. Kumar, Sanjay & Lata, Pushp. *Communication Skills: A Workbook.* Oxford University Press. (2019).
4. Board of Editors.*ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.* Orient Black Swan Pvt. Ltd. (2016).
5. Mishra, Veerendra et al. *English Language Skills: A Practical Approach.* Cambridge University Press. (2020).

WEB LINKS:

Listening Skills Lecture nptel
WL1:https://www.youtube.com/watch?v=JIKU_WT0Bls

NPTEL on role-play and conversation skills
WL2:https://www.youtube.com/watch?v=0AM35Nu5McY&list=PLbMVogVj5nJT3a24lj4KOkQCOElx cDQrs

NPTEL on syllables
WL3:https://www.youtube.com/watch?v=4V2CwQJ8pgc

NPTEL on listening for general details
WL4:https://www.youtube.com/watch?v=xY7z3nZOHqk&list=PLzJaFd3A7DZtnTdtOxvjO3GLPd1WVe6o q&index=17

NPTEL on stress shifts
WL 5: https://www.youtube.com/watch?v=_KHtfvob4j4

NPTEL on weak forms and strong forms
WL6:https://www.youtube.com/watch?v=VM0cNDxBySc&list=PL0P6HKIuShRnJeZjhAOy-2NejNjeC2_x2

WL7:NPTEL on Intonation
https://www.youtube.com/watch?v=A6aE4nceJt8

Basic Elements of Engineering and Technology

B. Tech. I Semester **L T P C**
Subject Code: 22CS109ES **0 0 2 1**

Course Objectives:

1. To Explore different engineering technologies and their applications.
2. To be able to learn various 3d printing technologies.
3. To Knowledge towards Assembling and testing of robots.
4. To Understand functionality of 3Dprinters and their application.
5. To Develop team work and in sight towards different disciplines of Engineering.

Course Outcomes:

1. Exploring different engineering technologies and their applications.
2. Students should able to learn various 3d printing technologies.
3. Knowledge towards Assembling and testing of robots.
4. Understanding functionality of 3Dprinters and their application.
5. Developing team work and in sight towards different disciplines of Engineering.

Module I: Internet of Things **[10 Lectures]**

Overview of IoT and Architecture: Brief History, evolution of IoT, Architecture, trends in the Adoption of IoT, Societal Benefits of IoT, Risks, Privacy, Security, Embedded Systems Components, Micro-controller Architecture and Properties and Installing and Setting up the Arduino and Raspberry Pi (RPi) development environment. Build Simple IoT Applications by using Arduino or RPi.

Module II: Robotics **[10 Lectures]**

Introduction, Different types of robots, Components of a Robot, Working principle of robots, Applications of robots in various fields, Innovation challenges, Scope of robotics research & its current trends, assembling and testing of Robot.

Module III:3D Printing **[10 Lectures]**

Introduction, Product Design & Development, 3D Scanning & Printing using different types of materials. Components of 3D Printer, Applications of 3D printed products in various fields, Hands on Experience on 3D printing Machine.

Module IV: Software and Post Processing [9 **Lectures]**

Cura, Flash print, 3dslicer, Tinkercad, Meshmixer. 3d printing parameters, print Speed, Layer Height, Infill density.Acetone bathing, Support Structure Removing.

Module V: Case Studies [9 **Lectures]**

Students has to submit a report by doing a study on various Engineering applications related to Manufacturing, Retail, Automotive, Logistics, Healthcare, Entertainment and E- Governance.

REFERENCE BOOKS:

1. PC Hardware-A Handbook –KateJ. Chase PHI(Microsoft)
2. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme.– CISCO Press, Pearson Education.
3. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015,ISBN: 9788173719547.

4. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace,O'Reilly (SPD),2014,ISBN: 9789350239759
5. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression,2010.
6. DebSR. And DebS.,—Robotics Technology and Flexible Automation ‖,Tata Mc GrawHill Education Pvt.Ltd,2010.
7. MikellP Groover,—Automation, Production Systems,and computer integrated Manufacturing‖,PrenticeHall, 2001.
8. CheeKaiChua, KahFaiLeong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping.
9. Andreas Gebhardt, Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling,Rapid Manufacturing.

Ordinary Differential Equations and Vector Calculus

B. Tech. II Semester **L T P C**
Subject Code: 22MA201BS **3 1 0 4**

Pre-requisites: Mathematical Knowledge at pre-university level
Course Objectives: To learn

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

Course Outcomes: After completion of this course, the students will be able to:

1. Identify whether the given differential equation of first order is exact or not.
2. Solve higher order differential equations.
3. Use Laplace transforms techniques to find the derivatives and integrals of given functions & inverse Laplace transforms techniques for solving ODE's.
4. Analyze vector and scalar point functions.
5. Evaluate the line and surface integrals and converting them from one to another.

UNIT-I: First Order ODE **[10 Lectures]**

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates).

Applications: Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order **[10 Lectures]**

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax},sinax, cosax, polynomials in x, $e^{ax}V(x)$and $xV(x)$, method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation.

UNIT-III: Laplace transforms **[10 Lectures]**

Laplace Transforms: First shifting theorem and Change of scale property, Multiplication by ' t' and division by 't', Laplace transforms of derivatives and integrals .Laplace transform of periodic functions. Inverse Laplace transforms: First Shifting theorem, Change of Scale Property, Inverse Laplace transforms of derivatives and Integrals, convolution theorem (without proof). Applications: Solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation **[9 Lectures]**

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

UNIT-V: Vector Integration **[9 Lectures]**

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

TEXT BOOKS:

1. B.S.Grewal, Higher Engineering Mathematics,KhannaPublishers,36th Edition,2021
2. R.K.JAIN, S.R.K.Iyengar,Advanced Engineering Mathematics,.Narosa Publishing House, 4th Edition New Delhi,2020
3. T.K.V.Iyengar, B.Krishna Gandhi, S. Ranganathan and M.V.S.S.N.Prasad, Engineering Mathematics, S.Chand Publishing

REFERENCE BOOKS:

1. Kreyszing,Advanced Engineering Mathematics,.JohnWiley&Sons, 9th Edition 2006.
2. G.B.Thomas and R.L.Finney, Calculus and Analytic geometry,9th Edition,Pearson,Reprint,2002.
3. H.K.Dass and Er.Rajnish verma,Higher Engineering Mathematics,S Chand and Company Limited,New Delhi.
4. N.P.Bali and Manish Goyal,A text book of Engineering Mathematics, Laxmi Publocations,Reprint,2008

Web Links:

1. https://nptel.ac.in
2. https://onlinecourses.nptel.ac.in

Engineering Chemistry

B. Tech. II Semester **L T P C**
Subject Code: 22CH202BS **3 1 0 4**

Prerequisites:

1. Engineering chemistry knowledge in school and college level.

Course Objectives:

To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.

1. To include the importance of water in industrial usage.
2. Analyze the properties and applications of industrial polymers.
3. Fundamental aspects of battery chemistry, significance of corrosion its control to protect the structures.
4. To imbibe the basic concepts of petroleum and its products.
5. To acquire required knowledge about engineering materials like cement, smart materials and Lubricants.

Course Outcomes: After completion of this course, the students will be able to:

1. Identify the basic properties of water and its usage in domestic and industrial purposes.
2. Learn the fundamentals and general properties of polymers and other engineering materials. Apply in day to day life.
3. Make use of basic knowledge of electrochemical procedures related to corrosion and its control.
4. Interpret the concepts of petroleum products and cement, Smartmaterials.
5. Find potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

UNIT - I: Water Chemistry **[10 Lectures]**

Introduction to hardness of water – Estimation of hardness of water by complex metric method and numerical problems. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break - point chlorination. Defluoridation – Removal of F^- ion in water by Nalgonda method. Desalination of water – Reverse osmosis.

UNIT – II : Polymers **[10 Lectures]**

Definition – Classification of polymers with examples – Types of polymerization –addition (free radical addition) and condensation polymerization with examples – Nylon 6:6.

Plastics: Definition and characteristics - thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite.

Rubbers: Natural rubber and its vulcanization.

Elastomers: Characteristics –preparation – properties and applications of Buna-S, and Thiokol rubber.

Biodegradable polymers: Concept and advantages - poly vinyl alcohol and their applications.

Conducting polymers: Characteristics and Classification with examples - mechanism Of conduction in trans - polyacetylene and applications of conducting polymers.

UNIT - III: Batteries & Corrosion [10 Lectures]

Introduction - Classification of batteries- primary, secondary and reserve batteries with examples. Construction, working and applications of Lithium, Lithium ion and Zn-air battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells-Construction and applications of Methanol Oxygen fuel cell.

Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods. Metallic coating methods: Galvanization, Tinning and Eelectroplating

UNIT- IV: Energy Sources: [9 Lectures]

Introduction, Classification- Calorific value of fuel – HCV, LCV- Dulongs formula. 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 – Trans esterification, advantages.

UNIT - V: Engineering Materials: [9 Lectures]

Cement: Portland cement, its composition, setting and hardening. Smart materials and their engineering applications Shape memory materials- Poly L- Lactic acid. Thermo response materials- Polyacryl amides, Poly vinyl amides.

Lubricants: Classification of lubricants with examples-characteristics Of good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

TEXT BOOKS:

1. P.C. Jain and M. Jain, Engineering Chemistry by Dhanpatrai Publishing Company, 2010.
2. Rama Devi, Venkata Ramana Reddy and Rath, Engineering Chemistry by Cengage learning,2016.
3. Jaya Shree Anireddy, Textbookof Engineering Chemistryby Wiley Publications.
4. M. Thirumala Chary, E. Laxminarayana and K.Shashikala, A text book of Engineering Chemistry by Pearson Publications, 2021.

REFERENCE BOOKS:

1. Shikha Agarwal, Engineering Chemistryby Cambridge University Press, Delhi 2015.
2. Shashi Chawla, Engineering Chemistryby Dhanpatrai and Company (P) Ltd. Delhi 2011.

Web Links

1. https://nptel.ac.in/courses/122106030
2. https://in.coursera.org/learn/corrosion
3. https://onlinecourses.nptel.ac.in/noc20_cy21/preview
4. https://archive.nptel.ac.in/courses/103/105/103105110/

Data Structures

B. Tech. II Semester **L T P C**
Subject Code: 22CS203ES **3 0 0 3**

Prerequisites:

1. A Course on "Programming for problem solving".

Course Objectives:

1. Exploring basic data structures such as stacks and queues.
2. Introduces a variety of data structures such as hash tables.
3. Discussion of search trees.
4. Understand the sorting algorithms.
5. Introduces pattern matching algorithms

Course Outcomes: After completion of this course, the students will be able to:

1. Explain the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures.
2. Discuss hashing and different collision resolve techniques.
3. Design programs using a variety of data structures including binary search trees, heaps trees and AVL-trees.
4. Design programs on sorting and graphs.
5. Apply different searching techniques on Non linear data structure.

UNIT–I **[10 Lectures]**

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array and linked representations of stacks, stack applications, Queues- operations, array and linked representations.

UNIT–II **[10 Lectures]**

Dictionaries: linear list representation, skip list representation, operations - insertion, deletion and searching.

Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

UNIT–III **[10 Lectures]**

Search Trees: Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion, AVL Trees, Definition, Height of an AVL Tree, Operations–Insertion, Deletion and Searching, Red –Black, Splay Trees.

UNIT–IV **[9 Lectures]**

Graphs: Graph Implementation Methods. Graph Traversal Methods.
Sorting: Heap Sort, External Sorting- Model for external sorting, Merge Sort.

UNIT–V **[9 Lectures]**

Pattern Matching and Tries: Pattern matching algorithms-Brute force, the Boyer – Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.

TEXTBOOKS:

1. E. Horowitz, S. Sahni and Susan Anderson Freed, *Universities Press*. Fundamentals of Data Structures in C, 2nd Edition,2008.
2. A. S. Tanenbaum, Y. Langsam, and M. J.Augenstein,PHI/Pearson Education. Data Structures using C ,2004.

REFERENCE BOOKS:

1. R. F. Gilberg and B.A. Forouzan, Cengage Learning. Data Structures: A Pseudocode Approach with C, 2nd Edition 2016.

WEB LINKS:

1. https://nptel.ac.in/courses/106102064
2. https://www.programiz.com/dsa/data-structure-types
3. https://www.coursera.org/learn/data-structures

Basic Electrical & Electronics Engineering

B. Tech. II Semester **L T P C**
Subject Code: 22EC204ES **3 1 0 4**

Course Objectives:

1. To introduce the concepts of electrical circuits and its components.
2. To study and understand the different types of DC, AC single & three phase circuits.
3. To study and understand the different types of DC, AC machines and Transformers.
4. To introduce the concepts of diodes & transistors.
5. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes: After completion of this course, the students will be able to:

1. Identify the basic DC electrical circuits.
2. Evaluate the basic single phase and three phase AC circuits.
3. Analyze the working principles of Electrical Machines.
4. Classify the concepts of diodes & Rectifiers.
5. Compare the knowledge of various transistor configurations, characteristics and applications.

UNIT- I: **[10 Lectures]**

D.C. CIRCUITS: Introduction, Types of elements, Definitions, Ohm's law and its limitations, Passive elements R-L-C, Energy Sources-Ideal and practical, Series and Parallel combination of Resistances, Inductances and Capacitances, Star-Delta Transformation, Source transformation, Kirchhoff's Laws, Mesh analysis, Nodal analysis.

UNIT-II: **[10 Lectures]**

A.C. CIRCUITS: Representation of sinusoidal waveforms, Instantaneous value, Peak value, Average and RMS value, Form factor and Peak factor for sinewave, Rectifier output, Saw tooth and Square Waveforms, Phasor representation, Real power, Reactive power, Apparent power, Power factor, Analysis of single- phase ac circuits RL, RC, RLC series combination. Three phase balanced circuits, Voltage and current relationship in star and delta connections.

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UNIT – III: **[10 Lectures]**

TRANSFORMERS: Construction, Types, Working principle of Single-phase transformer, EMF equation, Equivalent circuit, Losses in transformers, Efficiency and Condition for maximum efficiency.

DC& AC Machines: Construction, Working Principle of DC generator, EMF equation, Types, working principle of DC motor, Torque equation, Three phase induction motor construction and working, Slip and Rotor current frequency.

UNIT – IV: **[9 Lectures]**

DIODES: Principle of Operation, Diode current equation, Volt-Ampere characteristics, Static and dynamic resistances, Diffusion and Transition capacitances. Half Wave Rectifier, Full Wave Rectifier-Center-Tap and Bridge Rectifier, Ripple factor, Rectification efficiency, Peak

Inverse Voltage, Transformer Utilisation Factor, Simple problems. Zener diode characteristics, Zener diode as voltage regulator.

UNIT – V: [9 Lectures]

Bipolar junction Transistor: Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Current amplification factor, Relation between α and β, Comparison of CE, CB and CC configurations. SCR Construction, Operation and V-I characteristics.

TEXT BOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019
2. MS Naidu and SKamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. V.K. Mehta, Rohit Mehta, Principles of Electrical Engineering and Electronics – S.Chand Publications, 2nd Edition,2014.

REFERENCE BOOKS:

1. R. L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits – PEI/PHI, 9th Ed, 2006.
2. J. Millman and C. C. Halkias, SatyabrataJit, Electronic Devices and Circuits – TMH, 2/e, 1998.
3. William Hayt and Jack E. Kemmerly, Engineering circuit analysis- McGraw Hill Company, 6th edition,2012.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
5. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Web Links:

1. www.youtube.com/watch?v=vh_aCAHThTQ
2. www.electricaleasy.com/2014/03/electrical-transformer-basic.html
3. www.youtube.com/watch?v=Unh99Qn7CmI
4. www.youtube.com/watch?v=d_LOXUEFA-o
5. www.electricaleasy.com/2022/09/construction-and-working-of-dc-generator.html.

Computer Aided Engineering Graphics

B. Tech. II Semester **L T P C**
Subject Code: 22ME205ES **1 0 2 2**

Pre-requisites:

1. Computer Aided Engineering Graphics course of first year of study.

Course Objectives: To learn

1. To provide basic concepts in engineering drawing. To develop the ability of visualization of objects through technical drawings
2. To impart knowledge about standard principles of orthographic projection of objects.
3. To draw projections of solids and pictorial views of solids and to draw surfaces development of solid for prisms, pyramids, cone and cylinder.
4. To draw isometric views of solids and orthographic projections of solids.
5. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products.

Course Outcomes: After completion of this course, the students will be able to:

1. Apply computer aided drafting tools to sketch the conventions and the methods of drawings, engineering curves and scales.
2. Identify and draw the projections of points, lines and planes in different types of projections. Manually and by using computer aided drafting tools.
3. Analyze the need of projections of solids (prisms, pyramids, cone and cylinder) manually and by using computer aided drafting tools.
4. Evaluate and interpret engineering drawings for development of surfaces to Right Regular Solids-prism, manually and by using computer aided drafting tool.
5. Change the conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting tool.

UNIT- I: INTRODUCTION TO ENGINEERING DRAWING [10 Lectures]

Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid. Scales – Plain and Diagonal. Introduction to CAD Software commands and practice.

UNIT -II: ORTHOGRAPHIC PROJECTIONS [10 Lectures]

Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. manually and by using computer aided drafting.

UNIT –III: PROJECTIONS OF SOLIDS [10 Lectures]

Projections of Regular Solids – Prism, Cylinder, Pyramid and Cone. manually and byusing computer

aided drafting.

UNIT- IV: DEVELOPMENT OF SURFACE [9 Lectures]

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone. manually and by using computer aided drafting.

UNIT –V: ISOMETRIC PROJECTIONS [9 Lectures]

Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions –Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Conversion of Isometric Views to Orthographic Views and Vice-versa. manually and by using computer aided drafting

Note: - Internal exam and The End Semester Examination will be conducted by using Auto Cad Software.

TEXTBOOKS:

1. N.D. Bhatt / Charotar, Engineering Drawing, Publisher: ***Charotar*** Publishing House · Genre January 2019.
2. T. Jeyapoovan, Vikas: Engineering Drawing and graphics Using Auto CAD Third Edition S. Chand and company Ltd. January 2010.
3. N. S. Parthasarathy and Vela Murali/ Engineering Drawing/Oxford publications. 12th june 2015.
4. K Balaveera Reddyet al –Computer Aided Engineering Drawing, CBS Publishers. 2015.

REFERENCE BOOKS:

1. M. B. Shah, B.C. Rane / Engineering Drawing, Pearson. 2009
2. K Balaveera Reddy et al – Computer Aided Engineering Drawing, CBS Publishers. 2015
3. Basant Agrawal and CM Agrawal, Engineering Drawing, Third Edition McGraw Hil.2019
4. K Balaveera Reddy et al – Computer Aided Engineering Drawing -CBS Publishers. 2015.

WEBLINKS:

1. https://www.youtube.com/watch?v=ANEvQyt3PnU
2. https://www.youtube.com/watch?v=rp3swbAYZJU
3. https://www.youtube.com/watch?v=ga1ud9yQl4I
4. http://www.digimat.in/nptel/courses/video/105104148/L04.html
5. https://engineeringvideolectures.com/course/758

Engineering Chemistry Laboratory

B. Tech. II Semester **L T P C**
Subject Code: 22CH206BS **0 0 2 1**

Pre-requesities : To bring adaptability to new developments in engineering chemistry lab and acquire the knowledge in practical skills

Course Objectives:

The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

1. Estimation of hardness of water to check its suitability for drinking purpose.
2. To perform estimations of acids and bases using conductometry and potentiometry methods.
3. To prepare polymers such as Bakelite and nylon-6.6 in the laboratory.
4. Learn skills related to the lubricant properties such as saponification value,surface tension and viscosity of oils.
5. Apply the skills in rate of corrosion to solve engineering problems.

Course Outcomes: After completion of this course, the students will be able to:

1. Determination of parameters like hardness of water and rate of corrosion of mild steel in various conditions.
2. Perform methods such as conductometry and potentiometry in order to find out the concentration equivalence points of acids and bases.
3. Prepare polymers like bakelite and nylon-6.6
4. Estimations of saponification value, surface tension and viscosity of lubricant oils.
5. Find the rate of corrosion of mild steel in various conditions.

List of Experiments:

a. **Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometry method.
b. **Conductometry:** Estimation of the concentration of anacid by Conductometry.
c. **Potentiometry:** Estimation of the concentration of an acid by Potentiomentry
Estimation of the amount of Fe^{+2} by Potentiomentry.

I. Preparations:

1. Preparation of Bakelite.
2. Preparation Nylon – 6.6

II. Lubricants:

1. Estimation of acid value of given lubricant oil.
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

III. Corrosion: Determination of rate of corrosion of mild steel in the presenceand absence of inhibitor.

IV. Virtual lab experiments

1. Construction of Fuel cell and it's working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

REFERENCE BOOKS:

1. B. Ramadevi and P. Aparna, Engineering chemistry Lab manual for by S Chand Publications, New Delhi (2022).
2. Vogel's text book of practical organic chemistry 5th edition.
3. A.I. Vogel, Inorganic Quantitative analysis by ELBS Publications.
4. V.K. Ahluwalia, College Practical Chemistry by Narosa Publications Ltd. New Delhi (2007).

Web Links

1. www.youtube.com/watch?v=FCQ26RQBZLg
2. https://www.youtube.com/watch?v=-GS6uoFf3qQ
3. https://www.youtube.com/watch?v=Y48UgKi33Ps
4. https://www.youtube.com/watch?v=TC1M-XDHfDI

Data Structure Laboratory

B. Tech. II Semester **L T P C**

Subject Code: 22CS207ES **1 0 0 2**

Prerequisites:

1.A Course on "Programming for problem solving".

Course Objectives:

1. It provides an understanding of linear data structures such as stacks and queues.
2. It provides an understanding of nonlinear data structures like tress and graphs.
3. It provides an understanding of linear and binary search algorithms.
4. It provides an understanding of sorting algorithms.
5. It provides an understanding of searching algorithms.

Course Outcomes: After completion of this course, the students will be able to:

1. Implement various linear data structures.
2. Implement various nonl inear data structures.
3. Compare various searching and sorting algorithms.
4. Ability to implement trees and graphs traversals.
5. Understanding of searching algorithms

List of Experiment

1. Write a program that uses functions to perform the following operations on single linked list.
   i) Creation ii) Insertion iii) Deletion iv) Traversal

2. Write a program that uses functions to perform the following operations on double linked list.
   i) Creation ii) Insertion iii) Deletion iv) Traversal

3. Write a program that uses functions to perform the following operations on circular linked list.
   i) Creation ii) Insertion iii) Deletion iv) Traversal

4. Write a program that implement stack (its operations) using
   i) Arrays ii) Pointers

5. Write a program that implement Queue (its operations) using
   i) Arrays ii) Pointers

6. Write a program that implements the following sorting methods to sort a given list of integers in ascending order
   i) Bubble sort ii) Selection sort iii) Insertion sort

7. Write a program that use both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers:
   i) Linear search ii) Binary search
8. Write a program to implement the tree traversal methods.
9. Write a program to implement the graph traversal methods.

TEXT BOOKS:

1. E. Horowitz, S. Sahni and Susan Anderson Freed, *Universities Press*. Fundamentals of Data Structures in C, 2nd Edition,2008.
2. A. S. Tanenbaum, Y. Langsam, and M. J.Augenstein,PHI/Pearson Education.

REFERENCE BOOKS:

1. R. F. Gilberg and B.A. Forouzan, Cengage Learning. Data Structures: A Pseudocode Approach with C, 2nd Edition 2016.

WEB LINKS:

1. https://nptel.ac.in/courses/106102064
2. https://www.programiz.com/dsa/data-structure-types
3. https://www.coursera.org/learn/data-structures

Basic Electrical & Electronics Engineering Lab

B.Tech. II Semester	**L**	**T**	**P**	**C**
Subject Code 22EC208ES	**0**	**0**	**2**	**1**

Prerequisites: 1.A course on Mathematics
Corequisites: Basic Electrical and Electronics Engineering

Course Objectives:

1. To Analyze a given network by applying various electrical laws.
2. To Analyze the performance of single phase transformers.
3. To Analyze the performance of transformers, DC and AC machines.
4. To introduce the concepts of diodes and transistors.
5. To impart the knowledge of various types of Rectifiers.

Course Outcomes: After completion of this course, the students will be able to:

1. Verify the Ohms law, KCL, KVL with practical approach.
2. Estimate the performance calculations of single phase transformers.
3. Analyze the Performance characteristics of DC and AC machines through various testing methods.
4. Compare the characteristics of different types of diodes and transistors.
5. Evaluate the performance of Rectifiers with and without filters.

SECTION A: ELECTRICAL ENGINEERING:

1. Verification of Ohm's law.
2. Verification of KCLand KVL.
3. Brake test on DC Shunt motor.
4. Brake test on 3-phase Induction motor.
5. Load Test on Single-Phase Transformer.
6. Measurement of Voltage, Current and Real Power in Primary and Secondary circuits of a Single Phase Transformer.
7. No Load Characteristics of 3 phase Alternator.

SECTION B: ELECTRONICS ENGINEERING:

1. 1. Study and operation of
   i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies iv) CRO
2. PN Junction Diode Characteristics A)Forward bias B) Reverse bias
3. Zener Diode Characteristics A)Forward bias B) Reverse bias
4. Input and Output characteristics of BJT in CE Configuration.
5. Half wave Rectifier without and with Filters .
6. Full wave Rectifier without and with Filters .
7. Note: Total 10 experiments are to be conducted.
   (Minimum Five experiments from PART-A, Five experiments from PART-B)

TEXT BOOKS:

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

REFERENCE BOOKS:

1. P.Ramana, M.Suryakalavathi, G.T.Chandrasheker,"Basic Electrical Engineering" S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.

WEB LINKS:

1. .https://www.youtube.com/watch?v=Ki60DB0I3W4&list=PLwymdQ84KI-x0T05PcG6D_2rhbWV_O93B&index=2
2. https://www.youtube.com/watch?v=W-AqhZLm7h4
3. https://www.youtube.com/watch?v=UkH4CaAsG6Q
4. https://www.youtube.com/watch?v=Hfkd7UFSIF0
5. https://www.youtube.com/watch?v=i9wbWYtm2cI
6. https://www.youtube.com/watch?v=UdaATCmDfYU
7. https://www.youtube.com/watch?v=1IZIjIf3NDw
8. https://www.youtube.com/watch?v=X-i1MevYcpM
9. https://www.youtube.com/watch?v=syZgyPLHyp8
10. https://www.youtube.com/watch?v=QGawHsg4NpQ

Environmental Science

B. Tech. II Semester **L T P C**
Subject Code: 22CH209MC **3 0 0 0**

Prerequisites: None

Course Objectives:
1. To recognize the importance of environment, self-sustain eco systems.
2. To understand various natural resources – their importance, over exploitation, effects, and measures.
3. To create basic knowledge about different biotic resources and their need for conservation.
4. To be aware of the impacts of developmental activities and mitigation measures.
5. To know various environmental policies, legislation, and regulations.

Course Outcomes: After completion of this course, the students will be able to:
1. Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
2. Analyze and synthesize scientific data to characterize and evaluate the status of at least one type of ecological system and apply skills of measurement, spatial orientation, sampling, and data analysis to characterize natural resource phenomena.
3. Create awareness on the basic philosophy of science, concepts and scope.
4. Evaluate consequences of human exposure to pollution and its impacts to environmental quality.
5. Comprehending the statutory and regulatory mechanisms pertaining to environment in India and understanding judicial response to environmental issues in India**.**

UNIT-I **[10 Lectures]**

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, Biomagnifications, ecosystem value, services and carrying capacity, Field visits.

UNIT-II. **[10 Lectures]**

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

UNIT-III **[10 Lectures]**

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

UNIT-IV **[9 Lectures]**

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution,

Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Waste water

Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. Global Environmental Issues and Global Efforts: Climate change and Impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

NAPCC-GoI Initiatives.

UNIT-V **[9 Lectures]**

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wildlife 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). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Footprint, Life Cycle assessment (LCA), Low carbon lifestyle.

TEXTBOOKS:

1. Erach Bharucha , Textbook of Environmental Studies for Undergraduate Courses, The Orient Black swan, 2nd edition , 1 January 2015.
2. R. Rajagopalan, Environmental Studies , Oxford UniversityPress,3rd edition, April, 2015

REFERENCE BOOKS:

1. Richard T. Wright, Environmental Science: towards a sustainable future , Benjamin Cummings Pub Co,13th edition, 17 January 2016.
2. Gilbert M. Masters and Wendell P. Ela, Environmental Engineering and science, Pearson, 3rd edition, 15 December 2006.
3. Daniel B. Botkin & Edward A. Keller, Environmental Science , Wiley publishing,8th edition,2012.
4. Anubha Kaushik, Environmental Studies , New age international publishers, 4th Edition, 1 January 2012
5. Dr. M. AnjiReddy, Textbook of Environmental Science and Technology,BS Publications, 31 october 2014.
6. Y. Anjaneyulu , Introduction to Environmental Science , BS.Publications, 1 January 2004

Web links:

1. https://onlinecourses.nptel.ac.in
2. https://archive.nptel.ac.in
3. https://onlinecourses.swayam2.ac.in
4. https://onlinecourses.nptel.ac.in
5. https://onlinecourses.nptel.ac.in

Discrete Mathematics

B.Tech. III Semester **L T P C**

Subject Code: 22AM301PC **3 0 0 3**

Prerequisites: An understanding of Mathematics in general is sufficient.

Course Objectives:

1.To understand and construct precise mathematical proofs.
2.To use logic and set theory to formulate precise statements.
3.To analyze and solve counting problems on finite and discrete structures.
4.To describe methods of counting and able to solve recurrence relations.
5.To apply graph theory in solving computing problems.

Course Outcomes: After completion of this course, the students will be able to:

1.Construct precise mathematical proofs.
2.Use logic and set theory to formulate precise statements.
3.Apply algebraic structures and Boolean algebra.
4.Solve combinatorial counting problems.
5.Apply graph theory in solving computing problems.

UNIT – I **[10 Lectures]**

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 **[10 Lectures]**

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

UNIT – III **[10 Lectures]**

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

UNIT – IV **[9 Lectures]**

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

UNIT - V **[9 Lectures]**

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. J.P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science: McGraw-Hill, 1st ed., 1997
2. Joe l. Mott, Abraham Kandel, Teodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians: Prentis Hall of India, 2nd ed.2008

REFERENCE BOOKS:

1. Ralph.P. Grimald, Pearson education. Discrete and Combinatorial Mathematics - an applied introduction, , 5th edition.2016
2. J. P. Tremblay, R. Manohar, **Discrete Mathematical Structures** with Applications to. Computer Science, **Tata McGraw Hill**, India, 1st Edition,1997.

Web Link- 1) https://onlinecourses.nptel.ac.in/noc20_cs82/preview

2) https://www.javatpoint.com/discrete-mathematics-lattices

Software Engineering

B. Tech. III Semester **L T P C**
Subject Code: 22AM302PC **3 0 0 3**

Prerequisites:
1. Familiarity with at least one computer programming language.

Course Objectives
1. Understanding the end-use requirements.
2. Build system models based on the requirements.
3. Design architectural process.
4. Strategic approach for testing methodologies.
5. Understanding software quality management.

Course Outcomes: After completion of this course, the students will be able to:
1. Apply software development life cycle principles and process models to structure software products.
2. Construct the software requirements specifications with relevant use-cases.
3. Analyze the project management strategies and various components to build the architecture using suitable design strategies.
4. Estimate the best coding standards and testing strategies to develop high quality software products.
5. Design metrics for process and products with the help of risk and quality management.

UNIT – I **[10 Lectures]**

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 **[10 Lectures]**

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 **[10 Lectures]**

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 **[9 Lectures]**

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 **[9 Lectures]**

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

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering, A practitioner's Approach, McGraw Hill International Edition, 6th edition, 2016.
2. Sommerville, Software Engineering, Pearson Education, 7th edition, 2008.

REFERENCE BOOKS:

1. Grady Booch, James Rambaugh, Ivar Jacobson, The unified modeling language user guide, Pearson Education,2004.
2. James F. Peters, Witold Pedrycz, John Wiley, Software Engineering, an Engineering approach,2000.
3. Waman S Jawadekar, Software Engineering principles and practice- The McGraw-HillCompanies,2004.
4. Meiler page-Jones, Fundamentals of object-oriented design using UML: Pearson Education,2007.

Programming with Python

B. Tech. III Semester **L T P C**
Subject Code: 22AM303PC **3 0 0 3**

Prerequisites: Basic knowledge on C Programming.

Course Objectives:

1. Learn Syntax and Semantics in Python.
2. Explore the arrays and strings in Python.
3. Understand Lists, Dictionaries and Regular expressions in Python.
4. Handle Files, Modules, and exceptions in Python.
5. Implement Object Oriented Programming concepts in Python.

Course Outcomes: After completion of this course, the students will be able to:

1. Examine Python syntax and semantics, flow control.
2. Demonstrate proficiency in handling Strings and Arrays.
3. Apply Python Programs using core data structures like Lists, Dictionaries.
4. Conduct experiments on file handling, exception handling, and modules.
5. Interpret the concepts of Object-Oriented Programming as used in Python.

UNIT–I **[10 Lectures]**

Introduction to Python: History, Features, Applications, First Python Program, Variables, Data Types, Numbers, Operators, Input and Output statements.

Control Statements: Conditional Statements, A Word on Indentation, Looping Statements, the else Suite, break, continue, pass, assert, return.

UNIT–II **[10 Lectures]**

Arrays in Python: Arrays, Types of Arrays, Working with Arrays using numpy, Creating Arrays, Operations on Arrays, Attributes of an Array, The reshape () Method, The flatten () Method, Matrices in numpy, Matrix Addition and Multiplication.

Strings and Characters: Creating Strings, Operations on Strings, working with Characters, Sorting Strings, Searching Strings.

UNIT–III **[10 Lectures]**

Functions in Python: Defining a Function, Calling a Function, Parameters, Recursive Functions.

List: Creating Lists using range () Function, Operations on Lists, Methods to Process List, Sorting the List Elements.

Tuple: Creating Tuples, Accessing the Tuple Elements, Operations on Tuple, Functions to Process Tuples.

Dictionaries: Operations on Dictionaries, Dictionary Methods, Sorting the Elements of a Dictionary using Lambdas, Converting Lists in to Dictionary, Converting Strings in to Dictionary, Passing Dictionaries to Functions.

UNIT–IV **[9 Lectures]**

Files in Python: File Objects, File Built-in Function [open ()], File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules, Related Modules.

Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, *Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, *Creating Exceptions, Why Exceptions (Now)?,Why Exceptions at All?, Exceptions and the sys Module, Related Modules.

Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules.

UNIT–V **[9 Lectures]**

OOPS using Python: Classes and Objects, Inheritance and Polymorphism, Abstract Classes and Interfaces.

Regular Expressions: Introduction, Special Symbols and Characters, Re

Python Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules.

TEXT BOOKS

1. Wesley J. Chun, Core Python Programming, Pearson, Second Edition,2006.
2. R.Nageswara Rao, Core Python Programming, Dream Tech Press,2016.

REFERENCE BOOKS:

1. John M Zelle , Mark Lutz, Python Programming Books for Beginner & Advanced Coders, 5th edition**,2014.**

WEB LINK- 1) https://nptel.ac.in/courses/106106145

2) https://www.python.org/about/gettingstarted

Computer Organization and Architecture

B.Tech. III Semester **L T P C**
Subject Code: 22AM304PC **3 0 0 3**

Prerequisites:
1. A Course on "Digital Logic Design and Microprocessors".

Course Objectives:
1. Introduce principles of computer organization and the basic architectural concepts.
2. Explore the basic organization, design, and programming of a simple digital computer.
3. Introduces simple register transfer language to specify various computer operations.
4. Describing memory organization and I/O systems.
5. Introduce pipelining and vector processing.

Course Outcomes: After completion of this course, the students will be able to:
1. Identity of computer organization architecture.
2. Analyze the basics of instruction sets and their functionality.
3. Evaluate arithmetical operations by using data.
4. Demonstrate the functional units of the computer.
5. Design a pipeline for consistent execution of instructions.

UNIT–I **[10 Lectures]**

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

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

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.

UNIT–II **[10 Lectures]**

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instructions, Input – Output and Interrupt. Instruction cycle, Memory Reference **Micro programmed Control**: Control memory, Address sequencing, micro program example, design of control unit.

UNIT–III **[10 Lectures]**

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

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

UNIT–IV **[9 Lectures]**

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

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

UNIT–V **[9 Lectures]**

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, Cache herence.

TEXTBOOKS:

1. M.MorisMano,Computer System Architecture, ThirdEdition, Pearson/PHI,2016.
2. William Stallings, Computer OrganizationandArchitecture,6thed,Pearson/PHI, 2010.

REFERENCEBOOKS:

1. Car Hamacher, ZvonksVranesic, SafeaZaky, Computer Organization, Vth Edition, McGraw Hill, 2002.
2. Andrew S.Tanenbaum, Structured Computer Organization, 4 th Edition, PHI/Pearson,2003.
3. B.Ram, Computer Fundamentals Architecture and Organization, 5th ed.,New Age International Publications, 2000.

WEBLINKS:

1. https://nptel.ac.in/courses/106105163
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://www.udemy.com/topic/computer-architecture/

Operating System

B.Tech. III Semester **L T P C**
Subject Code: 22AM305PC **3 0 0 3**

Prerequisites:
1. A course on "Computer Programming and Data Structures".
2. A course on "Computer Organization".
3. A course on "Linux Programming".

Course Objectives:
1. Introduce the OS concepts and their services.
2. Describe the process and its scheduling algorithms.
3. Understand the deadlock, process communication and management systems.
4. Design the memory management systems.
5. Understand the file system and its operations.

Course Outcomes: After completion of this course, the students will be able to:
1. Demonstrate the basic concepts of Operating Systems.
2. Implement various process scheduling algorithms and deadlock techniques.
3. Examine various process management concepts.
4. Apply memory management strategies and page replacement algorithms.
5. Analyze file management and disk management aspects of operating systems.

UNIT – I **[10 Lectures]**

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 **[10 Lectures]**

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 **[10 Lectures]**

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

Interprocess Communication Mechanisms: IPC between processes on a single computer system,IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

UNIT – IV **[9 Lectures]**

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 **[9 Lectures]**

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

TEXT BOOKS:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne ,"Operating System Principles", John Wiley ,7th Edition,2007.
2. W.R. Stevens ,Advanced programming in the UNIX environment, Pearson education,2014.

REFERENCE BOOKS:

1. William Stallings, Operating Systems- Internals and Design Principles, Pearson Education/PHI, fifth Edition–2005,
2. Crowley, Operating System A Design Approach, TMH,1996.
3. Andrew S. Tanenbaum , Modern Operating Systems, Pearson/PHI, 2nd edition,2014.
4. Kernighan and Pike , UNIX programming environment, PHI/ Pearson Education,2015.

Web Link:

1) https://nptel.ac.in/courses/106102132
2) https://www.javatpoint.com/operating-system

Python Lab

B.Tech. III Semester **L T P C**
Subject Code: 22AM306PC **0 0 3 1.5**

Prerequisites: Basic knowledge on C Programming and students should install Python
Co-requisite: A Course on "Programming with Python".

Course Objectives:

1. To learn basic data types, operators, use of procedural statements like assignments, conditional statements, loops and function calls.
2. To make use of functions and string operations.
3. To work with the data structures like lists, set, dictionaries and tuples in python.
4. To acquire knowledge on object-oriented programming concepts in python.
5. To implement file handling and error handling mechanisms.

Course Outcomes: After completion of this course, the students will be able to:

1. Apply basic Python syntax and control structures.
2. Develop programs using functions and data structures.
3. Implement file handling and exception handling.
4. Apply object-oriented programming concepts.
5. Develop applications using modules, GUI, and scientific libraries.

Week -1:

1. i) Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
   ii) Start the Python interpreter and type help() to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
   i) Write a program to calculate compound interest when principal, rate and number of periods are given.
   ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points
3. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

i) Print the below triangle using for loop.

```
5
4 4
3 3 3
2 2 2 2
1 1 1 1 1
```

ii) Write a program to check whether the given input is digit or lowercase character or upper case character or a special character (use 'if-else-if' ladder)

iii) Python Program to Print the Fibonacci sequence using while loop

iv) Python program to print all prime numbers in a given interval (use break)

Week - 3:

1. i) Write a program to convert a list and tuple into arrays.
   ii)Write a program to find common values between two arrays.
2. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
3. Write a function called palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.

Week - 4:

1. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
2. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.

   i). Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.

   ii). The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add"I", "a", and the empty string.

   iii). Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
   ii) Remove the given word in all the places in a string?
   iii) Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
4. Writes a recursive function that generates all binarystrings of n-bit length

Week - 5:

1. i) Write a python program that defines a matrix and prints
   ii) Write a python program to perform addition of two square matrices
   iii) Write a python program to perform multiplication of two square matrices
2. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
3. Use the structure of exception handling all general purpose exceptions.

Week-6:

1. a. Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
   b. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.
   c. Write a function called draw_point that takes a Canvas and a Point as arguments and draws are presentation of the Point on the Canvas.
   d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw_circle that draws circles on the canvas.
2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.
3. Write a python code to read a phone number and email-id from the user and validate it for correctness.

Week- 7

1. Write a Python code to merge two given file contents into a third file.
2. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
3. Write a Python code to Read text from a text file, find the word with most number of occurrences
4. Write a function that reads a file *file1* and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.
2. Install NumPy package with pip and explore it.
3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
4. Write a program to implement Half Adder, Full Adder, and Parallel Adder
5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

TEXT BOOKS:

1. Wesley J. Chun, Core Python Programming, Second Edition, Pearson, 2006.
2. R. Nageswara Rao Core Python Programming, Dream Tech Press, 2018.
3. 3.Spercharged Python: Take your code to the next level, Overland 4th Edition, 2019.

REFERENCE BOOKS:

1. Vamsi Kurama, Python Programming: A Modern Approach, Pearson, 2017.
2. Sheetal Taneja, Naveen Kumar, Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Pearson, 2017.
3. Michael Dawson, Cengage Learning ,Programming with Python, A User's Book, India Edition.5th Edition 2013
4. W. Chun ,Core Python Programming, Pearson.2nd Edition ,2006.
5. Kenneth A. Lambert, Introduction to Python, Cengage 2nd Edition, 2017
6. Python Programming using problem solving approach, Reema thareja, Oxford University Press, 2019.
7. Dietel and Dietel, Python How to Program, 2002.

WEB LINKS:

1. https://nptel.ac.in/courses/106106145
2. https://onlinecourses.nptel.ac.in/noc20_cs83/preview
3. https://www.udemy.com/topic/python/free/
4. https://www.coursera.org/specializations/python

Software Engineering Lab

B.Tech. III Semester. **L T P C**
Subject Code: 22AM307PC **0 0 2 1**

Prerequisites: A course on Programming for Problem Solving.
Co-requisite : A course on Software Engineering.

Course Objectives:
1. To provide hands on experience in developing a software project.
2. To Design the Software Configuration Management and Risk Management
3. To Measure the high-level design of the system from the software requirements
4. To Develop awareness of testing problems with testing report
5. To Demonstrate the sample project.

Course Outcomes: After completion of this course, student will be able to:
1. Translate end-user requirements into system and software requirements.
2. Design the Software Configuration Management and Risk Management.
3. Measure the high-level design of the system from the software requirements.
4. Develop awareness of testing problems with testing report.
5. Demonstrate the sample project.

List of Experiments
1. Deadlock management,.
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:
a. Passport automation System
b. Book Bank
c. Online Exam Registration
d. Stock Maintenance System
e. Online course reservation system
f. E-ticketing
g. Software Personnel Management System
h. Credit Card Processing
i. E-book management System.
j. Recruitment system

TEXT BOOKS:
1. Roger S. Pressman,,Software Engineering, A practitioner's Approach-, McGraw Hill International Edition 6th edition.2007
2. Sommerville ,Software Engineering, Pearson Education, 7th edition.2008
3. GradyBooch, James Rambaugh, Ivar Jacobson ,The unified modeling language user guide,Pearson Education.1999

REFERENCE BOOKS:

1. James F. Peters, Witold Pedrycz, JohnWiley,Software Engineering, an Engineering approach, 1998.
2. Waman S Jawadekar ,Software Engineering principles and practice, The McGraw-Hill,2004.

Web Link ;1 https://nptel.ac.in/courses/106101061
2 https://www.javatpoint.com/software-engineering

Operating Systems Lab

B. Tech. III Sem **L T P C**
Subject Code: 22AM308PC **0 0 3 1.5**

Prerequisites: A course on Data Structures using C
Co-requisite: A course on Operating Systems.

Course Objectives:

1. To understand design aspects of operating system concepts through simulation.
2. To Introduce basic Unix commands, system call interface for process management.
3. To Develop C programs using Unix system call.
4. To illustrate the following IPC mechanisms
5. To Simulate Page Replacement Algorithms.

Course Outcomes: After completion of this course, student will be able to:

1. Examine different operating system concepts.
2. Develop C programs using UNIX system call.
3. Illustrate the following IPC mechanisms.
4. Simulate Page Replacement Algorithms.
5. Demonstrate Deadlock management.

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/LINUX system calls.
5. Write C programs to illustrate the following IPC mechanisms a) Pipes b) FIFOs c) Message Queues d) Shared Memory.
6. Write C 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. Abraham Silberchatz, Peter B. Galvin, Greg Gagne , John Wiley,Operating System Principles-7th Edition,
2. W.R.Stevens ,Advanced programming in the Unix environment, Pearson education 3rd Edition 2013.

REFERENCE BOOKS:

1. William Stallings, Operating Systems – Internals and Design Principles,Pearson Education/PHI, Fifth Edition–2005.
2. Crowley, Operating System - A Design Approach, TMH. 1996
3. Andrew S Tanenbaum ,Modern Operating Systems, Pearson/PHI, 2nd edition.
4. Kernighan and Pike ,UNIX Programming Environment, PHI/Pearson Education 2016
5. U. Vahalia ,UNIX Operating System: The New Frontiers, Pearson Education 2006

Web Link: 1) https://nptel.ac.in/courses/106108101
2) https://www.nptel.ac.in/courses/106/105/106105214/

Node Js/ React Js/ Django

B.Tech. III Semester **L T P C**
Subject Code: 22AM309PC **0 0 2 1**

Prerequisites:
1. Object Oriented Programming through Java, HTML Basics

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

Course Outcomes: After completion of this course, student will be able to:
1. Implement website with HTML, CSS, and Bootstrap and little JavaScript.
2. Demonstrate Advanced features of JavaScript and learn about JDBC.
3. Develop Server – side implementation using Java technologies.
4. Experiment on server – side implementation using Node JS.
5. 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, callbacks, 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 standalone 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 1 and 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, about pages 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 usingchart.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,new edition, 2010
2. Bryan Basham, KathySierra and Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2ndEdition, 2008.
3. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo,Express, React, and Node, A Press,2nd Edition, 2019.

Constitution of India

B.Tech. III Semester. **L T P C**
Subject Code: 22EN310MC **3 0 0 0**

Prerequisites: None

Course Objectives:
1. Introduction of constitution and it's evolution.
2. To know the fundamentals of Constitution
3. To analyze the fundamental rights and duties of Indian constitution
4. To know the governance of government and administration
5. To appraise the role organs of government.

Course Outcomes: After Completion of this course, the students will be able to:
1. Outline the evolution of Constitution.
2. Relate constitutional fundamentals with the present Era.
3. Analyze Liberalism, Federalism and Socialism.
4. Infer the knowledge of Administration and Governance.
5. Appraise and address the role of governments.

UNIT-1 **[5 Lectures]**
History of Making of the Indian Constitution-History of Drafting Committee.

UNIT- 2 **[5 Lectures]**
Philosophy of the Indian Constitution-Preamble Salient Features

UNIT- 3 **[3 Lectures]**
Contours of Constitutional Rights & Duties-Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties

.

UNIT-4 **[6 Lectures]**
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications , Powers and Functions

UNIT -5 **[6 Lectures]**

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grassroot democracy, Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:

1. Dr. M.V. Pylee India's Constitution, 16th Edition, S. Chand 2016.
2. Dr. S. N.Busi, Dr.B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P.Jain, Indian Constitutional Law, 7th Edn., Lexis Nexis, 2018.
4. D.D. Basu, Introduction to the Constitution of India, 23rd Edn Lexis Nexis, 2018.

Web Links:

1. https://youtu.be/4tI4QXhzqNU
2. https://youtu.be/TXhSrKJ1ahk

Automata Theory and Compiler Design

B.Tech. IV Semester. **L T P C**
Subject Code: 22AM401PC **3 0 0 3**

Prerequisites:
1. A course on Computer Organization

Course Objectives:
1. To introduce the fundamental concepts of formal languages, grammars and automata theory.
2. To understand about deterministic and non-deterministic machines.
3. To introduce the major concepts of language translation and compiler design.
4. To study the phases of compiler.
5. To learn skills in using lexical tool and design LR parsers.

Course Outcomes: After completion of this course, student will be able to:
1. Describe the fundamental concepts of abstract machines and their formal languages.
2. Design the finite state machines using regular expressions.
3. Demonstrate PDA and Turing Machines.
4. Apply lexical and syntax analysis techniques.
5. Develop intermediate code and runtime environments.

[10 Lectures]

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 Є-transitions to NFA without Є-transitions. Conversion of NFA to DFA

UNIT – II **[10 Lectures]**

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 **[10 Lectures]**

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA 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 **[9 Lectures]**

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 **[9 Lectures]**

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. John E. Hopcroft,Rajeev Motwani, Jeffrey D. Ullman,Introduction to Automata Theory, Languages, and Computation, Pearson Education,3nd Edition. 1939.
2. Mishra andChandrashekaran,Theory of Computer Science – Automata languages and computation, PHI,2nd Edition.2007.

REFERENCE BOOKS:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D, Ullman,,Compilers: Principles, Techniques and Tools, , Pearson,2nd Edition,1996.
2. Kamala Krithivasan,Rama R ,Introduction to Formal languages Automata Theory and Computation, Pearson, 2019.
3. John C Martin ,Introduction to Languages and The Theoryof Computation, TMH,2004.
4. John R. Levine, TonyMason, Doug Brown,lex & yacc –O'reilly,Compiler Construction, Course Technology.2020

Web Links:

1) https://www.javatpoint.com/automata-tutorial
2) https://nptel.ac.in/courses/106105196

Database Management Systems

B.Tech. IV Semester **L T P C**
Subject Code: 22AM402PC **3 0 0 3**

Prerequisites: Familiarity with data structures, elementary set theory, relations and functions.

Course Objectives:

1. Understand the basic concepts and the applications of database systems.
2. Introducing relational databases.
3. Basics of SQL and construct queries using SQL.
4. Topics include transaction control and concurrency control.
5. Understand storage structures and access techniques.

Course Outcomes: After completion of this course, the students will be able to:

1. Analyze the logical design concepts of the database.
2. Describe the physical model of a database and its operations.
3. Apply the knowledge of SQL to construct the queries for efficient data access and manipulation.
4. Implement transaction processing and concurrency control.
5. Examine different indexing mechanisms and database storage access.

UNIT – I **[10 Lectures]**

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 **[10 Lectures]**

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

Relational Algebra, Tuple relational Calculus, Domain relational calculus.

UNIT – III **[10 Lectures]**

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 databases.

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, First, Second, Third normal forms, BCNF, lossless join decomposition, multivalued dependencies, Fourth normal form, Fifth normal form.

UNIT – IV **[9 Lectures]**

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 **[9 Lectures]**

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Comparison of File Organizations, Indexes- Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM),

B+ Trees: A Dynamic Index Structure.

TEXT BOOKS:

1. Silberschatz, Korth , Database System Concepts, McGraw hill, 3rd Edition, V edition.
2. Raghurama Krishnan, Johannes Gehrke , Database Management Systems,Tata Mc Graw Hill. 3rd Edition 2002.

REFERENCE BOOKS:

1. Peter Rob & Carlos Coronel, Database Systems design, Implementation, and Management, 7thEdition.
2. Elmasri Navrate, Fundamentals of Database Systems, Pearson Education 2017
3. C. J. Date,Introduction to Database Systems, Pearson Education 2003
4. The X Team, S.Shah and V. Shah ,Oracle for Professionals, SPD. 2022
5. Shah,Database Systems Using Oracle: A Simplified guide to SQLand PL/SQL, PHI.2004
6. M. L. Gillenson, Fundamentals of Database Management Systems, Wiley Student Edition.4th Edition 2005

WEB LINKS:

1. https://nptel.ac.in/courses/106105175
2. https://onlinecourses.nptel.ac.in/noc21_cs04/preview
3. https://onlinecourses.nptel.ac.in/noc22_cs91/preview
4. https://www.mygreatlearning.com/database-management-system/free-courses
5. https://www.coursera.org/learn/database-management
6. https://www.coursera.org/learn/sql-practical-introduction-for-querying-databases

Mathematical and Statistical Foundations

B.Tech. IV Semester **L T P C**
Subject Code: 22MA403BS **3 0 0 3**

Pre-requisites: Mathematical Courses of first year of study
Course Objectives: To learn

1. The concept of Probability and Random variables
2. The Probability distributions of discrete and continuous random variables
3. Sampling Distribution.
4. Estimation, linear Regression and correlation
5. Tests of Hypothesis

Course outcomes: After completion of this course, the student will be able to:

1. Apply the concepts of probability and Random variables.
2. Analyze the concept of Probability distributions to some case studies.
3. Formulate and solve problems by apply statistical methods for analyzing experimental data.
4. Demonstrate the concept of estimation and distinguish regression analysis and to compute and interpret the coefficient of correlation.
5. Examine the given statistical hypothesis.

UNIT - I: Probability and Random Variable [10 Lectures]

Review of Probability, Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions. Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear Combinations of Random Variables

UNIT-II : Discrete and Continuous Distributions [10 Lectures]

Discrete Probability Distributions: Binomial Distribution, Poisson distribution. Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial Distributions.

UNIT-III: Sampling Distribution [10 Lectures]

Fundamentals of Sampling Distributions: Random Sampling, Some Important Statistics, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, t - Distribution, F- Distribution and Chi-square Distribution.

UNIT-IV: Estimation , Simple Linear Regression and Correlation [9 Lectures]

Estimation: Point and interval estimations, criteria of good estimator, estimations for means and properties.

Simple Linear Regression and Correlation: Introduction of linear regression, The simple Linear Regression Model, Least squares and fitted model, Inferences concerning the regression coefficients, Prediction, Simple Linear regression case study.

UNIT-V: Tests of Hypothesis [9 Lectures]

Statistical Hypothesis: General Concepts, Testing a Statistical Hypothesis, Single sample: Tests concerning a single mean, Two samples: tests on two means, One sample: test on a single proportion. Two samples: tests on two proportions.

Small Sample tests: Student-t-test for single mean, difference of means and F-test for equality of two variances , Chi-Square test for goodness of fit and independence of attributes.

TEXT BOOKS:

1. Dr.T.K.V. Iyengar, B.Krishna Gandhi, S. RanganathamandDr.M.V.S.S.N.Prasad, Probability and statistics , S.Chand, EigthRevisesed edition ,2020.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, S.Chand publications, 12th revised edition ,2020 .
3. S.D.Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut, Delhi,2014.

REFERENCE BOOKS:

1. Sheldon M Ross, Probabilityand statistics for Engineers and scientists, 6th edition, academic press, 2020.
2. Miller and Freund's, Probabilityand Statistics for Engineers, 8th Edition, Pearson Educations, 2015.

WEBLINKS:

1. https://youtu.be/r1s
2. https://youtu.be/enDYkFxJE9W
3. https://youtu.be/VVYLpmKRfQ8

Introduction to Artificial Intelligence

B.Tech. IV Semester **L T P C**
Subject Code: 22AM404PC **3 0 0 3**

Prerequisites:

1. A course on "Computer Programming and Data Structures"
2. A course on "Advanced Data Structures"
3. A course on "Design and Analysis of Algorithms"
4. A course on "Mathematical Foundations of Computer Science"
5. Some background in linear algebra, data structures and algorithms, and probability will all be helpful.

Course Objectives:

1. To learn the distinction between optimal reasoning Vs. human-like reasoning.
2. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
3. To learn different knowledge representation techniques.
4. To understand the applications of AI, namely game playing, theorem proving, and Machine learning.
5. To understand uncertainty learning.

Course Outcomes: After completion of this course, student will be able to:

1. Formulate an efficient problem space for a problem expressed in natural language
2. Select a search algorithm for a problem and estimate its time and space complexities.
3. Representing knowledge using the appropriate technique for a given problem.
4. Apply AI techniques to solve problems of game playing and machine learning.
5. Act on uncertain problem solving.

UNIT – I **[10 Lectures]**

Introduction to AI- Intelligent Agents, Problem-Solving Agents,
Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

UNIT – II **[10 Lectures]**

Games - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic- Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

UNIT-III **[10 Lectures]**

First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.
Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

UNIT-IV **[9 Lectures]**

Planning - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

UNIT-V **[9 Lectures]**

Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient

Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

TEXT BOOK:

1. Stuart Russell and Peter Norvig ,Artificial Intelligence: A Modern Approach, Pearson Education, Third Edition, 2010.

REFERENCE BOOKS:

1. E. Rich and K. Knight (TMH), Artificial Intelligence, 3rd Edition, 2010
2. Patrick Henny Winston, Artificial Intelligence, Pearson Education, 3rd Edn.2010 Shivani Goel , Artificial Intelligence, Pearson Education,2013
   Patterson , Artificial Intelligence and Expert systems , Pearson Education,2010

Web Links:

1) https://onlinecourses.nptel.ac.in/noc22_cs56/preview
2) https://www.javatpoint.com/artificial-intelligence-ai

Object Oriented Programming Through Java

B.Tech. IV Semester **L T P C**
Subject Code: 22AM405PC **3 0 0 3**

Prerequisites: Basic knowledge on C Programming.

Course Objectives:

1. To introduce the object-oriented programming concepts.
2. To introduce the implementation of packages and interfaces
3. To introduce the concepts of exception handling and multithreading.
4. To introduce the concepts of collection framework.
5. To introduce the design of Graphical User Interface using applets and swing controls.

Course Outcomes: After completion of this course, the students will be able to:

1. Solve real world problems using OOP techniques.
2. Apply the packages and interfaces, streams in I/O.
3. Examine development of exceptions, multithreaded applications with synchronization.
4. Analyze the usage of collection framework.
5. Design GUI based applications using applets and swings.

UNIT–I **[10 Lectures]**

Object-Oriented Thinking-Away of viewing world–Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling.

Inheritance– Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, Polymorphism-ad hoc polymorphism, pure polymorphism, method overriding, abstract classes, Object class, forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.

UNIT–II **[10 Lectures]**

Packages- Defining a Package, CLASSPATH, Access protection, importing packages. Interfaces- defining an interface, implementing interfaces, Nested interfaces, applying interfaces, variables in interfaces and extending interfaces.

Stream based I/O (java.io)–The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing,generics.

UNIT–III **[10 Lectures]**

Exception handling - Fundamentals of exception handling, Exception types, Termination or resumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception sub classes.

Multi threading- Differences between thread-based multitasking and process-based multi tasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT–IV **[9 Lectures]**

The Collections Framework (java.util)- Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hash table ,Properties, Stack, Vector More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner

UNIT–V **[9 Lectures]**

GUI Programming with Swing – Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.

Event Handling- The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes.

A Simple Swing Application, Applets – Applets and HTML, Security Issues, Applets and Applications, passing parameters to applets. Creating a Swing Applet, Painting in Swing, A Paint example, Exploring Swing Controls – Jlabel and Image Icon, JTextField.

The Swing Buttons- JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JCombo Box, Swing Menus, Dialogs.

TEXT BOOKS:

1. Herbert Schildt, Java The complete reference, 9thedition, McGraw Hill Education (India) Pvt. Ltd, 2014.
2. T. Budd, Understanding Object-Oriented Programming with Java, updated edition, Pearson Education, 2000.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch, An Introduction to programming and OO design using Java, John Wiley & sons, 2007.
2. Y.Daniel Liang, Introduction to Java programming, Pearson Education, 1998.
3. P. Radha Krishna, Object Oriented Programming through Java, University Press, 2007.
4. S. Malhotra, S. Chudhary, Programming in Java, 2nd edition, Oxford University Press, 2018.
5. R. A. Johnson, An Introduction to Java Programming and Object-oriented Application Development, Cengage Learning, 2012.

WEB LINKS:

1. https://nptel.ac.in/courses/106105191
2. https://www.coursera.org/specializations/object-oriented-programming
3. https://www.upgrad.com/blog/java-free-online-course/
4. https://www.edx.org/course/java-programming-fundamentals
5. https://education.oracle.com/java/java/pFamily_48

Database Management Systems Lab

B.Tech. IV Semester **L T P C**
Subject Code: 22AM406PC **0 0 2 1**

Prerequisites:
1. Familiarity with data structures, elementary set theory, relations and functions.
2. Students should install MySql.

Co-requisites: Course on "Database Management Systems".

Course Objectives:
1. To Introduce ER data model, database design and normalization.
2. To Learn SQL basics for data definition and data manipulation.
3. To introduce various procedures in SQL.
4. To practice different triggers in SQL.
5. To introduce cursors in SQL.

Course Outcomes: After completion of this course, the students will be able to:
1. Demonstrate the database design using ER Diagrams.
2. Develop SQL Queries to manipulate the data in the database.
3. Apply Procedural Language constructs to execute a block of SQL statements.
4. Design various triggers for different data using SQL.
5. Implement cursors using SQL.

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

TEXT BOOKS:
1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, Tata Mc Graw Hill,3rd Edition, 2003.
2. Silberschatz, Korth, Database System Concepts, McGraw Hill, V edition,2019

REFERENCE BOOKS:
1. Peter Rob & Carlos Coronel, Database Systems design, Implementation, and Management, 7th Edition, 2007.
2. Elmasri Navrate, Fundamentals of Database Systems, , Pearson Education,2010.
3. C.J. Date, Introduction to Database Systems, Pearson Education,2003
4. The X Team, S. Shah and V. Shah , SPD ,Oracle for Professionals, 2008.
5. Shah, Database Systems Using Oracle: A Simplified guide to SQLand PL/SQL, PHI new edition 2001.
6. M. L. Gillenson, Fundamentals of Database Management Systems, WileySecond Edition, 2011.

WEB LINKS:

1. https://nptel.ac.in/courses/106105175
2. https://onlinecourses.nptel.ac.in/noc21_cs04/preview
3. https://onlinecourses.nptel.ac.in/noc22_cs91/preview
4. https://www.visualpathedu.com/home/course/oracle-database-development/113
5. https://www.mygreatlearning.com/database-management-system/free-courses
6. https://www.coursera.org/learn/database-management
7. https://www.coursera.org/learn/sql-practical-introduction-for-querying-databases

Java Programming Lab

B.Tech. IV Sem.	L	T	P	C
Subject Code: 22AM407PC	0	0	2	1

Prerequisites: Basic knowledge on C Programming.

Co-requisite: A Course on "OOPS Through Java".

Course Objectives:

1. To impart hands on experience with java programming.
2. To understand Object Oriented Concepts in Java.
3. To learn exception handling in Java.
4. To understand multithreading makes java robust.
5. To write GUI programs using swing controls in Java.

Course Outcomes: After completion of this course, the students will be able to:

1. Execute programs for solving real-world problems using java collection framework.
2. Develop the standalone applications for Multi-Threaded and Exception Handling.
3. Apply OOP in Java Programming in problem solving.
4. Design Java applets and applications.
5. Implement GUI programs using swing controls in Java.

Note:

1. Use LINUX and MySQL for the Lab Experiments. Though not mandatory, encourage the use of 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 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, andclasses. 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 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 such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
3. Write a Java program that implements Bubble sort algorithm for sorting in descending order and also shows the number of interchanges occurred for the given set of integers.
4. Write a Java program that implements Quick sort algorithm for sorting a list of names in ascending order
5. 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.
6. Write a Java program to list all the files in a directory including the files present in all its subdirectories.

7. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.
8. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
9. Write a Java program that correctly implements the producer – consumer problem using the concept of inter thread communication.
10. 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.
11. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
12. Write a Java program that simulates a traffic light. The program lets the users elect 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 selected color. Initially, there is no message shown.
13. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).
14. 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 are cord are separated by at ab(\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).
15. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout.

TEXT BOOKS:

1. Herbert Schildt, Java The complete reference, 9thedition, McGraw Hill Education (India) Pvt. Ltd, 2014.
2. T. Budd, Understanding Object-Oriented Programming with Java, updated edition, Pearson Education, 2000.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch, An Introduction to programming and OO design using Java, John Wiley & sons, 2007.
2. Y. Daniel Liang, Introduction to Java programming, Pearson Education, 1998.
3. S. Malhotra, S. Chudhary, Programming in Java, 2nd edition, Oxford University Press, 2018.
4. R. A. Johnson, An Introduction to Java Programming and Object-oriented Application Development, Cengage Learning, 2012.

WEB LINKS:

1. https://nptel.ac.in/courses/106105191
2. https://www.coursera.org/specializations/object-oriented-programming
3. https://www.upgrad.com/blog/java-free-online-course/
4. https://www.edx.org/course/java-programming-fundamentals
5. https://education.oracle.com/java/java/pFamily_48

Gender Sensitization Lab

B.Tech. IV Semester **L T P C**
Subject Code: 22EN408MC **0 0 2 1**

Course Objectives:

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To introduce students to information about some key biological aspects of genders.
3. To expose the students to debates on the politics and economics of work.
4. To help students reflect critically on gender violence.
5. To expose students to more egalitarian interactions between men and women

Course Outcomes: After completion of this course the student will be able to :

1. List the important issues related to gender in contemporary India.
2. Describe a finer grasp of how gender discrimination works in our society and how to counter it.
3. Demonstrate the gendered division of labour and its relation to politics and economics.
4. Identify various forms of gender-based violence and understand legal and social responses.
5. Develop a sense of appreciation of women in all walks of life.

UNIT-I: UNDERSTANDING GENDER [4 Lectures]

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 [4 Lectures]

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: GENDER AND LABOUR [4 Letures]

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.

UNIT – IV: GENDER - BASED VIOLENCE [4 Lectures]

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu". Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

UNIT-V: GENDER AND CULTURE [4 Lectures]

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks The Brave Heart

TEXT BOOKS:

Writers: A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu
Published by: Telugu Academy, Telangana Government
Year: 2015

REFERENCE BOOKS:

1. Dr Rajpal Singh, Dr Anupama Sihag, Gender Sensization: Issues and Challenges, Raj Publications 2019.

WEB LINKS:

1. http://ncw.nic.in/sites/default/files/Booklet-%20Gender%20Sensitization_0.pdf
2. http://gmmrcg.in/Content/284_464_7.1.1%20weblink%20annual%20gender%20sensitization%20action%20plan.pdf

Prolog/ Lisp/ Pyswip

B.Tech. IV Semester **L T P C**
Subject Code: 22AM409PC **0 0 2 1**

Prerequisites:

1. A Course on Basic knowledge in English communication

Course Objectives:

1. To help students in learning prolog/lisp
2. To help students to make critical decision.
3. To develop Skills awareness of how to work with and negotiate with people.
4. To resolve stress and conflict in ourselves and others
5. To help students reflect knowledge of Artificial Intelligence.

Course Outcome: After completion of this course, student will be able to:

1. Develop the program in Prolog/Lisp/PYSWIP.
2. Demonstrate Real time application.
3. Solve Real time problems.
4. Experiment program using functions.
5. Analyze the prolog predicate.

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 traveling 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.

   -- 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 the predicate addLeaf(Tree, X, NewTree) which is true if NewTree is the Tree producedby adding the item X in a leaf node. Tree and NewTree are binary search trees. The empty treeis represented by the atom nil.
10. Write a Prolog predicate, countLists(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.

11. Define a predicate mem Count(AList,Blist,Count) that is true if A list 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.
12. Examples: memCount(a,b,a],N).
    N = 1 ;
    no
    memCount(a,[b,[a,a,[a],],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 2015.

Web Links:

1. https://onlincourses.nptel.ac.in/noc20_hs16/preview.

DESIGN AND ANALYSIS OF ALGORITHMS

B. Tech. V Semester **L T P C**
Subject code: 22AM501PC **3 1 0 4**

Prerequisites:

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

Course Objectives:

1. To analyze performance of algorithms.
2. To choose the divide and conquer, greedy algorithms design method for a specified application.
3. To understand how the choice of data structures and algorithm design methods impacts the performance of programs using dynamic programming strategies.
4. To solve problems using algorithm design methods such as backtracking and branch and bound.
5. To introduce P and NP classes.

Course Outcomes: After completion of this course, the students will be able to:

1. Analyzing the algorithm with space and time.
2. Design the algorithm using the divide and conquer greedy approach.
3. Implement dynamic programming strategy.
4. Apply the backtracking technique and branch and bound.
5. Construct the algorithm using the non-deterministic algorithm.

UNIT – I **[10 Lectures]**

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 **[10 Lectures]**

Disjoint Sets: Disjoint set operations, union and find algorithms, Priority Queue- Heaps, Heapsort **Backtracking:** General method, applications, n-queen's problem, sum of subsets problem, graph Coloring, hamiltonian cycles.

UNIT – III **[10 Lectures]**

Dynamic Programming: General method, applications- All pairs shortest path problem, Single source shortest path problem, Optimal binary search tree, 0/1 knapsack problem, Traveling salesperson problem, Reliability design.

UNIT – IV **[9 Lectures]**

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

Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs, Connected components, Biconnected components.

UNIT – V **[9 Lectures]**

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

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

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni and S. Raja sekharan, Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2012.
2. P. H. Dave, H.B .Dave, Design and Analysis of Algorithms,2nd edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. M.T. Good rich and R. Tomassia, Algorithm Design: Foundations, Analysis and Internet examples, John Wiley and sons, 2001.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford Univ.Press,2014.
3. Aho, Ullman and Hop croft, Design and Analysis of algorithms, Pearson Education, 1st Edition, 2002.
4. R. Neapolitan and K.Naimipour, Foundations of Algorithms,4thedition,JonesAndBartlett India Private Limited, 2010.
5. T. H. Cormen, C. E.Leiserson, R. L. Rivest, and Stein, Introduction to Algorithms, 3rd Edition, PHI, 2010.

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2. https://www.coursera.org/learn/analysis-of-algorithms
3. https://www.udemy.com/course/design-and-analysis-of-algorithms/
4. https://www.classcentral.com/course/youtube-design-and-analysis-of-algorithms-daa-46806

MACHINE LEARNING

B.Tech. V Semester **L T P C**
Subject code: 22AM502PC **3 0 0 3**

Prerequisites

1. Knowledge of Data Mining, AI.
2. Knowledge of statistical methods.

Course Objectives

1. To introduce the basic concepts of Machine Learning techniques, hypothesis, and version spaces.
2. To learn machine learning problems for different applications.
3. To Understand the concept of Decision Tree and Ensemble Learning.
4. To gain knowledge on evolutionary computing algorithms for real-world problems.
5. To explore Reinforcement and Bayesian Learning techniques.

Course Outcomes: After completion of this course, the students will be able to:

1. Distinguish between supervised, unsupervised, and semi-supervised learning techniques.
2. Evaluate the performance and accuracy of various machine learning algorithms.
3. Build classifiers and design ensemble methods to increase classification accuracy.
4. Implement evolutionary computing algorithms for real-world problems.
5. Analyze Reinforcement Learning and Bayesian Networks.

UNIT – I **[10 Lectures]**

Introduction: 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 Discriminates, Perceptron, Linear Separability, Linear Regression.

UNIT – II **[10 Lectures]**

Multi-layer Perceptron: Going Forwards, Going Backwards, Back Propagation Error, Multi-layer Perceptron in Practice, Examples of using the MLP, Deriving Back-Propagation. **Radial Basis Functions and Splines:** Concepts, RBF Network, Curse of Dimensionality, Interpolations and Basis Functions, Support Vector Machine.

UNIT – III **[10 Lectures]**

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 Algorithm.

UNIT - IV **[9 Lectures]**

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 **[9 Lectures]**

Reinforcement Learning: Overview of reinforcement learning, 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.

TEXT BOOKS:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition, Chapman andall/CRC Machine Learning and Pattern Recognition Series, 2014.

REFERENCE BOOKS:

1. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖,First Edition, Cambridge University Press, 2012.
3. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals, First Edition, Wiley,2014
4. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and MachineLearning Series), Third Edition, MIT Press, 2014

WEB LINKS:

1. https://www.udemy.com/course/machine-learning-foundation-with-practical-approaches/
2. https://mll.iiit.ac.in/
3. https://onlinecourses.nptel.ac.in/noc23_ee87/preview

COMPUTER NETWORKS

B.Tech. V Semester **L T P C**

Subject code: 22AM503PC **3 0 0 3**

Prerequisites:

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

Course Objectives:

1. To learn about the functionalities of layered models.
2. To gain knowledge about sliding window protocols and medium access sub layer.
3. To design a routing algorithm in a network.
4. To know the services of the transport layer.
5. To explore the knowledge of computer network applications.

Course Outcomes: After completion of this course, the students will be able to:

1. Enumerate the basic concepts of reference models.
2. Apply sliding window protocols and multiple access protocols.
3. Design the routing algorithms, congestion control techniques.
4. Analyze TCP and UDP protocols and services of the Transport Layer.
5. Implement different protocols at the application layer.

UNIT– I **[10 Lectures]**

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

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

Datalink layer: Design issues, framing, Error detection and correction.

UNIT– II **[10 Lectures]**

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

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

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

UNIT– III **[10 Lectures]**

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance vector routing, Link state routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

UNIT– IV **[9 Lectures]**

Transport Layer: Transport Services; Elements of Transport Protocols-Addressing, Connection management, Error control and Flow control, Multiplexing; The Internet Transport Protocol: UDP, TCP, Performance Issues – Problems, Measurements, Host Design.

UNIT– V **[9 Lectures]**

Application Layer: Domain Name System-DNS Name Space, Domain Resource Records, Name Servers; Electronic Mail-Architecture, User Agent, Message Formats, Message Transfer; SNMP; The World Wide Web- Architecture, HTTP; Streaming audio and video – Digital audio, Digital video, Streaming stored media, Streaming live media, Real-time conference.

TEXT BOOKS:

1. Andrew S Tanenbaum, David. j. Wetherall, Computer Networks, 5thEdition, Pearson Education/ PHI, 2011.
2. Behrouz A. Forouzan -Data Communications and Networking, 4th Edition, Tata McGraw Hill, 2006.

REFERENCE BOOKS:

1. S.Keshav,An Engineering Approach to Computer Networks, Addison Wesley, 1st edition, 2010.
2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 5th Edition, Elsevier, 2010.
3. Alberto Leon-Garcia and Indra Widjaja: Communication Networks -Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw-Hill, 2004.

WEB LINKS:

1. https://nptel.ac.in/courses/106105183
2. https://www.coursera.org/learn/illinois-tech-computer-networking
3. https://www.udemy.com/course/computer-networks-fundamentals/
4. https://www.classcentral.com/course/youtube-computer-networks-complete-playlist-46807
5. https://www.geeksforgeeks.org/computer-network-tutorials/
6. https://www.mygreatlearning.com/academy/learn-for-free/courses/basics-of-computer-networking
7. https://www.nesoacademy.org/ec/03-computer-networks

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.Tech. V Semester **L T P C**

Subject code: 22MB504HS **3 0 0 3**

Course Objective:

1. Understand the basic Business types, the impact of the Economy Businesses and Firms specifically.
2. Learn the market demand and supply.
3. Gain knowledge of the production theories and cost analysis while dealing with the concept of BEA.
4. Analyze the Business from the Financial Perspective.
5. Interpret the performance of the business with the help of ratios.

Course Outcome: After completion of this course, the students will be able to:

1. Describe the various forms of business and Economics.
2. Examine the demand and supply analysis.
3. Explore the usage of pricing strategies in PLC.
4. Analyze the financial accounts of a firm or company.
5. Demonstrate the financial performance of a business using ratio analysis techniques.

UNIT – I [10 Lectures]

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, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II [10 Lectures]

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 in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT – III [10 Lectures]

Production, Cost, Market Structures & Pricing:

Production Analysis: Factors of Production, Production Function, Production Function with one variable 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, Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT – IV **[9 Lectures]**

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Postingto Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT – V **[9 Lectures]**

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 Book House Pvt. Ltd., 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGrawHill, 2011.
3. Geethika Ghosh,Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, TataMcGraw Hill Education Pvt. Ltd., 2012.

REFERENCEBOOKS:

1. Paresh Shah,Financial Accounting for Management 2e,OxfordPress, 2015.
2. S.N.Maheshwari, Sunil KMaheshwari, Sharad K Maheshwari, FinancialAccounting, 5e, Vikas Publications, 2013.

WEB LINKS:

1. https://nptel.ac.in/courses/110101005
2. https://www.coursera.org/specializations/managerial-economics-business-analysis
3. https://www.udemy.com/course/engineering-economics-take-decision-between-alternatives/
4. https://www.classcentral.com/course/youtube-mefa-managerial-economics-financial- analysis-91420
5. https://www.emerald.com/insight/publication/issn/1569-3759

GRAPH THEORY (Professional Elective – I)

B. Tech. V Semester **L T P C**
Subject code: 22AM511PE **3 0 0 3**

Prerequisites:

1. A course on "Discrete Mathematics"

Course Objectives:

1. To introduce graphs, their properties and their applications as models of networks.
2. To understand the core theorems and algorithms to find the shortest paths.
3. To learn Trees algorithms and different types of Graphs.
4. To describe independent sets and matching algorithms in graphs.
5. To explore vertex coloring in Graphs.

Course Outcomes: After completion of this course, the students will be able to:

1. Implement classes of graph theoretic problems.
2. Apply some basic algorithms for graphs to find the shortest paths.
3. Prove central theorems about trees, matching, connectivity, coloring and planar graphs.
4. Develop independent sets and matching algorithms for graphs.
5. Formulate and prove central theorems about coloringand planar graphs.

UNIT – I **[10 Lectures]**

Introduction: Graphs, Subgraphs, Isomorphic graphs, Matrix representations of graphs, Degree of a vertex, directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs, Eulerian digraphs, Hamilton digraphs, Special graphs, Complements, Larger graphs from smaller graphs, union, Sum, Cartesian Product, Composition, Graphic sequences, Graph theoretic model of the LAN problem, Havel-Hakimi criterion, Realization of a graphic sequence.

UNIT – II **[10 Lectures]**

Connected graphs and shortest paths: Walks, trails, paths, cycles, Connected graphs, Distance, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs and shortest paths, Weighted graphs, Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm.

UNIT – III **[10 Lectures]**

Trees: Definitions and characterizations, Number of trees, Cayley's formula, Kirchoff- matrix-tree theorem, Minimum spanning trees, Kruskal's algorithm, Prim's algorithm, Special classes of graphs, Bipartite Graphs, Line Graphs, Chordal Graphs, Eulerian Graphs, Fleury's algorithm, Chinese Postman problem, Hamilton Graphs, Necessary conditions and sufficient conditions.

UNIT – IV **[9 Lectures]**

Independent sets coverings and matchings: Introduction, Independent sets and coverings: basic equations, Matchings in bipartite graphs, Hall's Theorem, Konig's Theorem, Perfect matchings in graphs, Greedy and approximation algorithms.

UNIT – V **[9 Lectures]**

Vertex Colorings- Basic definitions**,** Cliques and chromatic number, Mycielski's theorem, Greedy coloring algorithm, Coloring of chordal graphs, Brooks theorem, Edge Colorings, Introduction and Basics, Gupta-Vizing theorem, Class-1 and Class-2 graphs, Edge-coloring of bipartite graphs, Class-2 graphs, Hajos union and Class-2 graphs, A scheduling problem and equitable edge-coloring.

TEXTBOOKS:

1. J. A. Bondy, U. S. R. Murty, Graph Theory, volume 244 of Graduate Texts in Mathematics, Springer, 1st edition, 2008.
2. J. A. Bondy, U. S. R. Murty, Graph Theory with Applications, Elsevier Science Ltd/North- Holland, 1984.

REFERENCEBOOKS:

1. Douglas Brent West, Introduction to Graph Theory, Pearson College Div,Subsequent edition, 2000.
2. V.Balakrishnan, Schaum's Outline of Graph Theory: Including Hundreds of Solved Problems, McGraw Hill, 1st edition, 1997.
3. RobinJ.Wilson, Introduction to Graph Theory, Pearson Education Limited, 5th edition, 2010.
4. Deo, Graph theory withapplications to engineering & computer science, prentice hall india, new edition, 1979.
5. Robin J.Wilson, John J.Watkins, Graphs:An Introductory Approach—A First Course in Discrete Mathematics, Wiley, 1st edition, 1990.

WEB LINKS:

1. https://nptel.ac.in/courses/111106102
2. https://www.coursera.org/learn/graphs
3. https://www.udemy.com/course/graph-theory/
4. https://freecomputerbooks.com/compscGraphTheoryBooks.html
5. https://link.springer.com/book/10.1007/978-3-662-53622-3

INTRODUCTION TO DATA SCIENCE (Professional Elective – I)

B. Tech. V Semester **L T P C**
Subject code: 22AM512PE **3 0 0 3**

Prerequisites:

1. A Course on "Mathematical and Statistical Foundations".
2. A Course on " Data Structures."

Course Objectives:

1. To Learn concepts, techniques and tools deal with various facets of data science practice, including data collection and integration
2. To understand the basic types of data and basic statistics
3. To demonstrate the use of vectors, matrices, factors, Data frames and Lists
4. To learn about iterative programming in R
5. To identify the importance of data visualization techniques

Course Outcomes: After the completion of this course, the student will able to:

1. Discuss a flow process for data science problems.
2. Identify types of data and basic Statistical Description.
3. Create vectors, matrices and list using R.
4. Develop R codes using iterative programming.
5. Correlate results to the solution approach.

UNIT- I **[10 Lectures]**

Introduction: Definition of Data Science, Big Data and Data Science hype, Data fication, 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 **[10 Lectures]**

Types of Data: Attribute, Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attributes, 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 Interquartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

UNIT- III **[10 Lectures]**

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, Introduction 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 **[9 Lectures]**

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 Functions in R.

UNIT- V **[9 Lectures]**

Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations And Drawing on a Subplot, Saving Plots to File, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

Regression: Linear Regression Analysis, Multiple Linear regression

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly,2014.
2. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques,3rd ed. The Morgan Kaufmann Series in Data Management Systems.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch,Pearson Eduation.
3. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
4. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
5. Paul Teetor, "R Cookbook", O'Reilly, 2011.

WEBLINKS:

1. https://www.geeksforgeeks.org/introduction-to-data-science/
2. https://onlinecourses.nptel.ac.in/noc24_cs54/preview

WEB PROGRAMMING (Professional Elective – I)

B.Tech. V Semester **L T P C**

Subject code: 22AM513PE **3 0 0 3**

Prerequisites:

1. A Course on "Object Oriented Programming through Java".

Course Objectives:

1. To learn the concepts of HTML, XML for creating web pages.
2. To learn about client side scripting using java script
3. To design webpages using AngularJS and ReactJS
4. To introduce server side programming with servlets
5. To learn about server side programming using JSP

Course Outcomes: After the completion of this course, the student will able to:

1. Design web pages using HTML & XML.
2. Apply client side scripting using java script.
3. Design webpages using AngularJS and ReactJS.
4. Build server side applications using servlets.
5. Apply server side programming using JSP.

UNIT I **[10 Lectures]**

Introduction to HTML: HTML Basic tags- List, Tables, images, forms, Frames; Cascading Style sheets; reading data from web form controls like text boxes, radio buttons and etc., Webpage Designing using HTML, CCS3, HTML5, HTML canvas.

Introduction to XML: Defining XML tags, their attributes and values, Difference between HTML and XML,Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data, DOM and SAX Parsers in java.

UNIT II **[10 Lectures]**

Client-side Scripting: Introduction to Javascript, Javascript language – declaring variables, scope of variables, operators and expressions-statements functions. Event handlers, Document Object Model, Form validation.

UNIT III **[10 Lectures]**

AngularJS: Angular MVC, AngularJS Expressions, controllers,tables,DOM,Forms, validation, AJAX, AngularJS Animation.

ReactJS: Introduction, Features of React, React Installation, ReactJS Vs AngularJS, ReactJS and VueJS, React Forms, React Events, React Lists,React Tables, React CSS,React Animation.

UNIT IV **[9 Lectures]**

Introduction to Servlets: Common Gateway Interface (CGI), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling HTTP Request &Responses, Using Cookies and Sessions.

UNIT V **[9 Lectures]**

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP.

TEXT BOOKS:

1. Harvey Deitel, Abbey Deitel, Internet and World Wide Web: How To Program 5th Edition.
2. Uttam K Roy, "Web Programming", Oxford University Press, 2nd Edition, 2010.

REFERENCE BOOKS:

1. John Pollock, JavaScript - A Beginners Guide, 3rd Edition –- Tata McGraw-Hill Edition.
2. Keyur Shah, Gateway to Java Programmer Sun Certification, Tata McGraw Hill, 2002.
3. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.

WEB LINKS:

1. https://www.geeksforgeeks.org/internet-and-web-programming/
2. https://www.visualpathedu.com/home/course/ui-development/9
3. https://www.visualpathedu.com/home/course/javascript-training/10
4. https://www.visualpathedu.com/home/course/ui-ux-design-training/199
5. https://www.coursera.org/learn/django-database-web-apps
6. https://extension.harvard.edu/academics/programs/web-technologies-certificate/#outcomes
7. https://www.coursera.org/learn/html-css-javascript-for-web-developers
8. https://www.coursera.org/specializations/web-design
9. https://www.coursera.org/learn/web-development
10. https://www.udemy.com/course/web-developer-course-on-creating-a-business-website

IMAGE PROCESSING (Professional Elective – I)

B.Tech. V Semester **L T P C**

Subject code: 22AM514PE **3 0 0 3**

Prerequisites

1. Knowledge of Digital Signal Processing.
2. A course on "Computational Mathematics".
3. A course on "Computer Oriented Statistical Methods".

Course Objectives

1. To understand the concepts of Digital Image Processing.
2. To explore image enhancement techniques.
3. To know the image restoration models.
4. To analyze image segmentation models.
5. To compare image techniques.

Course Outcomes: After completion of this course, the students will be able to:

1. Explore the basic concepts of Image processing and two-dimensional signal acquisition, sampling, and quantization.
2. Design image enhancement mechanisms.
3. Apply image restoration models.
4. Implement image segmentation methods.
5. Impart the image compression techniques.

UNIT – I **[10 Lectures]**

Digital Image Fundamentals: Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbors of pixel adjacency connectivity, Regions and Boundaries, Distance measures, Applications.

UNIT– II **[10 Lectures]**

Image Enhancements: Spatial domain, Basic gray level transformations, Histogram processing, using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters.

Frequency domain: Introduction to the Fourier transform, frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

UNIT – III **[10 Lectures]**

Image Restoration: Noise models, Mean Filters, Order Statistics, Adaptive filters, Band reject Filters, Band pass Filters, Notch Filters, Optimum Notch Filtering, Inverse Filtering, Wiener filtering.

Segmentation: Edge detection, Edge Linking and Boundary detection, Region based segmentation, Morphological processing, Erosion and dilation.

UNIT – IV **[9 Lectures]**

Compression: Image Compression Redundancies, Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

Representation and Descriptions: Introduction to some descriptors: Chain codes, Signatures, Shape Numbers, Fourier Descriptors.

UNIT – V **[9 Lectures]**

Recognition: Patterns and pattern classes, Decision-Theoretic Methods, Introduction to Neural Networks, Neural Network based Image Recognition.

Pattern Recognition: Overview of Pattern Recognition with block diagram.

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 L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wilely, 3rd Edition, 2004.

WEB LINKS:

1. https://archive.nptel.ac.in/courses/117/105/117105135/
2. https://www.coursera.org/specializations/image-processing
3. https://www.coursera.org/courses?query=image%20processing
4. https://www.udemy.com/topic/image-processing/
5. https://www.classcentral.com/course/computervision-imageprocessing-13567
6. https://www.v7labs.com/blog/image-processing-guide

COMPUTER GRAPHICS (Professional Elective – I)

B.Tech. V Semester **L T P C**
Subject code: 22AM515PE **3 0 0 3**

Prerequisites
1. Knowledge of Mathematical Computation.
2. A course on "Computer Programming and Data Structures"

Course Objectives
1. To know the fundamental concepts of computer graphics.
2. To explore the knowledge of geometrical transformations.
3. To understand object representation using surface.
4. To explore the concept of geometrical projections.
5. To gain knowledge of computer animation.

Course Outcomes: After completion of this course, the students will be able to:
1. Describe the mathematical foundations of computer graphics and its applications.
2. Design 2D geometrical transformations and 2D viewing functions.
3. Construct 3D object representations using polygonal surfaces, curves, and shading models.
4. Apply geometric projections for 3D objects and 3D viewing functions.
5. Analyze animation sequence and visible surface detection methods.

UNIT – I **[10 Lectures]**

Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random-scan systems, graphic monitors, work stations and input devices

Output primitives: Points and lines, line drawing algorithms, DDA and Bresenham's Algorithms, circle- generating algorithms and ellipse - generating algorithms

Polygon Filling: Scan-line algorithm, boundary-fill and flood-fill algorithms

UNIT – II **[10 Lectures]**

2-D Geometric transformations: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems

2-D Viewing: Viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, clipping operations, point clipping, Line clipping-Cohen Sutherland algorithms, Polygon clipping-Sutherland Hodgeman polygon clipping algorithm.

UNIT – III **[10 Lectures]**

3-D Object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces, Polygon rendering methods, color models and color applications.

UNIT – IV **[9 Lectures]**

3D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations composite transformations.

3D Viewing: Viewing pipeline, viewing coordinates, projections, view volume and general projection transforms and clipping.

UNIT – V **[9 Lectures]**

Computer animation: Design of animation sequence, general computer animation functions, raster animations, computer animation languages, key frame systems, motion specifications.

Visible surface detection methods: Classification, back-face detection, depth-buffer method, BSP- tree method, area sub-division method and octree method.

TEXT BOOKS:

1. "Computer Graphics C version", Donald Hearn and M. Pauline Baker, Pearson Education

REFERENCE BOOKS:

1. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
2. Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
3. Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.
4. "Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
5. Computer Graphics, Steven Harrington, TMH.

WEBLINKS:

1. https://www.javatpoint.com/computer-graphics-tutorial
2. https://onlinecourses.nptel.ac.in/noc20_cs90/preview

MACHINE LEARNING LAB

B.Tech. V Semester **L T P C**
Subject code: 22AM505PC **0 0 3 1.5**

Co-requisites:
1. A course on "Machine learning"

Prerequisites:
1. A Course on "Mathematical and Statistical Foundations". A Course on "Programming with Python".
2. A Course on" Data Structure".

Course Objective:
1. To overview of the various machine learning techniques using python.
2. To understand the data analysis using ML techniques.
3. To understand the complexity of Machine Learning algorithms and their limitations.
4. To prepare students to become Familiarity with Python programming in AI environment.
5. To train Students with Python programming to comprehend, analyze, design, and create AI platforms and solutions for real-life problems.

Course Outcomes: After completion of this course, the students will be able to:
1. Experiment on Machine Learning algorithms using real-world data.
2. Apply the modern notions in data analysis-oriented computing.
3. Implement standard Machine Learning algorithms.
4. Use python programming in AI environment.
5. Analyze the performance of predictive models.

List of Experiments
1. Write a python program to compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation
2. Write a python program to demonstrate the use of statistics, math, numpy and scipy libraries
3. Write a python program to demonstrate a Machine Learning application using pandas, matplot lab libraries
4. Write a python program to apply simple linear regression algorithm for a regression problem
5. Write a python program to apply multiple linear regression algorithm for house price prediction using sk learn library.
6. Write a python program to apply decision tree algorithm for a classification problem and perform parameter tuning for better results
7. Write a python program to apply KNN algorithm for a classification problem using sklearn library
8. Write a python program to apply Logistic regression algorithm for a classification problem using sklearn library
9. Write a python program to apply k-means algorithm for a clustering problems
10. Mini Project by including performance analysis of any three classification algorithms on a specific dataset.

TEXT BOOKS:

1. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn and TensorFlow, Oreilly, March 2017.
2. Dr. M Gopal, Applied Machine Learning, 1st Edition, McGraw-Hill, 2001.

REFERENCE BOOKS:

1. Stephen Marshland, Machine Learning: An Algorithmic Perspective, Chapman and Hall/CRC, 2nd edition, 2014.
2. Davy Cielen, Arno Meysman, Mohamed Ali, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Manning Publications, First Edition, 2016.

WEB LINKS:

1. https://deepakdvallur.weebly.com/machine-learning-laboratory.html
2. https://ml.informatik.uni-freiburg.de/
3. https://mll.iiit.ac.in/

COMPUTER NETWORKS LAB

B.Tech. V Semester	L	T	P	C
Subject code: 22AM506PC	0	0	3	1.5

Co-requisite: A Course on "Computer Networks".

Prerequisites:

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

Course Objectives

1. To understand the working principle of various communication protocols.
2. To analyze the traffic flow and the contents of protocol frames.
3. To interpret various routing algorithms.
4. To explore the concepts of data encryption and decryption.
5. To know congestion control and network and operating functionalities.

Course Outcomes: After completion of this course, the students will be able to:

1. Implement data link layer farming methods.
2. Analyze error detection and error correction using CRC codes.
3. Design and implement routing algorithms and congestion control techniques used in networks.
4. Develop Encoding and Decoding techniques used in presentation layer.
5. Apply network tools for network scanning and security auditing.

List of Experiments

1. Write a Program to implement the data link layer farming methods such as character, character-stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP
3. Write a Program to implement 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. Write a Program to Implement Dijsktra's algorithm to compute the shortest path through a network.
5. Write a Program to simulate the subnet of hosts and obtain a broadcast tree for the subnet.
6. Write a Program to Implement distance vector routing algorithm for obtaining routing tables at each node.
7. Write a Program to Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
8. Write a program for congestion control using Leaky bucket algorithm.
9. Write a program for frame sorting techniques used in buffers.
10. Demonstrate how to run N Map scan.

11. Demonstration of Operating System Detection using N map.
12. Study of basic Network configuration commands and utilities to debug the network issues.

TEXT BOOKS:

1. Andrew S Tanenbaum, David. j. Wetherall, Computer Networks, 5th Edition, Pearson Education/PHI, 2011.
2. Behrouz A. Forouzan -Data Communications and Networking,4th Edition, Tata McGraw Hill, 2006.

REFERENCE BOOKS:

1. S. Keshav, An Engineering Approach to Computer Networks, Addison Wesley, 1st edition, 2010.
2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 5th Edition, Elsevier, 2010.
3. Alberto Leon-Garcia and Indra Widjaja: Communication Networks -Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw-Hill, 2004.

WEB LINKS:

1. https://www.bits-pilani.ac.in/computer-networks-network-programming-lab/
2. https://www.spiceworks.com/tech/networking/articles/what-is-a-computer-network/
3. https://aws.amazon.com/what-is/computer-networking/
4. https://www.geeksforgeeks.org/computer-science-fundamentals/what-is-computer-networking/

UI DESIGN-FLUTTER

B.Tech. V Semester **L T P C**
Subject code: 22AM507PC **0 0 2 1**

Course Objectives:

1. To learn installation of SDK of Flutter, Xcode and Android Emulator
2. To understanding Stateless and Stateful Widgets and Widget Tree
3. To know Dart basics.
4. To learn starter project template and widget tree.
5. To explore Application of Animation to app.

Course Outcomes: After completion of this course, the students will be able to:

1. Install and configure Flutter and Dart environment.
2. Design responsive user interfaces using Flutter widgets.
3. Implement navigation and state management in Flutter apps.
4. Develop forms, validations, and animated UI components.
5. Integrate REST APIs and perform testing and debugging.

List of Experiments: Students need to implement the following experiments

1. a) Installation of 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) Demonstrate 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) Demonstrate the use of Flutter's debugging tools to identify and fix issues.

TEXT BOOK:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc21_ar05/preview
2. https://www.coursera.org/projects/googlecloud-getting-started-with-flutter-development-guo1q
3. https://www.udemy.com/course/the-complete-flutter-ui-course-build-amazing-mobile-ui/
4. https://iqonic.design/blog/8-best-flutter-ui-kits-free-ui-kits-and-templates/

INTELLECTUAL PROPERTY RIGHTS

B.Tech. V Semester **L T P C**
Subject code: 22AM508MC **3 0 0 0**

Course Objectives

1. To explore intellectual property rights.
2. To outline the basics of trademarks.
3. To describe the copyrights and its laws.
4. To understand the nature of trade secrets and unfair competition.
5. To define the new developments of intellectual property rights.

Course Outcomes: After completion of this course, the students will be able to:

1. Interpret intellectual property rights.
2. Identify different types of trademarks and related laws.
3. Explore copyrights and their laws.
4. Differentiate the trade secrets and unfair competition.
5. Impart the rules, laws, and properties of intellectual property rights.

UNIT– I **[10 Lectures]**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT– II **[10 Lectures]**

Trademarks: Purpose and function of trademarks, acquisition of trade markrights, protectable matter, selecting, and evaluating trademark, trademark registration processes.

UNIT– III **[10 Lectures]**

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copyright 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 **[9 Lectures]**

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 of right of publicity, false advertising.

UNIT– V **[9 Lectures]**

New development of intellectual property: new developments in trademark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international trademark law, copyright law, international patent law, and international development in trade secrets law.

TEXT BOOKS:

1. Deborah E. Bouchoux, Intellectual Property: The Law Of Trademarks Copyrights Patents And Trade Secrets, 4Th Edn, Cengage India, 2015.
2. Prabuddha ganguli, Intellectual property right – Unleashing the knowledge economy, McGraw Hill Education, 1st edition, 2017.

REFERENCEBOOKS:

1. William M. Landes, Richard A. Posner, The Economic Structure of Intellectual Property Law, Belknap Press, Illustrated edition, 2003.
2. Rami M. Olwan, Intellectual Property and Development: Theory and Practice, Springer-Verlag Berlinand Heidelberg GmbH & Co. K, 2013th edition, 2015.
3. VKAhuja, Law Relating To Intellectual Property Rights, Lexis Nexis, Third edition,2017.

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc22_hs59/preview
2. https://www.coursera.org/learn/introduction-intellectual-property
3. https://www.udemy.com/topic/intellectual-property/
4. https://allea.org/intellectual-property-rights/
5. https://www.stopfakes.gov/Online-Intellectual-Property-Training-Module

KNOWLEDGE REPRESENTATION AND REASONING

B.Tech. VI Semester **L T P C**
Subject code: 22AM601PC **3 0 0 3**

Prerequisites:
A course on "Introduction to Artificial Intelligence"

Course Objectives:
1. To learn about the key concepts of knowledge, Representation and Reasoning.
2. To gain knowledge about different ontological categories.
3. To apply the principles of knowledge representations.
4. To identify different types of processes and contexts.
5. To know about vagueness, uncertainity, randomness and ignorance.

Course Outcomes: After the completion of this course, the student will be able to:
1. Enumerate the key concepts of knowledge, Representation and Reasoning.
2. Interpret different ontological categories.
3. Apply the principles of knowledge representations.
4. Classify different types of processes and contexts.
5. Interpret vagueness, uncertainity, randomness and ignorance.

UNIT – I **[10 Lectures]**

The Key Concepts: Knowledge, Representation, Reasoning, need of knowledge representation and reasoning, Knowledge based systems, Role of logic

Logic: Historical background, Representing knowledge in logic, Varieties of logic, Name, Type, Measures, Unity Amidst diversity.

UNIT – II **[10 Lectures]**

Ontology: Ontological categories, micro worlds, cyc categories, Philosophical background, Aristotles Categories, Kant's categories,Top-level categories, describing physical entities, Defining abstractions, Sets, Collections, Types and Categories, Space and Time.

UNIT – III **[10 Lectures]**

Knowledge Representations: Knowledge Engineering, Informal Specifications, Formalization, Principles of Knowledge Representations, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation

UNIT – IV **[9 Lectures]**

Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change.

Contexts: Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts, Agents.

UNIT – V **[9 Lectures]**

Knowledge Soup: Vagueness, Uncertainty, Randomness and Ignorance, Limitations of logic, Fuzzy logic, Non monotonic Logic, Theories, Models and the world, Semiotics.

Knowledge Acquisition and Sharing: Sharing Ontologies, Conceptual schema, accommodating multiple paradigms, Relating different knowledge representations, Language patterns, Tools for knowledge acquisition.

TEXT BOOKS:

1. Knowledge Representation logical, Philosophical, and Computational Foundations by John F. Sowa, Thomson Learning.
2. Knowledge Representation and Reasoning by Ronald J. Brachman, Hector J. Levesque, Elsevier.

WEBLINKS:

1. https://www.javatpoint.com/knowledge-representation-in-ai
2. https://onlinecourses.nptel.ac.in/noc24_cs14/prev

DATA ANALYTICS

B. Tech. VI Semester **L T P C**
Subject code: 22AM602PC **3 0 0 3**

Prerequisites
1. A course on "Database Management Systems".
2. Knowledge of Probability and Statistics.

Course Objectives:
1. To understand the Data pre-processing mechanisms.
2. To learn the fundamental concepts of data analytics.
3. To explore the basic building models for classification.
4. To analyze supervised and unsupervised models.
5. To discover visualization techniques.

Course Outcomes: After completion of this course, the students will be able to:
1. Explore various Data Sources and Pre-processing mechanisms.
2. Experiment on data and statistical analysis.
3. Demonstrate on Regression models.
4. Analyze the impact of data analytics for business decisions and strategy.
5. Implement standard data visualization and formal inference procedures.

UNIT – I **[10 Lectures]**

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors, Signals, GPS. Data Management, Data Pre Processing, Data Quality, Data Cleaning, noise outliers, missing values, duplicate data, Data Processing.

UNIT – II **[10 Lectures]**

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, Need for Business Modeling.

UNIT – III **[9 Lectures]**

Regression: Definition, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains.

UNIT – IV **[9 Lectures]**

Object Segmentation: Regression Vs Segmentation, Supervised and Unsupervised Learning, Tree Building, Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees.

Time Series Methods: ARIMA, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy and analyze for prediction.

UNIT – V **[10 Lectures]**

Data Visualization: Need of data visualization**,** Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Scatter Plots, Icon-Based Visualization Techniques, Chernoff faces, 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.

WEB LINKS:

1. https://www.geeksforgeeks.org/data-analytics-and-its-type/
2. https://onlinecourses.nptel.ac.in/noc24_cs20/preview

NATURAL LANGUAGE PROCESSING

B.Tech. VI Semester **L T P C**
Subject code:22AM603PC **3 0 0 3**

Prerequisites:
1. A Course on "Data structures".
2. A Course on "finite automata and probability theory".

Course Objectives
1. To Introduce the NLP structure of documents.
2. To understand the experimental methodology for empirical syntax analysis.
3. To describe the parsing structure of NLP systems.
4. To design NLP Algorithms.
5. To use language modelling techniques.

Course Outcomes: After completion of this course, the students will be able to:
1. Summarize methods for identifying the structure of documents in NLP.
2. Experiment for evaluating NLP systems.
3. Construct statistical models over strings, trees and estimate parameters using supervised and unsupervised training methods.
4. Implement the NLP algorithms.
5. Design different language modelling Techniques.

UNIT – I **[12 Lectures]**

Introduction : Definition , challenges of NLP, Application of NLP**.**

Finding the Structure of Words: Words and their Components, Tokens, Lexemes, Morphemes, Typology, issues and Challenges, Morphological Models

Finding the Structure of Documents: Sentence Boundary Detection, Topic Boundary Detection, Methods, Complexity of the Approaches, Performances of the Approaches.

UNIT – II **[10 Lectures]**

Syntax: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in parsing, Multilingual issues, Tokenization, Case and Encoding, Word Segmentation, Morphology.

UNIT – III **[8 Lectures]**

Semantic Parsing: Introduction, Semantic Interpretation, Structural Ambiguity, wordsense Disambiguation, Entity and Event Resolution, Predicate Argument Structure, Meaning Representation, System Paradigms, Resources, Systems and software for word sense, Resources, Systems and software for predicate argument structure, Resources, Systems and software for meaning representation.

UNIT – IV **[9 Lectures]**

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Crosslingual Language Modeling**.**

UNIT – V **[9 Lectures]**

Multilingual Sentiment and Subjectivity Analysis: Introduction, Sentiment and Subjectivity on English, word and phrase level annotations, sentence level annotations, document level annotations, manually annotated corpora, corpus based cross lingual projections, Bootstraping a lexicon, translating a lexicon.

TEXT BOOKS:

1. Daniel M. Bike and Imed Zitouni Multilingual Natural Language Processing Applications: From Theory to Practice, Pearson Publication
2. Tanvier Siddiqui, U.S.Tiwary Natural Language Processing and Information Retrieval

REFERENCE:

1. Daniel Jurafsky & James H Martin, Pearson Publications Speech and
2. Natural Language Processing**.**
3. Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction
4. to Natural Language Processing, Computational Linguistics and Speech Recognition.
5. Prentice Hall, Second Edition, 2009.

WEB LINKS:

1. https://nptel.ac.in/courses/106105158
2. https://www.coursera.org/specializations/natural-language-processing
3. https://www.coursera.org/courses?query=nlp
4. https://www.udemy.com/topic/natural-language-processing/
5. https://www.kaggle.com/code/kmldas/free-nlp-resources-courses

SOFTWARE TESTING METHODOLOGIES (Professional Elective – II)

B.Tech. VI Semester **L T P C**
Subject code: 20AM621PE **3 0 0 3**

Prerequisites:

A course on "Software Engineering".

Course Objectives

1. To introduce the concepts in software testing such as testing process, criteria, strategies, and methodologies.
2. To understand the transaction flow, data flow and domain testing techniques.
3. To explore the logic-based testing technique.
4. To describe the testing based on state graphs and transitions.
5. To know the software test automation and management using the latest tools.

Course Outcomes: After completion of this course, the students will be able to:

1. Compare and contrast the various testing strategies.
2. Experiment on dataflow and domain testing strategies.
3. Build decision tables and KV charts.
4. Apply the graph-based testing metrics to its application.
5. Implement test cases using any automated testing tools (Jmeter or WinRunner).

UNIT – I **[12 Lectures]**

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.

Flow graphs and Path testing: Basic concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT – II **[10 Lectures]**

Transaction Flow Testing: transaction flows, transaction flow testing techniques.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of dataflow testing.

Domain Testing: domains and paths, Nice and ugly domains, domain testing, domains and interfaces testing, domains and testability.

UNIT – III **[9 Lectures]**

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 **[9 Lectures]**

State, State Graphs and Transition testing: State, State graphs, State table, Software Implementation, good and bad state graphs, state bugs, Transition bugs, Encoding bugs, state testing, Limitations and Extensions, Test ability tips

UNIT – V **[8 Lectures]**

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, Introduction to building tools, Jmeter, winRunner, selenium, soapUI, Catalon.

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)8 Software Testing in the Real World – Edward Kit, Pearson.
3. Effective methods of Software Testing, Perry, John Wiley.
4. Art of Software Testing – Meyers, John Wiley.

WEBLINKS:

1. https://www.geeksforgeeks.org/software-testing-techniques/
2. https://onlinecourses.nptel.ac.in/noc24_cs47/preview

INFORMATION RETRIEVAL SYSTEMS (Professional Elective – II)

B.Tech. VI Semester **L T P C**

Subject code: 22AM622PE **3 0 0 3**

Prerequisites:

1. A course on "Data Structures".
2. A course on "Data Base Management Systems".

Course Objectives

1. To learn the concepts of IRS.
2. To understand the structure of information.
3. To design document clustering algorithms.
4. To explore Information Retrieval System for web search tasks.
5. To learn visualization technologies for multimedia data retrieval.

Course Outcomes: After the completion of this course, the students will be able to:

1. Apply IR principles to locate relevant information from large collections of data.
2. Develop data models using statistical approaches.
3. Implement different automatic document clustering algorithms.
4. Design the Information Retrieval System for web search tasks.
5. Apply visualization tools for multimedia information retrieval.

UNIT – I **[12 Lectures]**

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 **[10 Lectures]**

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction.

Data Structures: Introduction to Data Structures, 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 **[9 Lectures]**

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 **[8 Lectures]**

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext

Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies

UNIT – V **[9 Lectures]**

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.

WEBLINKS:

1. https://www.geeksforgeeks.org/what-is-information-retrieval/
2. https://onlinecourses .nptel.ac.in/noc24_ee47/preview

PATTERN RECOGNITION (Professional Elective – II)

B.Tech. VI Semester **L T P C**
Subject code: 22AM623PE **3 0 0 3**

Prerequisites:

A Course on "Machine Learning"
A Course on "Mathematics and Statistical Foundatation "

Course Objectives:

1. To learn about the importance of pattern recognition and its representation.
2. To know about the variants of Nearest Neighbour algorithm.
3. To Identify the necessity of Hidden Markov models.
4. To gain the knowledge of ensembles of classifiers.
5. To learn different types of clustering algorithms

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

1. Interpret the importance of pattern recognition and its representation.
2. Analyze the variants of Nearest Neighbour algorithm.
3. Identify the necessity of Hidden Markov models.
4. Examine the support vector machine classifier and ensembles of classifiers.
5. Design the different types of clustering algorithms

UNIT – I **[10 Lectures]**

Introduction: 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 **[10 Lectures]**

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 **[10 Lectures]**

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 **[9 Lectures]**

Support Vector Machines: Introduction, Learning the Linear Discriminant Functions, Neural Networks, SVM for Classification.

Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers.

UNIT – V **[9 Lectures]**

Clustering: Importance of clustering, 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.

WEBLINKS:

1. https://www.geeksforgeeks.org/pattern-recognition-introduction/
2. https://onlinecourses.nptel.ac.in/noc24_cs40/preview

COMPUTER VISION AND ROBOTICS (Professional Elective – II)

B.Tech. VI Semester **L T P C**
Subject code: 22AM624PE **3 0 0 3**

Pre-Requisites:
A course on "Linear Algebra and Probability".

Course Objectives:
1. To know the Fundamental concepts related to sources, shadows and shading.
2. To learn about filters, edge detection and texture analysis.
3. To learn about segmentation by clustering.
4. To know about Geometric camera models and Geometric camera calibration.
5. To learn about common sensing techniques for reactive robots.

Course Outcomes: After the completion of this course the student can be able to:
1. Apply fundamental image processing techniques required for computer vision.
2. Examine Linear Filters, Edge Detection and Texture Analysis.
3. Apply segmentation by clustering.
4. Develop segmentation and Fitting using Probabilistic methods.
5. Enumerate common sensing techniques for reactive robots.

UNIT – I **[10 Lectures]**

CAMERAS: Pinhole Cameras
Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases **Sources, Shadows and Shading:** Qualitative Radiometry, Sources and Effects, LocalShading Models, Application: Photometric Stereo, Interreflections: Global Shading Models **Color:** Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT – II **[10 Lectures]**

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates.
Edge Detection: Noise, Estimating Derivatives, Detecting Edges
Texture: Representing Texture, Analysis and Synthesis using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT – III **[10 Lectures]**

Geometry of Multiple Views: Two Views
Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras **Segmentation by Clustering:** Segmentation, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT – IV **[9 Lectures]**

Segmentation by Fitting a Model: Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and Perspective Projection, Affine Cameras and Affine Projection Equations **Geometric Camera Calibration:** Least-Squares Parameter Estimation, Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, Application: Mobile Robot Localization.

UNIT – V **[9 Lectures]**

Introduction to Robotics: Social Implications of Robotics, history of Robotics, Attributes of hierarchical paradigm, Closed world assumption and frame problem, Representative Architectures, Attributes of Reactive Paradigm, Subsumption Architecture, Potential fields and Perception.

Common sensing techniques for Reactive Robots: Logical sensors, Behavioural Sensor Fusion, Pro- prioceptive sensors, Proximity Sensors, Topological Planning and Metric Path Planning

TEXT BOOKS:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHILearning (Indian Edition), 2009.
2. Robin Murphy, Introduction to AI Robotics, MIT Press

REFERENCE BOOKS:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. The Robotics premier, Maja J Matari, MIT Press
3. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.

WEBLINKS:

1. https://www.javatpoint.com/computer-vision
2. https://onlinecourses.nptel.ac.in/noc24_ee38/preview

DATA WAREHOUSING AND BUSINESS INTELLIGENCE
(Professional Elective – II)

B.Tech. VI Semester **L T P C**
Subject code: 22AM625PE **3 0 0 3**

Pre-Requisites:
1. A Course on "Database Management Systems".

Course Objectives:
1. To learn about fundamentals of data warehouse and perform OLAP operations.
2. To know the fundamental concepts of Business Intelligence.
3. To compare Business Intelligence Key Performance indicators.
4. To gain knowledge of using Advanced Business Intelligence Tools.
5. To learn about integrating Business Intelligence systems.

Course Outcomes: After the completion of the course the student can able to
1. Design a data warehouse and perform OLAP operations.
2. Enumerate the fundamental concepts of Business Intelligence.
3. Compare Business Intelligence Key Performance indicators.
4. Make use of Advanced Business Intelligence Tools.
5. Develop Integrated Business Intelligence systems.

UNIT – I **[10 Lectures]**

Data Warehousing: Definition, A multi-tier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, , OLAP operations.

Data Cube: A multidimensional data model, Star, Snowflake and Fact constellation: Schemas for multidimensional Data models, Data Cube Computation methods measures of Similarity and dissimilarity.

UNIT – II **[10 Lectures]**

Business Intelligence Introduction : Definition, Leveraging Data and Knowledge for BI, BI Components, BI Dimensions, Information Hierarchy, Business Intelligence and Business Analytics. BI Life Cycle. Data for BI - Data Issues and Data Quality for BI.

UNIT – III **[10 Lectures]**

BI Implementation: Key Drivers, Key Performance Indicators and Performance Metrics, BI Architecture/Framework, Best Practices, Business Decision Making, Styles of BI-vent-Driven alerts, A cyclic process of Intelligence Creation. The value of Business Intelligence-Value driven and Information use.

UNIT – IV **[9 Lectures]**

Advanced BI : Big Data and BI, Social Networks, Mobile BI, emerging trends, Description of different BI-Tools, Types of BI Tools, Choose appropriate BI Tool, Pentaho Reporting Tool, Features of Pentaho, User interfaces available in pentaho, Introduction to KNIME Tool, Features of KNIME.

UNIT – V **[9 Lectures]**

Business Intelligence and integration implementation: connecting in BI systems to databases and Enterprise systems, On-Demand BI,Benefits of On-Demand BI, Issues of legality- Privacy and ethics- Social networking and BI, Types of Integration, functional Integration, Physical Integration, Need of integration,

TEXT BOOKS:

1. JIAWEI HAN & MICHELINE KAMBER, Elsevier Data Mining – Concepts and Techniques Elsevier 4th Edition.
2. Rajiv Sabherwal "Business Intelligence" Wiley Publications, 2012.

REFERENCE BOOKS:

1. Efraim Turban, Ramesh Sharda, Jay Aronson, David King, Decision Support and Business Intelligence Systems, 9th Edition, Pearson Education, 2009.
2. David Loshin, Business Intelligence - The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.
3. Philo Janus, Stacia Misner, Building Integrated Business Intelligence. Solutions with SQL Server, 2008 R2 & Office 2010, TMH, 2011.

WEBLINKS:

1. https://www.geeksforgeeks.org/difference-between-business-intelligence-and-data- warehouse/
2. https://onlinecourses.nptel.ac.in/noc24_cs65/preview

FUNDAMENTALS OF AI (Open Elective – I)

B.Tech. VI Semester **L T P C**

Subject code:**22AM611OE** **3 0 0 3**

Prerequisites:

1. A course on "Mathematical and Statistical Foundations"

Course Objective:

1. To learn about fundamental concepts of Artificial Intelligence.
2. To know about uninformed and informed search strategies.
3. To explore logical agents and inference in first order logic.
4. To learn about uncertainty and probabilistic reasoning.
5. To know about applications of Artificial Intelligence.

Course Outcome : After the completion of this course, the students will be able to

1. Enumerate the fundamental concepts of Artificial Intelligence.
2. Solve problems by uninformed and informed search strategies.
3. Apply first order logic to solve problems.
4. Solve the problems using probabilistic reasoning.
5. List the applications of Artificial Intelligence.

UNIT – I **[12 Lectures]**

Foundations of AI: Introduction to AI, History of AI, Strong and Weak AI, Risks and Benefits of AI

Philosophy, Ethics and Safety of AI: Limits of AI, Machine thinking capability, Ethics of AI

Intelligent Agents: Agents and Environments, Good Behavior: Concept of Rationality, Nature of Environments, Structure of Agents.

UNIT – II **[10 Lectures]**

Uninformed Search Strategies: Best-First Search, Breadth-First Search, Uniform-Cost Search, Depth-First Search, Iterative Deepening Search and Bidirectional Search

Informed Search Strategies: Greedy Best-First Search, A* Search.

UNIT – III **[9 Lectures]**

Logical Agents: Knowledge-based agents, Propositional Logic.

First-Order Logic: Syntax and Semantics of First-Order Logic.

Inference in First-Order Logic: Propositional Vs First-Order Inference, Unification and First-Order Inference, Forward Chaining, Backward Chaining.

UNIT – IV **[9 Lectures]**

Quantifying Uncertainty: Basic Probability Notation, Inference using Full-Joint Distributions, Independence, Bayes' Rule and its Use, Naive Bayes Models.

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, semantics of Bayesian Networks, Exact Inference in Bayesian Networks.

UNIT – V **[8 Lectures]**

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Model Selection, Linear Regression and Classification, Ensemble Learning.

Natural Language Processing: Language Models, Grammar, Parsing, Complications of Real Natural Language, Natural Language Tasks.

TEXT BOOKS:

1. "Artificial Intelligence a Modern Approach", Fourth Edition, Stuart J. Russell & Peter Norvig – Pearson.

REFERENCE BOOKS:

1. Elaine Rich, Kevin Knight & Shivashankar B Nair "Artificial Intelligence",– McGraw Hill Education.
2. E. Rich and K. Knight Artificial Intelligence, 3rd Edn (TMH)
3. Patrick Henny Winston, Artificial Intelligence, 3rd Edn., Pearson Education.
4. Artificial Intelligence, Shivani Goel, Pearson Education.
5. Artificial Intelligence and Expert systems – Patterson, Pearson Education

WEBLINKS:

1. https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/
2. https://onlinecourses.nptel.ac.in/noc24_mg05/preview

MACHINE LEARNING BASICS (Open Elective – I)

B.Tech. VI Semester **L T P C**
Subject code: 22AM612OE **3 0 0 3**

Prerequisites
1. Knowledge of Data Mining, AI.
2. Knowledge of statistical methods.

Course Objectives
1. To introduce the basic concepts of Machine Learning techniques, hypothesis, and version spaces.
2. To learn machine learning problems for different applications.
3. To Understand the concept of Decision Tree and Ensemble Learning.
4. To gain knowledge on evolutionary computing algorithms for real-world problems.
5. To explore Reinforcement and Bayesian Learning techniques.

Course Outcomes: After completion of this course, the students will be able to:
1. Distinguish between supervised, unsupervised, and semi-supervised learning techniques.
2. Evaluate the performance and accuracy of various machine learning algorithms.
3. Build classifiers and design ensemble methods to increase classification accuracy.
4. Implement evolutionary computing algorithms for real-world problems.
5. Analyze Reinforcement Learning and Bayesian Networks.

UNIT – I **[10 Lectures]**

Introduction: 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, the Candidate Elimination Algorithm, Linear Regression.

UNIT – II **[10 Lectures]**

Multi-layer Perceptron: Going Forwards, Going Backwards: Back Propagation Error, Multi-layer Perceptron in Practice, Examples of using the MLP – Overview – Deriving Back-Propagation, Support Vector Machine.

UNIT – III **[10 Lectures]**

Learning with Trees: Decision Trees, Constructing Decision Trees, Classification and Regression Trees

Ensemble Learning: Boosting, Bagging, Different ways to Combine Classifiers, Nearest Neighbor Methods

UNIT – IV **[9 Lectures]**

Unsupervised Learning: Clustering, K means Algorithm, Strengths ans weaknesses of K-Means.

Evolutionary Learning: Genetic algorithms, Genetic Offspring, Genetic Operators, using Genetic Algorithms

UNIT – V **[9 Lectures]**

Reinforcement Learning: Overview of Reinforcement Learning, Getting Lost Example. **Markov Chain Monte Carlo Methods:** Sampling, Proposal Distribution, Markov Chain Monte Carlo, Hidden Markov Models

TEXT BOOKS:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.

REFERENCE BOOKS:

1. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
3. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
4. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.

WEBLINKS:

1. https://www.javatpoint.com/basic-concepts-in-machine-learning
2. https://onlinecourses.nptel.ac.in/noc24_cs51/preview
3. https://www.udemy.com/course/machine-learning-foundation-with-practical-approaches/
4. https://mll.iiit.ac.in/
5. https://onlinecourses.nptel.ac.in/noc23_ee87/preview

DATA ANALYTICS LAB

B.Tech. VI Semester **L T P C**
Subject code: 22AM604PC **0 0 2 1**

Co-requisites: A course on " Data Analytics"

Prerequisites:

1. A course on " Programming with python "
2. A course on " Mathematical and statistical Foundations "

Course Objectives:

1. To learn about data preprocessing methods
2. To gain the knowledge of linear regression and logistic regression models.
3. To design different classification models.
4. To apply data visualization techniques using different graphs.
5. To learn about predictive models for different types of data.

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

1. Apply data preprocessing methods.
2. Develop linear regression and logistic regression models.
3. Design different classification models.
4. Apply data visualization techniques using different graphs.
5. Design predictive models for different types of data.

List of Experiments:

1. Write a python program to perform the following Data Preprocessing methods
   a) Handling missing values
   b) Noise detection and removal
   c) Identifying data redundancy and elimination
2. Write a python program to apply any one imputation model on a sample data set
3. Write a python program to apply Linear Regression algorithm on a data set
4. Write a python program to apply Logistic Regression algorithm on a data set
5. Write a python program to apply Decision Tree Induction for classification on a data set
6. Write a python program to apply Random Forest algorithm on a data set
7. Write a python program to apply ARIMA on Time Series data
8. Write a python program for Object segmentation using hierarchical based methods
9. Write a python program to perform Visualization techniques (types of maps - Bar, Colum, Line, Scatter, 3D Cubes)
10. Write a python program to Descriptive analytics on healthcare data
11. Write a python program to Perform Predictive analytics on Product Sales data
12. Write a python program to 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 Kaufmann Publishers.

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 Milliway Labs Jeffrey D Ullman Stanford Univ.

WEBLINKS:

1. https://onlinecourses.nptel.ac.in/noc21-cs45/preview
2. https://github.com/hetshanh99/big-data-analytics-lab -practical
3. https:www.analyticsvidhya.com

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

B.Tech. VI Semester **L T P C**
Subject code: 22EN605HS **0 0 2 1**

Co-reequisites:

1. A Course on "English Communication" .

Course Objectives

1. To improve the students' fluency in English, through a well-developed vocabulary.
2. To read and comprehend texts in different contexts.
3. To communicate their ideas relevantly and coherently in writing.
4. To make students' industry ready.
5. To acquire behavioral skills for their personal and professional life.

Course Outcomes: After completion of this course, the students will be able to:

1. Interpret the vocabulary to improve the fluency in English.
2. Comprehend effectively in different contexts.
3. Develop proficiency in academic reading and writing.
4. Identify possibilities of job prospects.
5. Communicate effectively in formal and informal contexts.

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 professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

1. Gathering ideas and information to organize ideas relevantly and coherently.
2. Engaging in debates.
3. Participating in group discussions.
4. Facing interviews.
5. Writing project/research reports/technical reports.
6. Making oral presentations.
7. Writing formal letters.
8. Transferring information from non-verbal to verbal texts and vice-versa.
9. Taking part in social and professional communication.

SYLLABUS:

The following course content to conduct the activities is prescribed for theAdvanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms andantonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, 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, critical reading& effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different typesof writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/e-mails/assignments etc.
5. **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 English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

1. Spacious room with appropriate acoustics.
2. Round Tables with movable chairs
3. Audio-visual aids
4. LCD Projector
5. Public Address system
6. P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
7. T. V, a digital stereo & Camcorder
8. Headphones of High quality

SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should beprocured and used.

- 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 HillEducation(India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by StephenBailey, Routledge, 5th Edition.

REFERENCE BOOKS:

1. Learn Correct English – A Book of Grammar, Usage and Composition byShiv K.Kumar and 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 University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
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, AyshaVishwamohan,Tata Mc Graw- Hill 2009.

WEB LINKS:

1. https://nptel.ac.in/courses/109104031
2. https://www.udemy.com/topic/english-conversation/?p=3
3. https://www.coursera.org/specializations/business-english

NATURAL LANGUAGE PROCESSING LAB

B.Tech. VI Semester **L T P C**
Subject code: 22AM606PC **0 0 2 1**

Co-requisites:

A course on " Natural Language Processing"

Prerequisites:

A course on "Data structures".
A course on "Automata theory and compile Design".
A course on "Mathematical and statistical Foundations".

Course Objectives:

1. To learn about Tokenization and Stop word Removal techniques.
2. To develop Porter stemmer algorithm for stemming.
3. To design nlp model for POS tagging.
4. To know about Morphological Analysis using NLTK library.
5. To develop a model that converts audio into text using NLTK.

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

1. Apply Tokenization and Stop word Removal techniques.
2. Develop Porter stemmer algorithm for stemming.
3. Design NLP model for POS tagging.
4. Develop Morphological Analysis using NLTK library.
5. Build a model that converts audio into text using NLTK.

List of Experiments

1. Write a Python Program to perform the 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 a Python program to implement WSD (Word Sense Disambiguation)
5. Install NLTK tool kit and perform stemming
6. Create Sample list of at least 10 words POS tagging and write a program to find the POS for any given word
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. Write a python program to convert audio file to text and text file to audio files using NLTK Package.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
2. Oreilly Practical Natural Language Processing, A Comprehensive Guide to Building 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.

DEVOPS

B.Tech. VI Semester **L T P C**
Subject code: 22AM608PC **0 0 4 2**

Pre-Requisites:
1. A course on "Software Engineering".
2. A course on "Software Project Management"

Course Objectives:
1. To learn about Git and GitHub commands.
2. To develop the environment for a software application development.
3. To know about different project management, integration and development tools.
4. To Integrate Kubernetes and Docker.
5. To design automated testing of an application using selenium.

Course Outcomes: After the completion of the course the student will able to:
1. Make use of Git and GitHub commands.
2. Develop the environment for a software application development.
3. Apply different project management, integration and development tools.
4. Demonstrate integration of Kubernetes and Docker.
5. Design automated testing of an application using selenium.

List of Experiments:
1. Write code for a simple user registration form for an event.
2. Demonstrate the use of Git and GitHub commands.
3. Practice Source code management on GitHub. Experiment with the source code in exercise
4. Jenkins's installation and setup, explore the environment.
5. Demonstrate continuous integration and development using Jenkins.
6. Explore Docker commands for content management.
7. Develop a simple containerized application using Docker.
8. Integrate Kubernetes and Docker
9. Automate the process of running containerized application for exercise 7 using Kubernetes.
10. Install and Explore Selenium for automated testing.
11. Write a simple program in JavaScript and perform testing using Selenium.
12. Develop test cases for the above containerized application using selenium.

TEXT BOOKS:
1. Joakim Verona., Practical DevOps, Packt Publishing, 2016.

REFERENCE BOOKS:
1. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications.
2. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley.

WEB LINKS:

1. Edureka DevOps Full Course - https://youtu.be/S_0q75eD8Yc
2. https://business-support.udemy.com/hc/en-us/articles/6806664783639-DevOps-Labs-
3. https://azuredevopslabs.com/
4. https://devopslabs.tech/
5. https://cloudacademy.com/library/devop

PROFESSIONAL PRACTICE LAW & ETHICS

B. Tech. VII Semester **L T P C**
Subject Code:22MB701HS **3 0 0 3**

Course Objectives:

1. To Understand the types of roles they are expected to play in the society.
2. To develop some ideas of the legal and practical aspects of their profession.
3. To be aware of alternative dispute resolution system
4. To know arbitration agreements
5. To understand the law relating to intellectual property

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

1. Practice ethics and rule of the land in their profession.
2. Follow the principles and elements of legal contracts.
3. Able to resolve disputes pertaining to arbitration, reconciliation.
4. Aware of intellectual property loss.
5. Discuss the Law relating to Intellectual property.

UNIT–I **[12 Lectures]**

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stakeholders

UNIT–II **[10 Lectures]**

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

UNIT–III **[8 Lectures]**

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration;

UNIT–IV **[9 Lectures]**

Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT–V **[9 Lectures]**

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India

Digital Rights Management (DRM): Importance of DRM, Working of DRM, DRM Use cases, Benefits of DRM, Key functions of DRM software.

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016.

REFERENCE BOOKS:

1. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
2. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
3. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers.
4. B.K. Jain , Digital Rights Management Imperatives and Innovative Opportunities , 2nd Ediition, Global Vision Publishing house, 2019.

DEEP LEARNING

B. Tech. VII Semester **L T P C**
Subject Code:22AM702PC **3 0 0 3**

Pre-Requisites:

1. A course on 'Machine learning'**.**

Course Objectives:

1. To learn Machine Learning basics and neural networks.
2. To know optimal usage of data for training deep models.
3. To Apply CNN and RNN models for real-world data.
4. To build Deep Learning Algorithms
5. To understand the real world application

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

1. Implement deep Learning algorithms and their applications in real-world data.
2. Create optimal usage of data for training deep models.
3. Apply CNN models for real-world data.
4. Create and Evaluate RNN models for real-world data.
5. Develop deep models for real-world problems..

UNIT - I **[12 Lectures]**

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, Challenges Motivating Deep Learning

Deep Feedforward Networks Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

UNIT - II **[10 Lectures]**

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 **[9 Lectures]**

Convolutional Networks

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features

UNIT - IV **[9 Lectures]**

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 **[8 Lectures]**

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, Natural Language 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.

WEBLINKS:

1. https://www.geeksforgeeks.org/introduction-deep-learning
2. https://onlinecourses.nptel.ac.in/noc24_ee04/preview

INTERNET OF THINGS (Professional Elective–III)

B. Tech. VII Semester **L T P C**
SubjectCode:22AM731PE **3 0 0 3**

Prerequisites:
1. A Course on "Python Programming".
2. A Course on "Computer Organization".
3. A Course on "Computer Networks".

Course Objectives:
1. To introduce the terminology, technology and applications of IoT in different Domains.
2. To understand the concept of M2M (Machine to Machine) with necessary protocols used in IoT.
3. To learn the Python Programming Language used in many IoT Devices.
4. To know the Raspberry PI platform and different API's that are widely used in IoT applications.
5. To explore case studies for different domains.

Course Outcomes: After completion of this course, the students will be able to:
1. Interpret the impact and challenges posed by IoT in different domains leading to new architectural models.
2. Compare and Contrast the deployment of smart objects and the technologies to connect them in M2M network with necessary protocols.
3. Implement Python Programs to operate different IoT Devices.
4. Expertise Raspberry PI platform and different APIs used in various IoT applications.
5. Solve different real-time case studies and identify the IoT applications in Industry.

UNIT - I **[12 Lectures]**

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates **Domain Specific IoTs** – Home automation, Environment, Agriculture, Health and Lifestyle

UNIT - II **[10 Lectures]**

IoT and M2M – M2M, Difference between IoT and M2M, SDN and NFV for IoT,

IoT System Management with NETCOZF, YANG- Need for IoT system Management, Simple Network management protocol, Network operator requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG

UNIT - III **[9 Lectures]**

IoT Systems – Logical design using Python-Introduction to Python – Python Data types & Data structures, Control flow, Functions, Modules, Packaging, File handling, Date/Time operations, Classes, Exception, Python packages of Interest for IoT

UNIT - IV **[9 Lectures]**

IoT Physical Devices and Endpoints - Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry PI with Python, Other IoT devices.

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs, WAMP-AutoBahn for IoT, Xively Cloud for IoT, Python web application framework–Django, Designing a RESTful web API.

UNIT V **[8 Lectures]**

Case studies- Home Automation, Environment, weather monitoring, weather reporting, air pollution monitoring, Agriculture.

TEXT BOOK:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.

REFERENCE BOOK:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016
3. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

WEBLINKS:

1. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
2. https://onlinecourses.nptel.ac.in/noc24_cs35/preview

DATA MINING (Professional Elective–III)

B. Tech. VII Semester **L T P C**
Subject Code:22AM732PE **3 0 0 3**

Pre-Requisites:
1. A course on Database Management System
2. Knowledge of Probability and Statistics

Course Objectives:
1. To understand the data preprocessing methods.
2. To present methods for mining frequent patterns, associations, and correlations.
3. To describe methods for data classification and prediction.
4. To explore the data clustering approaches.
5. To know the various types of data stores such as spatial, textual, multimedia, streams.

Course Outcomes: After completion of this course, the students will be able to:
1. Explore the types of data to be mined and primitives of the data mining system.
2. Extract interesting patterns from large amounts of data.
3. Discover the classification of data mining in various fields.
4. Employ suitable data mining algorithms to clustering applications.
5. Evaluate the accuracy of supervised and unsupervised models and algorithms.

UNIT - I **[10 Lectures]**

Introduction to Data Mining:
Definition of Data mining, Kinds of Data, Knowledge Discovery process, Data Mining Functionalities, Kinds of Patterns, Major Issues in Data Mining. Data Objects and Attribute 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 **[10 Lectures]**

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 **[10 Lectures]**

Classification: Basic Concepts, Bayes Classification Methods, Naïve Bayesian Classification, Rule-Based Classification, Metrics for Evaluating Classifier Performance, Ensemble Methods, Random Forest, Bayesian Belief Networks, Multilayer Feed- Forward Neural Network

UNIT - IV **[9 Lectures]**

Cluster Analysis: Requirements for Cluster Analysis, Overview of Basic Clustering Methods, Partitioning Methods, 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 **[9 Lectures]**

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.

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei., Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann/Elsevier, 2012.
2. Margaret H Dunham, Data Mining Introductory and Advanced Topics, 2nd Edition, Pearson Education, India, 2006.

REFERENCE BOOKS:

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar, Introduction to Data Mining,
2nd Edition, Pearson Education India, 2021.
3. Amitesh Sinha, Data Warehousing, Thomson Learning, India, 2007.

WEBLINKS:

1. https://www.javatpoint.com/data-mining 2.https://onlinecourses.nptel.ac.in/noc24_cs22/preview

GO PROGRAMMING (Professional Elective–III)

B. Tech. VII Semester **L T P C**
Subject Code:22AM733PE **3 0 0 3**

Prerequisites:

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

Course Objectives:

1. To understand the basic concepts of Go programming
2. To learn functions and methods in Go programming
3. To study interfaces, go routines and channels in Go programming
4. To understand the use of concurrency with shared variables
5. To study the use of packages and the Go Tool.

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

1. Illustrate the basic concepts of Go programming.
2. Demonstrate functions and methods in Go programming.
3. Outline interfaces, Goroutines and channels in Go programming.
4. Make use of concurrency with shared variables.
5. Demonstrate the use of packages and the Go Tool.

UNIT – I **[12 Lectures]**

Introduction: Program Structure, Names, Declarations, Variables, Assignments, Basic Data Types, Integers, Floating point numbers, Complex numbers, Booleans, Strings, Constants, Composite Types, Arrays, Slices, Maps, Structs, JSON, Text and HTML Templates.

UNIT - II **[10 Lectures]**

Functions: Function Declarations, Recursion, Multiple return values, Errors, Function Values, Anonymous Functions, Variadic Functions, Deferred Function Calls, Panic, Recover

Methods: Method Declarations, Methods with a Pointer Receiver, Composing Types by Struct Embedding, Method Values and Expressions, Bit Vector Type, Encapsulation

UNIT - III **[8 Lectures]**

Interfaces: Interfaces as Contracts, Interface Types, Parsing Flags with flag.Value, Interface Values, Sorting with sort. Interface, The error Interface, Type Assertions, Type Switches.

Goroutines and Channels: Concurrent Clock Server, Concurrent Echo Server, Channels, looping in Parallel, Concurrent Web Crawler, Multiplexing with select, Cancellation, Chat Server.

UNIT - IV **[9 Lectures]**

Concurrency with shared variables: Race Conditions**,** Mutual Exclusion: sync.Mutex, Read/Write Mutexes: sync.RWMutex, Memory Synchronization, Lazy Initialization: sync.Once,

The Race Detector, Concurrent Non-Blocking Cache, Goroutines and Threads

UNIT - V **[9 Lectures]**

Packages and the Go Tool: Import Paths, The Package Declaration, Import Declarations, Blank Imports, Packages and Naming, The Go Tool.

Testing: The go test Tool, Test Functions, Coverage, Benchmark Functions, Profiling, Example Functions

TEXT BOOKS:

1. The Go Programming Language - Alan A. A. Donovan, Brian W. Kernighan Released October 2015, Addison-Wesley Professional, ISBN: 9780134190570.
2. Go in Action - William Kennedy with Brian Ketelsen and Erik St. Martin Foreword by Steve Francia November 2015, ISBN: 9781617291784.

REFERENCE BOOKS:

1. Mastering Go: Create Golang Production Applications using Network Libraries, Concurrency, and Advanced Go Data Structures, Mihalis Tsoukalos, Packt Publisher, 2019.

WEB LINKS:

1. https://go.dev/doc/tutorial/
2. https://www.geeksforgeeks.org/golang-tutorial-learn-go-programming-language/

MOBILE APPLICATION DEVELOPMENT (Professional Elective–III)

B.Tech. IV Year I Sem. **L T P C**
Subject code: 22AM734PE **3 0 0 3**

Pre-requisites:
1. Acquaintance with JAVA programming
2. A Course on Operating System and DBMS

Course Objectives
1. To demonstrate their understanding of the fundamentals of Android operating systems.
2. To improve the skills of using Android software development tools.
3. To learn to broadcast and notifications on a mobile platform.
4. To explore persistent storage.
5. To understand database for mobile applications.

Course Outcomes: After the completion of the course, the students will be able t**o:**
1. Work on Android OS Practically.
2. Apply the concepts of mobile applications and user interfaces on Android.
3. Develop the broadcast and notifications on mobile applications.
4. Create persistent storage for Android Applications.
5. Design database for mobile Android Applications.

UNIT - I **[10 Lectures]**

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes

Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT – II **[10 Lectures]**

Android User Interface: Measurements – Device and pixel density independent measuring unit - s Layouts – Linear, Relative, Grid and Table Layouts

User Interface (UI) Components –Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

UNIT - III **[10 Lectures]**

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT - IV **[9 Lectures]**

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

UNIT - V **[9 Lectures]**

Database: Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and editing data, Registering Content Providers, using content Providers (insert, delete, retrieve and update)

TEXT BOOK:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.

REFERENCE BOOKS:

1. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
2. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

WEBLINKS:

1. https://github.com/topics/mobile-app-development?l=java&o=asc&s=forks
2. https://www.javatpoint.com/android-tutorial

CLOUD COMPUTING (Professional Elective–III)

B. Tech. VII Semester **L T P C**
SubjectCode:22AM735PE **3 0 0 3**

Pre-requisites:

1. A course on "Computer Networks".
2. A course on "Operating System".

Course Objectives:

1. To introduce an insight into cloud computing.
2. To learn cloud service types, and practice on cloud deployment models and technologies supporting and driving the cloud.
3. To gain knowledge on programming models for cloud and development of software applications that runs the cloud and various services available from major cloud providers.
4. To explore networking for cloud computing.
5. To describe security concerns and issues in cloud computing.

Course Outcomes: After completion of this course, the students will be able t**o:**

1. Practice on different computing paradigms and potential of the paradigms and specifically cloud computing.
2. Identify cloud service types, and practice on cloud deployment models and technologies supporting and driving the cloud.
3. Acquire the knowledge of programming models for cloud and development of software application that runs the cloud and various services available from major cloud providers.
4. Design networking for cloud computing.
5. Analyze security concerns and issues in cloud computing.

UNIT – I **[10 Lectures]**

Introduction to Cloud Computing: Computing Paradigms, Cloud Computing Fundamentals, Motivation for Cloud Computing, Defining Cloud Computing, Principles of Cloud Computing, Cloud Computing Architecture and Management, Cloud Architecture, Network Connectivity in Cloud Computing, Applications on Cloud, Managing the Cloud, Migrating Application to Cloud.

UNIT – II **[10 Lectures]**

Cloud Computing models: Cloud Deployment Models, Cloud Service Models, Technological Drivers for Cloud Computing: SOA and Cloud, Multicore Technology, Web 2.0 and Web 3.0,
Software Process Models for Cloud, Programming Models, Pervasive Computing, Operating System, Application Environment, Cloud Application Development Platforms.

UNIT – III **[10 Lectures]**

Virtualization: Approaches to Virtualization, Hypervisors, Virtualization to Cloud Computing, Programming Models for Cloud Computing: MapReduce, Cloud Haskell, Software Development in Cloud, Different Perspectives on SaaS Development, New Programming Models Proposed for Cloud: Orleans, BOOM and Bloom, Grid Batch, Simple API for Grid Applications.

UNIT – IV **[9 Lectures]**

Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Networking Issues in Data Centers, Transport Layer Issues in DCNs, TCP Enhancements for DCNs, Cloud Service Providers: Google, Amazon Web Services, Microsoft, IBM, SAP Labs, Salesforce, Rackspace, VMware.

UNIT – V **[9 Lectures]**

Open-Source Support for Cloud: Open-Source Tools for IaaS, Open-Source Tools for PaaS, SaaS, Distributed Computing Tools for Management of Distributed Systems: Hadoop, MongoDB, Security in Cloud Computing, Security Aspects, Platform-Related Security, Audit and Compliance.

TEXT BOOK:

1. Chandrasekaran, K. Essentials of cloud computing. CRC Press, 2014

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

WEB LINKS:

1. https://www.geeksforgeeks.org/cloud-computing/
2. https://www.javatpoint.com/introduction-to-cloud-computing
3. https://onlinecourses.nptel.ac.in/noc24_cs17/preview

QUANTUM COMPUTING (Professional Elective–IV)

B. Tech. VII Semester **L T P C**
Subjectcode:22AM741PE **3 0 0 3**

Pre-requisites:
1. A Course on "Computer Networks".
2. A course on "Operating System".

Course Objectives
1. To learn the fundamentals of quantum computing
2. To know the basics of quantum computing.
3. To learn Disseminate physical implementation of Qubit.
4. To Apply Quantum Algorithms and Their Implementation.
5. To learn the Impact of Quantum Computing Cryptography.

Course Outcomes: After the completion of the course, the students will be able to:
1. Discuss Basics of Quantum Computing.
2. Disseminate physical implementation of Qubit.
3. Apply Quantum Algorithms and Their Implementation.
4. Develop the Impact of Quantum Computing Cryptography.
5. Compare Between Classical and Quantum Information Theory.

UNIT – I **[10 Lectures]**
History Of Quantum Computing: Importance of Mathematics, Physics and Biology, Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum Logical Operations.
Quantum Mechanics: Linear Algebra, The Postulates of Quantum Mechanics, Application, Density Operator, EPR and Bell Inequality.

UNIT – II **[10 Lectures]**
Background Mathematics: Basics of Linear Algebra, Hilbert Space, Probabilities and Measurements. Background Physics: Paul's Exclusion Principle, Superposition, Entanglement and Super-Symmetry, Density Operators and Correlation, Basics of Quantum Mechanics, Measurements in Bases Other than Computational Basis.
Background Biology: Basic Concepts of Genomics and Proteomics (Central Dogma).

UNIT – III **[9 Lectures]**
Quantum Architecture: Physical Implementations of Qubit, Quantum Gates, More with Gates, Quantum Circuits, D-Wave Quantum Architecture.
Quantum Hardware: Qubits, Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

UNIT – IV **[9 Lectures]**
Quantum Algorithms: Classical Computation on Quantum Computers, Relationship Between Quantum and Classical Complexity Classes, Deutsch's Algorithm, Deutsch's-Jozsa Algorithm, Shor's Factorization Algorithm, Grover's Search Algorithm.

UNIT – V **[9 Lectures]**

Noise and Error Correction: Graph States and Codes, Quantum Error Correction, Fault-Tolerant Computation.

Quantum Information and Cryptography: Comparison Between Classical and Quantum Information Theory, Quantum Cryptography, Quantum Teleportation.

TEXT BOOK:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge.

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. I: Basic Concepts, Vol II.
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

WEB LINKS:

1. https://github.com/microsoft/Reference-Guide-For-Quantum-Computing-A-Microsoft-Garage-Project
2. https://www.javatpoint.com/what-is-quantum-computing

GENERATIVE AI (Professional Elective–IV)

B. Tech. VII Semester **L T P C**
SubjectCode:22AM742PE **3 0 0 3**

Pre-requisites:

1. A Course on Artificial Intelligence

Course Objectives:

1. To understand the challenges of Generative modeling
2. To learn about the Generative models for Text
3. To study the different image Generative models
4. To outline the different models for generating painting and music
5. To understand open source models for generating text, image, music.

Course Outcomes: After the completion of the course, the students will be able to**:**

1. List the challenges of Generative modeling.
2. Illustrate the Generative models for Text.
3. Describe the different image Generative models.
4. Outline the different models for generating painting and music.
5. Summarize open source models for generating text, image, music.

UNIT- I **[10 Lectures]**

Introduction to Gen AI: Historical Overview of Generative modelling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, Understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI, Responsible AI, Use Cases.

UNIT- II **[10 Lectures]**

Generative Models for Text: Language Models Basics, building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Exploring ChatGPT.

Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation, Multimodal LLM, Issues of LLM.

UNIT- III **[10 Lectures]**

Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- Dall-E2 and Dall-E3, GPT-4V, Issues of Image Generation models.

UNIT- IV **[9 Lectures]**

Generation of Painting, Music: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.

UNIT- V **[9 Lectures]**

Open Source Models: Training and Fine tuning of Generative models, GPT 4 All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, Lang Chain, Open Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.

TEXT BOOKS:

1. David Foster," Generative Deep Learning", O'Reily Books, 2024.

REFERENCE BOOKS:

1. Altaf Rehmani, "Generative AI for Everyone", BlueRose One, 2024.
2. Denis Rothman, "Transformers for Natural Language Processing and Computer Vision", Third Edition, Packt Books, 2024

WEB LINKS:

1. https://onlinecourses.swayam2.ac.in/imb24_mg116/preview
2. https://www.w3schools.com/gen_ai/
3. https://www.tutorialspoint.com/gen-ai/index.htm
4. https://www.simplilearn.com/tutorials/generative-ai-tutorial

SEMANTIC WEB (Professional Elective – IV)

B. Tech. VII Semester **L T P C**
Subject code:22AM743PE **3 0 0 3**

Pre-requisites:

1. A Course on Web Programming.

Course Objectives:

1. To learn the Semantic Web Vision and learn Web intelligence
2. To understand about XML, RDF, RDFS, OWL
3. To Query Ontology and Ontology Reasoning
4. To learn Semantic Web Applications, Services and Technology
5. To learn Knowledge Representation for the Semantic Web

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

1. Discuss the characteristics of the semantic web technology.
2. Disseminate the concepts Web Science, semantics of knowledge resource and ontology.
3. Identify the logic semantics and inference with OWL.
4. Use ontology engineering approaches in semantic applications.
5. Explain about Semantic web applications.

UNIT - I **[12 Lectures]**

Introduction: Introduction to Semantic Web, Benefits of the Semantic Web, Semantic Web standers, Real-World Applications, the Business Case for the Semantic Web, XML schema and Its Impact on the Enterprise.

UNIT - II **[10 Lectures]**

Web Services: Uses, Basics of Web Services, web services characteristics, web service components: SOAP, UDDI, service oriented Architecture, Orchestrating Web Services, Securing Web Services, web service standers, Grid Enabled and Semantic Web of Web Services.

UNIT - III **[8 Lectures]**

Resource Description Framework: Features, Capturing Knowledge with RDF.
XML Technologies: XPath, The Style Sheet Family: XSL, XSLT, and XSL FO, XQuery, XLink, XPointer, XInclude, XMLBase, XHTML, XForms, SVG.

UNIT - IV **[9 Lectures]**

Taxonomies and Ontologies: Overview of Taxonomies, Defining the Ontology Spectrum, Topic Maps, Overview of Ontologies, Syntax, Structure, Semantics, and Pragmatics, Expressing Ontologies Logically, Knowledge Representation.

UNIT - V **[9 Lectures]**

Semantic Web Application: Semantic Web Services, e-Learning, Semantic Bio informatics, Enterprise Application Integration, Knowledge Base.

Semantic Search Technology: Search Engines, Semantic Search, Semantic Search Technology, Web Search Agents, Semantic Methods, Latent Semantic Index Search, TAP, Swoogle

TEXT BOOKS:

1. The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management

   by Michael C. Daconta, Leo J. Obrst , Kevin T. Smith, Wiley Publishing, Inc.
2. Peter Mika, Social Networks and the Semantic Web, Springer

REFERENCE BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley Interscience
2. The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management

   by Michael C. Daconta, Leo J. Obrst , Kevin T. Smith, Wiley Publishing, Inc.
3. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
4. Semantic Web and Semantic Web Services - Liyang Lu Chapman and Hall/CRC Publishers, (Taylor & Francis Group)
5. Information Sharing on the semantic Web - Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
6. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

WEB LINKS:

1. https://www.geeksforgeeks.org/semantic-web-and-rdf/
2. https://www.tutorialspoint.com/semantic-web-definition-applications-and-benefits

NATURE INSPIRED COMPUTING (Professional Elective–IV)

B. Tech. VII Semester **L T P C**
Subject Code: 22AM744PE **3 0 0 3**

Pre-requisites:

- A Course on Artificial Intelligence
- A Course on Machine Learning

Course Objectives:

1. To gain knowledge on Significance of Evolutionary Computing.
2. To gain knowledge on Neural computing.
3. To gain knowledge on swarm intelligence.
4. To gain knowledge on Artificial Immune Systems.
5. To gain knowledge on different Real-world problems.

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

1. Familiar with Evolutionary Computing algorithms.
2. Discuss Scope of Neuro computing.
3. Compare different Ant Colony Optimization algorithmic models.
4. Analyze the scope of artificial immune systems.
5. Tackle Different Real-world problems.

UNIT - I **[12 Lectures]**

Evolutionary Computing: Problem Solving as a Search Task, types of search problems, search strategies, state space representation, Advances search strategies: Hill Climbing and Simulated Annealing, Applications of search in problem solving, Evolutionary Biology, Evolutionary Computing, The Other Main Evolutionary Algorithms, From Evolutionary Biology to Computing, Scope of Evolutionary Computing.

UNIT - II **[10 Lectures]**

Neuro computing: The Nervous System, Artificial Neural Networks, types of neural networks, Typical ANNS and Learning Algorithms, training neural networks, applications of Neuro computing, From Natural to Artificial Neural Networks, Neuro computing and cognitive modelling, Scope of Neuro computing. Tools and software for Neuro computing.

UNIT - III **[9 Lectures]**

Swarm Intelligence: Structure of Ant Colonies, Collective Behavior in Ant Colonies Ant Colony Optimization (ACO) and Its Inspirations, Ant Colony's Relevance to Swarm Intelligence, key principles of Swarm Robotics, Applications and challenges of Swarm Robotics, Social Adaptation of Knowledge.

UNIT - IV **[9 Lectures]**

Immuno computing: The Immune System Analogy, Artificial Immune Systems(AIS), Applications of Immuno Computing, Bone Marrow Models, Negative Selection Algorithms, Clonal Selection and Affinity Maturation, Types of Artificial Immune Networks, From Natural to Artificial Immune Systems, Scope of Artificial Immune Systems

UNIT - V **[8 Lectures]**

Case Studies- Bioinformatics: Protein Structure Prediction Using Clonal Selection Algorithms, Gene Expression Data Analysis for Cancer Diagnosis, Modeling of Immune System in Cancer Immunotherapy, Information Display

TEXT BOOKS:

1. Leandro Nunes de Castro - " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Albert Y.Zomaya - "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006

REFERENCE BOOKS:

1. Floreano, D. and C. Mattiussi -"Bio-Inspired Artificial Intelligence: The oriesethods, and Technologies" IT Press, 2008
2. Marco Dorrigo, Thomas Stutzle -" Ant Colony Optimization", Prentice Hall of India, New Delhi, 2005
3. Vinod Chandra S S, Anand H S - "Machine Learning: A Practitioner's Approach", Prentice Hall of India, New Delhi, 2020

WEB LINKS:

1. https://www.researchgate.net/publication/251265840_Nature-Inspired_Computing_Technology_and_Applications

MOBILE COMPUTING (Professional Elective–IV)

B. Tech. VII Semester **L T P C**
Subject code:22AM745PE **3 0 0 3**

Prerequisites:

1. A Course on Computer Networks
2. A Course on Distributed Systems

Course Objectives:

1. To make the student understand the concept of mobile computing paradigm.
2. To understand its novel applications and limitations.
3. To understand typical mobile networking infrastructure through a popular GSM protocol.
4. To understand the issues of various layers of mobile networks and their solutions.
5. To understand the principles, technologies and challenges involved in the design implementation of MANETs.

Course Outcomes: After the completion of the course, the students will be able to**:**

1. Discuss the Concept of Mobile Computing Paradigm.
2. Analyze MAC and Mobile Network Layer.
3. Disseminate the issues of Mobile Network Layer.
4. Classification of Data Delivery Mechanisms.
5. Explain Classification of Routing Algorithms.

UNIT - I **[12 Lectures]**

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

UNIT - II **[10 Lectures]**

(Wireless) Medium Access Control (MAC) Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)

Mobile Network Layer

IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

UNIT - III **[8 Lectures]**

Mobile Transport Layer Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

Database Issues Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation Transactional Models, Query processing, Data Recovery Process & QoS Issues.

UNIT - IV **[9 Lectures]**

Data Dissemination and Synchronization Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols

UNIT - V **[9 Lectures]**

Mobile Ad hoc Networks (MANETs) Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery.

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

REFERENCE BOOK:

1. Asoke K Talukder, Hasan Ahmed, Roopa Yavagal Mobile Computing: Technology, Applications and Service Creation, McGraw Hill Education.

WEB LINKS:

1. https://www.javatpoint.com/mobile-computing
2. https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/

INTRODUCTION TO NATURAL LANGUAGE PROCESSING (Open Elective–II)

B. Tech. VII Semester **L T P C**
Subject code:**22AM721OE** **3 0 0 3**

Prerequisites:
1. A Course on "Data structures".
2. A Course on "finite automata and probability theory".

Course Objectives
1. To Introduce the NLP structure of documents.
2. To understand the experimental methodology for empirical syntax analysis.
3. To describe the parsing structure of NLP systems.
4. To design NLP Algorithms.
5. To use language modelling techniques.

Course Outcomes: After completion of this course, the students will be able to:
1. Summarize methods for identifying the structure of documents in NLP.
2. Experiment for evaluating NLP systems.
3. Construct statistical models over strings, trees and estimate parameters using supervised and unsupervised training methods.
4. Implement the NLP algorithms.
5. Design different language modelling Techniques.

UNIT – I **[12 Lectures]**

Finding the Structure of Words: Words and Their Components: Tokens, Lexemes, Morphemes, Typology, Issues and Challenges, Morphological Models: Dictionary Lookup, Finite-State Morphology, Unification-Based Morphology, Functional Morphology, Morphology Induction.

Finding the Structure of Documents: Sentence Boundary Detection, Topic boundary Detection, Methods: Generative Sequence Classification Methods, Discriminative Local Classification Methods, Complexity of the Approaches, Performances of the Approaches

UNIT – II **[10 Lectures]**

Syntax-I: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure: Syntax Analysis Using Dependency Graphs, Syntax Analysis Using Phrase Structure Trees, Parsing Algorithms: Shift-Reduce Parsing, Hypergraphs and Chart Parsing, Minimum Spanning Trees and Dependency Parsing.

UNIT – III **[9 Lectures]**

Syntax-II: Models for Ambiguity Resolution in Parsing: Probabilistic Context-Free Grammar, Generative Models for Parsing, Discriminative Models for parsing, Multilingual Issues: Tokenization, Case, and Encoding, Word Segmentation, Morphology

Semantic Parsing-I: Semantic Interpretation: Structural Ambiguity, Word Sense, Entity and Event Resolution, Predicate-Argument Structure, Meaning Representation, System Paradigms.

UNIT - IV **[8 Lectures]**

Semantic Parsing -II: Word Sense: Resources, Systems, Software, Predicate-Argument Structure: Resources, Systems, Software, Meaning Representation Systems: Resources, Systems, Software.

Language Modeling-I: Introduction, N-Gram Models, Language Model Evaluation.

UNIT – V **[9 Lectures]**

Language Modeling-II: Bayesian parameter estimation: Maximum-Likelihood Estimation and Smoothing, Bayesian Parameter Estimation, Large-Scale Language Models, 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 Zitouni, 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.

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc25_cs51/preview

AI APPLICATIONS (Open Elective–II)

B. Tech. VII Semester **L T P C**
3 0 0 3

Subject code: 22AM722OE
Prerequisites: A course on Fundamentals of AI

Course Objectives:

1. To give deep knowledge of AI and how AI can be applied in various fields to make life easy.
2. To understand usage of robots and AI to automate process.
3. To understand the role of AI to enhance the user experience.
4. To understand AI in helping Business to Customer relation analysis.
5. To understand the use of AI in IoT and Intelligent cars.

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

1. Correlate AI and solutions to modern problems.
2. Make use of AI in business applications.
3. Disseminate Artificial Intelligence to Do Everything.
4. Apply AI in manufacturing and automation.
5. Make use of Artificial Intelligence to Build Intelligent Cars

UNIT – I **[10 Lectures]**
Artificial Intelligence to Power the Retail and Business-To-Business Services of the Future: Automated sales copy, Cloud services, Smart Cities, Smart Farming, key challenges.
Deep Learning to Drive Business Performance: personal home assistant, Web services, Key challenges.

UNIT – II **[10 Lectures]**
Robots and Artificial Intelligence to Automate Processes: self-service kiosks, Robots at task, key challenges. Artificial Intelligence to Keep Shelves Stacked: AI shelf Scanning systems, key challenges.

UNIT – III **[10 Lectures]**
Artificial Intelligence to Solve the Skills Crisis: matching applicants to job roles vice versa, Key challenges. Artificial Intelligence for Better Screen Experience: personalized assistant and recommender system, key challenges

UNIT – IV **[9 Lectures]**
Artificial Intelligence Helps Businesses Understand Their Customers: AI-CRM, key challenges. Artificial Intelligence to Do Everything: Map routes, assign driver using GPS data, Key challenges.

UNIT – V **[9 Lectures]**
Artificial Intelligence and Analytics: Building systems with the Internet of Things, Key challenges. Artificial Intelligence in Building Intelligent Cars: Neural networks in decision making based on camera perception, key challenges.

TEXT BOOK:

1. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.

REFERENCE BOOKS:

1. Artificial Intelligence Technologies, Applications and Challenges, Lavanya Sharma, Pradeep Kumar Garg, CRC Press.
2. Applications of Artificial Intelligence in process systems engineering, JingZhong Ren, Weifing Shen, Yi Man Lichun Dong, Elsevier.

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc22_cs56/preview

DEEP LEARNING LAB

B. Tech. VII Semester **L T P C**
Subject code:**22AM703PC** **0 0 2 1**

Course Objectives:

1. To Build the Foundation of Deep Learning.
2. To Understand How to Build the Neural Network.
3. To enable student to develop successful machine learning concepts.
4. To understand auto encoders to solve real world data
5. To be able to use GANs for image generation & Unsupervised tasks

Course Outcomes: After the completion of the course, the students will be able to**:**

1. Choose the Spyder IDE Environment.
2. Interpret Keras, Tensorflow and Pytorch libraries.
3. Apply the Convolution Neural Network on computer vision problems.
4. Build a sentiment analysis model on IMDB dataset and use RNN layers.
5. Evaluate Deep Learning Algorithms and Solve Real-world problems.

LIST OF EXPERIMENTS:

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them
3. Applying the Convolution Neural Network on computer vision problems
4. Image classification MNIST dataset (CNN model with Fully connected layer)
5. Applying the Deep Learning Models in the field of Natural Language Processing
6. Train a sentiment analysis model on IMDB dataset use RNN layers with LSTM/GRU nodes
7. Applying the Auto encoder algorithm for encoding the real-world data
8. Applying Generative Adversarial Networks for image generation and unsupervised tasks.

TEXTBOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T.Hastie, R.Tibshirani, and J.Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N.Friedman, MIT Press.

REFERENCES:

1. Bishop,C.M., Pattern Recognition and Machine Learning, Springer,2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt.Ltd,2009.
3. Golub,G.H., and Van Loan,C.F.,Matrix Computations, JHUPress,2013.
4. SatishKumar, Neural Networks: A Classroom Approach, Tata Mc Graw Hill Education, 2004.

WEB LINKS:

1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. http://neuralnetworksanddeeplearning.com/

INTERNET OF THINGS LAB (Professional Elective–III Lab)

B. Tech. VII Semester **L T P C**
Subject code:22AM731PL **0 0 2 1**

Prerequisites:

1 . A course on Computer Organization

2. A course on Computer Networks

Corequisite:

1.A Course on "Internet of Things"

Course Objectives:

1. To Introduce the Raspberry PI Platform, that is widely used in IoT applications.
2. To understand the implementation of distance sensor on IoT Devices.
3. To describe the basic functionality of LED's, LDR and Sensors.
4. To explore the usage of Arduino and Node MCU with distance sensor, LED and Temperature sensor.
5. To know about DJANGO framework, MySQL and REST API .

Course Outcomes: After completion of this course, the students will be able to**:**

1. Perform the concept of M2M with necessary protocols.
2. Implement distance sensor applications.
3. Write python programming for IoT Devices.
4. Develop models with connecting distance sensors, LED's, Temperature sensors and other sensors with Arduino Board and Node MCU.
5. Configure MySQL with DJANGO framework to create DJANGO project.

List of Experiments:

1. Using Raspberry pi

a. Calculate the distance using a distance sensor.

b. Interface an LED and switch with Raspberry pi.

c. Interface an LDR with Raspberry Pi.

2. Using Arduino

a. Calculate the distance using a distance sensor.

b. Interface an LED and switch with Aurdino.

c. Interface an LDR with Aurdino

d. Calculate temperature using a temperature sensor.

3. Using Node MCU

a. Calculate the distance using a distance sensor.

b. Interface an LED and switch with Raspberry pi.

c. Interface an LDR with Node MCU

d. Calculate temperature using a temperature sensor.

4. Installing OS on Raspberry Pi

a) Installation using PiImager

b) Installation using image file

- Downloading an Image
- Writing the image to an SD card
- using Linux
- using Windows
- Booting up Follow the instructions given in the URL n
  https://www.raspberrypi.com/documentation/computers/getting- started.html

5. Accessing GPIO pins using Python

a) Installing GPIO Zero library. update your repositories list:
   install the package for Python 3

b) Blinking an LED connected to one of the GPIO pin

c) Adjusting the brightness of an LED Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

6. Create a DJANGO project and an app.
7. Create a DJANGO view for weather station REST API
8. Create DJANGO template
9. Configure MYSQL with DJANGO framework

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

REFERENCE BOOKS:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016
2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc23_cs38/preview
2. https://www.udemy.com/course/software-manual-testing-course/
3. https://www.scribd.com/document/418157684/stm-lab
4. https://itqcr.com/

DATA MINING LAB (Professional Elective – III Lab)

B. Tech. VII Semester **L T P C**
Subject Code:22AM732PL **0 0 2 1**

Prerequisites

1. A course on "Database Management System"

Course Objectives:

1.To introduce weka, pentaho, python
2.To understand Data processing techniques
3.To obtain hands-on experience using datamining software.
4.To provide practical exposure on the concepts of datamining algorithms
5.To classify data using different approaches

Course Outcomes: After completion of course, students will be able to:

1.Apply preprocessing statistical methods for any given raw data.
2.Gain practical experience of constructing a data warehouse.
3.Implement various algorithms for data mining in order to discover interesting patterns from large amounts of data.
4.Apply OLAP operations on data cube construction.
5.Compute information gain measure.

LIST OF EXPERIMENTS: Experiments using Weka/ Pentaho/Python

1. Data Processing Techniques:
(i) Data cleaning (ii) Data transformation – Normalization (iii) Data integration
2. Partitioning - Horizontal, Vertical, Round Robin, Hash based
3. Data Warehouse schemas – star, snowflake, fact constellation
4. Data cube construction – OLAP operations
5. Data Extraction, Transformations & Loading operations
6. Implementation of Attribute oriented induction algorithm
7. Implementation of apriori algorithm
8. Implementation of FP – Growth algorithm
9. Implementation of Decision Tree Induction
10. Calculating Information gain measures
11. Classification of data using Bayesian approach
12. Classification of data using K – nearest neighbour approach
13. Implementation of K – means algorithm
14. Implementation of BIRCH algorithm
15. Implementation of PAM algorithm
16. Implementation of DBSCAN algorithm

TEXT BOOKS:

1. Data Mining – Concepts and Techniques - JIAWEI HAN &MICHELINE KAMBER, Elsevier.
2. Data Warehousing, Data Mining &OLAP- Alex Berson and Stephen J. Smith- Tata McGraw-Hill Edition, Tenth reprint 2007

REFERENCE BOOK:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Anuj Karpatne, Introduction to Data Mining, Pearson Education

WEBLINKS:

1. https://sites.google.com/view/hyudatalab.
2. https://github.com/saif-mahmud/Data-Mining-Lab.

GO PROGRAMMING LAB (Professional Elective – III Lab)

B. Tech. VII Semester **L T P C**
Subject Code:22AM733PL **0 0 2 1**

Prerequisites:

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

Course Objectives:

1. To understand basic programs using Go language.
2. To understand the use of packages in Go programming.
3. To learn Go programs using strings and arrays.
4. To study CRUD operations using mysql and Go language.
5. To study real-time applications using Go language.

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

1. Write basic programs using Go language.
2. Demonstrate the use of packages in Go programming.
3. Write Go programs using strings and arrays.
4. Implement CRUD operations using mysql and Go language.
5. Build real-time applications using Go language.

LIST OF EXPERIMENTS:

1. a) Write a Go Program to find LCM and GCD of given two numbers.
b) Write a Go Program to print pyramid of numbers.
2. a) Write a Go program to use struct that is imported from another package.
b) Write a Go Program to calculate standard deviation in Math package.
3. a) Write a Go program to print Floyd's Triangle.
b) Write a Go Program to take user input and addition of two strings.
c) Write a Go Program to check whether a string is Palindrome or not.
4. a) Write a Go Program to Build a contact form.
b) Write a Go program comprising of Contains, Contains Any, Count and Equal Fold string functions
5. a) Write a Go Program to calculate average using arrays
b) Write a Go program to delete duplicate element in a given array.
c) Write a Go Program with example of Array Reverse Sort Functions for integer and strings.
6. a) Write a Go Program for CRUD using MYSQL from scratch.
b) Write a Go Program to create multiple go routines and implement how the go routines scheduler behaves with three logical processors for CRUD using MYSQL from scratch.
7. a) Build a database using Go Programming.
b) Create a Tic Tac Toe using Go Programming.
8. Convert a text file to PDF using Go Programming.
9. Build a simple website using Go Programming.

10. Build a book management system using Go Programming.
11. Build a restaurant management system using Go Programming.
12. Build an office management system using Go Programming.

TEXT BOOKS:

1. The Go Programming Language - Alan A. A. Donovan, Brian W. Kernighan Released October 2015, Addison- Wesley Professional, ISBN: 9780134190570.
2. Go in Action - William Kennedy with Brian Ketelsen and Erik St. Martin Foreword by Steve Francia November 2015, ISBN: 9781617291784.

REFERENCE BOOKS:

1. Mastering Go: Create Golang Production Applications using Network Libraries, Concurrency, and Advanced Go Data Structures, Mihalis Tsoukalos, Packt Publisher, 2019.

WEB LINKS:

1. https://go.dev/doc/tutorial/
2. https://www.geeksforgeeks.org/golang-tutorial-learn-go-programming-language/

MOBILE APPLICATION DEVELOPMENT LAB (Professional Elective – III Lab)

B. Tech. VII Semester **L T P C**
Subject Code:22AM734PL **0 0 2 1**

Corequisite: A course on "Mobile Application Development".

Course Objectives:

1. To learn how to develop Applications in an android environment.
2. To introduce Layout Management and Multi layout definition techniques to create adaptable user Interface.
3. To know user interface for mobile Application using widgets with event handling.
4. To describe push notifications for incoming messages.
5. To explore applications to the Android marketplace for distribution.

Course Outcomes: After completion of this course, the students will be able to :

1. Work with Android operating system practically.
2. Configure Android environment and use development tools.
3. Develop rich user Interfaces by using layouts and controls.
4. Implement User Interface components for android application development.
5. Create Android applications using a database and publish it.

LIST OF EXPERIMENTS:

1. Create an Android application that shows Hello + name of the user and run it on an emulator.
   (b) Create an application that takes the name from a text box and shows a hello message along with the name entered in the text box, when the user clicks the OK button.
2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Datepicker), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout (b) Relative Layout and (c) Grid Layout or Table Layout.
3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a "Back" button. If the screen is rotated to landscape mode (width greater than height), then the screen should show a list on left fragment and details on the right fragment instead of the second screen with the back button. Use Fragment transactions and Rotation event listeners.
4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
6. Create an application that uses a text file to store usernames and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with a Login Failed message.
7. Create a user registration application that stores the user details in a database table.

8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.

9. Create an admin application for the user table, which shows all records as a list and the admin can select any record for edit or modify. The results should be reflected in the table.Develop an application that shows all contacts of the phone along with details like name, phone number, mobile number etc.Create an application that saves user information like name, age, gender etc. in shared preference and retrieves them when the program restarts.
10. Create an alarm that rings every Sunday at 8:00 AM. Modify it to use a time picker to set alarm time.

TEXT BOOKS:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Cengage, 2013.

REFERENCE BOOK:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

WEBLINKS:

1. https://www.udemy.com/course/mobile-application-development-using-android/
2. https://github.com/shubhaam13/Mobile-Application-Development
3. https://www.codingconnect.net/mobile-application-development-lab/
4. https://www.tutorialspoint.com/android
5. https://www.tutorialspoint.com/android/android_advanced_tutorial.pdf
6. https://developer.android.com

CLOUD COMPUTING LAB (Professional Elective – III lab)

B. Tech. VII Semester **L T P C**
Subject Code:22AM735PL **0 0 2 1**

Prerequisites: A course on Networking and C Programming

Course Objectives:

1.To introduce virtualbox/vmware workstation with different flavors.
2.To provide insights into cloud computing.
3.To learn different distributed system models and cloud service models.
4.To understand cloud programming.
5.To learn database instance in cloud using Google cloud SQL

Course Outcomes: After completion of course, students will be able to:

1.Install virtualbox/vmware workstation with different flavors using different OS.
2.Install Google app engine.
3.Simulate cloud scenarios using Cloudsim.
4.Find procedures for cloud service providers like cloudsim, Globus Toolkit
5.Examine various programming paradigm suitable to solve real world and scientific problems using cloud services.

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 Cloud Sim.
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

WEB LINKS:

1.https://www.javatpoint.com/cloud-computing
2.https://www.edureka.co/blog/what-is-cloud-computing

SOCIAL NETWORK ANALYSIS (Professional Elective – V)

B. Tech. VIII Semester **L T P C**
Subject code:**22AM851PE** **3 0 0 3**

Prerequisites
1. A Course on Web Technologies
2. A Course on Computer Networks
3. A Course on Data Warehousing and Data Mining

Course Objectives
1. Understand the concepts of social media.
2. Learn the mechanisms for social network analysis.
3. Analysis of widely used services such as email, Wikis, Twitter, flickr, YouTube, etc.
4. Learn the concepts of visualizing and interpreting through case studies.
5. Get familiar with connection of creativity and collaboration.

Course Outcomes: After completion of course, students will be able to:
1. Describe the basic concepts of Social Network Analysis.
2. Demonstrate social network analysis using NodeXL.
3. Analyze email networks, thread networks and twitter networks.
4. Infer Facebook networks and www hyperlink networks.
5. Outline YouTube networks and wiki networks.

UNIT - I **[10 Lectures]**

Introduction: Social Media and Social Networks, Types of Social Networks, Key Concepts, Applications of Social Network Analysis, New Technologies of Collaboration, and AI powered Collaboration Tools.

Measuring Connections, Mapping, Layout algorithms and modelling collections of Connections, Network Formation models, Diffusion Models, Community Detection Algorithms Statistical Network Models, Dynamic Network Analysis

UNIT - II **[10 Lectures]**

NodeXL: Introduction, Key features, Data Representation, Graph Analysis, Graph Visualization, Layout, Visual Design, and Labelling, Calculating and Visualizing Network Metrics, Preparing Data and Filtering, clustering: Finding Clusters, Grouping Vertices, visualizing groups, Analyzing groups, Effective Clustering and Grouping.

UNIT - III **[9 Lectures]**

CASE STUDIES:

Email: Types of Email communication, Key Features and Functions, Best practices for Email communication.

Thread Networks: Introduction, Construction, Applications, Key Metrics and Analysis Mapping Message Boards and Email Lists

Twitter: Conversation, Entertainment and Information, The interplay of Conversation, Entertainment and Information, Key features: Character Limit, Multimedia Support, Mobile Accessibility, Challenges and Considerations.

UNIT - IV **[9 Lectures]**

CASE STUDIES:

Visualizing and Interpreting Facebook Networks, Data collection, Network Representation, Visualization techniques, Interpretation and analysis, Challenges and Limitations.

WWW Hyperlink Networks: Introduction, Importance of WWW hyperlink networks, Analyzing WWW hyperlink networks, Applications.

UNIT - V **[8 Lectures]**

CASE STUDIES:

You Tube: Contrasting Patterns of Content Interaction and Prominence. Types of Prominence Factors influencing, Prominence, Interplay between Interaction and Prominence

Wiki Networks: Network Structure and Properties, A foundation for collaboration, Collaborative Content Creation, Social dynamics and interaction, Knowledge organization and Management, Technical infrastructure and Tools, Challenges and Issues.

TEXT BOOK:

1. Hansen, Derek, Ben Sheiderman, Marc Smith, Analyzing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 2011.

REFERENCE BOOKS:

1. Avinash Kaushik, Web Analytics 2.0: The Art of Online Accountability, Sybex, 2009.
2. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting and Using Metrics, 1st Edition, MGH, 2011.

WEB LINKS:

1. https://snap.stanford.edu/
2. https://networx.org

FEDERATED MACHINE LEARNING (Professional Elective – V)

B. Tech. VIII Semester **L T P C**
Subject code:22AM852PE **3 0 0 3**

Prerequisites

1. A Course on machine learning and basic programming skills

Course Objectives

1. Understand the key concepts and issues behind Federated Learning.
2. Get familiar with key theoretical results of Federated Learning.
3. Learn the concepts of horizontal federated learning and vertical federated learning.
4. Understand the key concepts of federated transfer learning.
5. Learn the concepts of federated reinforcement learning.

Course Outcomes: After completion of course, students will be able to:

1. Understand the basics on privacy-preserving ML.
2. Analyze the key concepts of Distributed ML and FL.
3. Design key concepts and applications of Horizontal FL and Vertical FL.
4. Motivates the intensive mechanism design for FL.
5. Analyze the concepts of federated reinforcement learning.

UNIT - I **[10 Lectures]**

Introduction: Motivation, Federated Learning as a Solution, The Definition of Federated Learning, Categories of Federated Learning, Current Development in Federated Learning, Research Issues in Federated Learning, Open-Source Projects, Standardization Efforts, The Federated AI Ecosystem Background: Privacy-Preserving Machine Learning, PPML and Secure ML, Threat and Security Models, Privacy Threat Models, Adversary and Security Models, Privacy Preservation Techniques, Secure Multi-Party Computation, Homomorphic Encryption, Differential Privacy

UNIT - II **[10 Lectures]**

Distributed Machine Learning: Introduction to DML, The Definition of DML, DML Platforms, Scalability- Motivated DML, Large-Scale Machine Learning, Scalability-Oriented DML Schemes, Privacy-Motivated DML, Privacy-Preserving Decision Trees, Privacy-Preserving Techniques, Privacy-Preserving DML Schemes, Privacy-Preserving Gradient Descent, Vanilla Federated Learning, Privacy-Preserving Methods

UNIT - III **[10 Lectures]**

Horizontal Federated Learning: The Definition of HFL, Architecture of HFL, The Client- Server Architecture, The Peer-to-Peer Architecture, Global Model Evaluation, The Federated Averaging Algorithm, Federated Optimization, The FedAvg Algorithm, The Secured FedAvg Algorithm, Improvement of the FedAvg Algorithm, Communication Efficiency, Client Selection Vertical Federated Learning:

The Definition of VFL, Architecture of VFL, Algorithms of VFL, Secure Federated Linear Regression, Secure Federated Tree-Boosting

UNIT - IV **[9 Lectures]**

Federated Transfer Learning: Heterogeneous Federated Learning, Federated Transfer Learning, The FTL Framework, Additively Homomorphic Encryption, The FTL Training Process, The FTL Prediction Process, Security Analysis, Secret Sharing-Based FTL Incentive Mechanism Design for Federated Learning: Paying for Contributions, Profit- Sharing Games, Reverse Auctions, A Fairness-Aware Profit Sharing Framework, Modeling Contribution, Modeling Cost, Modeling Regret, Modeling Temporal Regret, The Policy Orchestrator, Computing Payoff Weightage

UNIT - V **[9 Lectures]**

Federated Learning for Vision, Language, and Recommendation: Federated Learning for Computer Vision, Federated CV, Federated Learning for NLP, Federated NLP, Federated Learning for Recommendation Systems, Recommendation Model, Federated Recommendation System

Federated Reinforcement Learning: Introduction to Reinforcement Learning, Policy, Reward, Value Function, Model of the Environment, RL Background Example, Reinforcement Learning Algorithms, Distributed Reinforcement Learning, Asynchronous Distributed Reinforcement Learning, Synchronous Distributed Reinforcement Learning, Federated Reinforcement Learning, Background and Categorization

TEXT BOOK:

1. Federated Learning, Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen, and Han Yu , Synthesis Lectures on Artificial Intelligence and Machine Learning 2019.

REFERENCE BOOK:

1. Federated learning, Qiang yang, Morgan & Claypool Publishers.
2. Advances and open problems in federated learning, peter kairouz and H. Brendan, now publishers.

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc24_cs86/preview
2. https://www.v7labs.com/blog/federated_learning_guide

AUGMENTED REALITY & VIRTUAL REALITY (Professional Elective –V)

	L	T	P	C
B. Tech. VIII Semester				
Subject code:**22AM853PE**	**3**	**0**	**0**	**3**

Prerequisites

1. A study on Computer Networks
2. A study on Distributed Systems

Course Objectives:

1. To provide a foundation to the fast growing field of AR and make the students aware of the various AR concepts**.**
2. To give historical and modern overviews and perspectives on virtual reality.
3. To describe the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.
4. To provide a physiology of human vision, visual perception.
5. To get familiar with motion in real and virtual world.

Course Outcomes: After completion of course, students will be able to:

1. Describe how AR systems work and list the applications of AR.
2. Design the software architectures of AR.
3. Understand the Visual perception and rendering in VR.
4. Find the interaction, auditory perception and rendering in VR.
5. Describe the motion in real and virtual worlds.

UNIT - I **[12 Lectures]**

Introduction to Augmented Reality: Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields

Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays

Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

UNIT - II **[10 Lectures]**

Computer Vision for Augmented Reality: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.

Interaction: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction

Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs.

UNIT - III **[8 Lectures]**

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception.

The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations.

Light and Optics: Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays.

UNIT - IV **[9 Lectures]**

The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR

Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color **Visual Rendering:** Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT - V **[9 Lectures]**

Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection

Interaction: Motor Programs and Remapping, Locomotion, Social Interaction

Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

TEXT BOOKS:

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016),ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

REFERENCE BOOKS:

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

WEB LINKS:

3. https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and- augmented-reality/?v=c86ee0d9d7ed

WEB SECURITY (Professional Elective –V)

B. Tech. VIII Semester **L T P C**
Subject code:**22AM854PE** **3 0 0 3**

Prerequisites

1. A course on "Computer Networks"
2. A Course on "Distributed Systems"
3. A course on "Mobile Computing"

Course Objectives:

1. To understand the challenges of routing in ad-hoc and sensor networks.
2. To know the MAC and transport protocols for ad-hoc networks.
3. To introduce the protocols TCP and MANET.
4. To describe basics of Wireless sensors, and Lower Layer Issues.
5. To learn basics of Wireless sensors, and Upper Layer Issues of WSN.

Course Outcomes: After completion of this course, the students will be able to:

1. Gain knowledge of Ad Hoc and Wireless Sensor Networks.
2. Compare the MAC and routing protocols for ad hoc networks.
3. Design the solutions for TCP over Ad-hoc sensor networks.
4. Solve the issues in real-time application development based on ASN.
5. Develop the applications in the domain of ASN.

UNIT - I **[10 Lectures]**

The Web Security: The Web Security Problem, Risk Analysis and Best Practices
Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification

UNIT - II **[10 Lectures]**

The Web Privacy: Privacy-Protecting Techniques, Backups and Anti Theft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications

UNIT - III **[10 Lectures]**

Database Security: Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems

UNIT - IV **[9 Lectures]**

Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities.

UNIT - V **[9 Lectures]**

Future Trends Privacy in Database Publishing: A Bayesian Perspective, Privacy-enhanced Location Based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment

TEXT BOOKS:

1. Web Security, Privacy and Commerce Simson G Arfinkel, Gene Spafford, O'Reilly.
2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia

REFERENCE BOOKS:

1. Web application security: A beginners guide, Bryan sulliavan

WEB LINKS:

1. https://nptel.ac.in/courses/128106006
2. https://owasp.org

AD-HOC & SENSOR NETWORKS (Professional Elective – V)

B. Tech. VIII Semester **L T P C**

Subject code:**22AM855PE** **3 0 0 3**

Prerequisites

1. A course on "Computer Networks"
2. A Course on "Distributed Systems"
3. A course on "Mobile Computing"

Course Objectives:

1. To understand the challenges of routing in ad-hoc and sensor networks.
2. To know the MAC and transport protocols for ad-hoc networks.
3. To introduce the protocols TCP and MANET.
4. To describe basics of Wireless sensors, and Lower Layer Issues.
5. To learn basics of Wireless sensors, and Upper Layer Issues of WSN.

Course Outcomes: After completion of this course, the students will be able to:

1. Gain knowledge of Ad Hoc and Wireless Sensor Networks.
2. Compare the MAC and routing protocols for ad hoc networks.
3. Design the solutions for TCP over Ad-hoc sensor networks.
4. Solve the issues in real-time application development based on ASN.
5. Develop the applications in the domain of ASN.

UNIT - I **[10 Lectures]**

Introduction to Ad Hoc Networks: Characteristics of MANETs, Applications of MANETs and Challenges of MANETs, Routing in MANETs

Criteria for classification, Taxonomy of MANET routing algorithms, Topology-based routing algorithms- Proactive: DSDV, WRP, Reactive: DSR, AODV, TORA, Hybrid: ZRP.

UNIT - II **[10 Lectures]**

Position- based routing algorithms: Location Services-DREAM, Quorum-based, GLS; Forwarding Strategies, Greedy Packet, Restricted Directional Flooding-DREAM, LAR; Other routing algorithms-QoS Routing, CEDAR.

UNIT - III **[10 Lectures]**

Data Transmission: Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area- based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. Multicasting: Tree-based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AM Route, MCEDAR.

UNIT – IV **[9 Lectures]**

Geo casting: Key features of Geo casting, real-world applications, Data-transmission Oriented-LBM, Key features of LBM, Route Creation Oriented-GeoTORA, MGR, Key features of MGR, challenges. TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT - V **[9 Lectures]**

Basics of Wireless Sensors and Lower Layer Issues: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

Upper Layer Issues of WSN Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

TEXT BOOKS

1. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P.Aggarwal, World Scientific Publications, March 2006, ISBN – 981-256-681-3
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman)

REFERENCE BOOKS:

1. C. Siva Ram Murthy, B.S. Manoj Ad Hoc Wireless Networks: Architectures and Protocols.
2. Taieb Znati Kazem Sohraby, Daniel Minoli, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley.

WEB LINKS:

1. https://archive.nptel.ac.in/courses/106/105/106105160/
2. https://onlinecourses.nptel.ac.in/noc25_cs74/preview

SPEECH AND VIDEO PROCESSING (Professional Elective – VI)

B. Tech. VIII Semester **L T P C**
Subject code:22AM861PE **3 0 0 3**

Prerequisites

1. A study on Computer Networks
2. A study on Video processing

Course Objectives:

1. Understand the underlying mechanisms of speech processing concepts to analyze and manipulate speech signals.
2. Explore the theoretical foundations of speech recognition and Gaussian Mixture models for effective speech recognition.
3. Gain proficiency in the principles of video formation, perception, and representation.
4. Master motion estimation criteria, ranging from optical flow to pixel-based and gradient-based methods.
5. Develop expertise in advanced video analysis techniques and object tracking, while also understanding the concepts of compensation for enhanced video processing.

Course Outcomes: After completion of course, students will be able to:

1. Describe the mechanisms of human speech production systems and methods for speech feature extraction.
2. Understand basic algorithms of speech analysis and speech recognition.
3. Explain basic techniques in digital video processing, including imaging characteristics and sensors.
4. Apply motion estimation and object tracking algorithms on video.
5. Employ diverse techniques in object tracking and segmentation to contribute to real-world video analysis and applications.

UNIT - I **[10 Lectures]**

Speech processing concepts : The speech production mechanism, Discrete time speech signals, Pole-Zero modeling of speech, relevant properties of the fast Fourier transform for speech recognition, convolution, linear and non linear filter banks, spectral estimation of speech using DFT, Linear Prediction analysis of speech.

UNIT - II **[10 Lectures]**

Speech recognition: Feature extraction for speech, static and dynamic feature for speech recognition, MFCC, LPCC, Distance measures, vector quantization models, Gaussian Mixture model, HMM.

UNIT - III **[10 Lectures]**

Multi-Dimensional Signals and Systems: Multi-Dimensional Signals, Multi-Dimensional Transforms, Multi-Dimensional Systems, Multi- Dimensional Sampling Theory, Sampling Structure Conversion

Digital Images and Video: Human Visual System and Color, Digital Video.

UNIT - IV **[9 Lectures]**

Motion Estimation: Image Formation, Motion Models, 2D Apparent-Motion Estimation, Differential Methods, Matching Methods, Nonlinear Optimization Methods, Transform-Domain Methods, 3D Motion and Structure Estimation

UNIT - V **[9 Lectures]**

Video Segmentation and Tracking: Image Segmentation, Change Detection, Motion Segmentation, Motion Tracking, Image and Video Matting, Performance Evaluation

Image Segmentation, Graph-Based Methods, Active-Contour Models, Change Detection, Shot-Boundary Detection, Background Subtraction, Motion Segmentation, Dominant-Motion Segmentation, Multiple-Motion Segmentation, Motion Tracking, Graph-Based Spatio-Temporal Segmentation and Tracking, 2D-Mesh Tracking, Image and Video Matting, Performance Evaluation

TEXT BOOKS:

1. Fundamentals of Speech recognition – L. Rabiner and B. Juang, Prentice Hall signal processing series
2. Digital Video processing, A Murat Tekalp, 2nd edition,Prentice Hall.

REFERENCE BOOKS:

1. Discrete-time speech signal processing: principles and practice, Thomas F. Quatieri, Coth.
2. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson Education
3. “Speech and Audio Signal Processing”, B.Gold and N. Morgan, Wiley.
4. “Digital image sequence processing, Compression, and analysis”, Todd R. Reed, CRC Press
5. “Handbook of Image and Video processing”, Al Bovik, Academic press, second Edition.

WEB LINKS:

1. https://archive.nptel.ac.in/courses/117/105/117105145/
2. https://cmusphinx.github.io/wiki/tutorialconcepts/
3. https://www.coursera.org/learn/digital
4. https://users.cs.cf.ac.uk/Dave.Marshall/Multimedia/node259.html
5. https://manipulation.csail.mit.edu/segmentation.html

ROBOTIC PROCESS AUTOMATION (Professional Elective – VI)

B. Tech. VIII Semester	**L T P C**
Subject code:22AM862PE	**3 0 0 3**

Prerequisites

1.A study on Internet of Things

Course Objectives:

1. To understand the concepts of Robotic Process Automation and UI Path tool.
2. To learn flow chart mechanism in various calculations.
3. To introduce controls, OCR, Plugins, and extensions.
4. To explore user events, with the exception of handling and debugging techniques.
5. To gain knowledge of system management techniques.

Course Outcomes: After completion of this course, the students will be able to:

1. Implement the concepts of Robotic Process Automation and UI Path tool.
2. Apply the flow chart mechanism in various calculations.
3. Design controls, OCR, Plugins, and extensions.
4. Create user events, exception handling and debugging techniques.
5. Prepare system management techniques.

UNIT - I **[10 Lectures]**

Robotic Process Automation: Introduction**,** Scope and techniques of automation, Robotic process automation, Components of RPA, RPA platforms, About UiPath

UIPath Stack Uipath Studio, Uipath Robot, Types of Robots, UiPath Orchestrator

UIPath Studio Projects, User interface

The User Interface: Task recorder, Advanced UI interactions: Input methods, Output methods

UNIT - II **[10 Lectures]**

Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control Flow, various types of loops and decision making

Data Manipulation: Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, File operation with step-by-step example, CSV/Excel to data table and vice versa

UNIT - III **[10 Lectures]**

Taking Control of the Controls: Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Handling events, revisit recorder, when to use OCR, Types of OCR available, how to use OCR

Plugins and Extensions: Terminal Plugin, SAP Automation, Citrix automation and Credential management

UNIT - IV **[9 Lectures]**

Handling User Events and Assistant Bots: Assistant bots, Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event

Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways

to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting

UNIT - V **[9 Lectures]**

Managing and Maintaining the Code: Project organization, nesting workflows, Reusability of workflows, commenting techniques, State Machine, when to use Flowcharts, State Machines, or Sequences, Using config files

Deploying and Maintaining the Bot: Publishing using publish utility, using Orchestration Server to control bots, deploy bots, License Management, Publishing and Managing updates

TEXT BOOK:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition

REFERENCE BOOK:

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

WEBLINKS:

1. https://onlinecourses.nptel.ac.in/noc21_me76/preview
2. https://www.uipath.com/rpa/robotic-process-automation
3. https://www.academy.uipath.com

RANDOMIZED ALGORITHMS (Professional Elective – VI)

B. Tech. VIII Semester **L T P C**
Subject code:22AM863PE **3 0 0 3**

Prerequisites

1. A study on Data structure and Algorithms

Course Objectives:

1. To introduce the power of randomization in the design of algorithms.
2. Understand the fundamentals of randomized algorithms.
3. Analyze probabilistic techniques such as occupancy problems, Markov and Chebyshev inequalities, and randomized selection.
4. Understand and apply randomized data structures such as treaps, skip lists, and hash tables
5. Explore geometric algorithms such as convex hulls, Delaunay triangulations, and trapezoidal decompositions

Course Outcomes: After completion of course, students will be able to:

1. Appreciate the fundamentals of randomized algorithm design.
2. Understand the fundamentals of Markov chains and the Monte Carlo method.
3. Apply high probability analysis to selected randomized algorithms.
4. Understand the Fingerprint and Pattern Matching techniques.
5. Apply geometrics and parallel algorithms.

UNIT- I **[10 Lectures]**

Introduction: A Min – Cut algorithm, Las Vegas and Monte Carlo, Binary Planar Partitions, A Probabilistic Recurrence

Game-Theoretic Techniques: Game Tree Evaluation, The Minimax Principle

UNIT- II **[10 Lectures]**

Moments and Deviations: Occupancy Problems, The Markov and Chebyshev Inequalities, Randomized Selection, Two Point sampling, The Coupon Collector's problem.

Markov Chains and Random Walks: A 2-SAT example, Markov Chains, Random Walks on Graphs, Graph Connectivity

UNIT – III **[10 Lectures]**

Algebraic Techniques: Fingerprinting and Freivald's Technique, Verifying Polynomial Identities, Perfect Matching in Graphs, Verifying Equality of Strings, A Comparison of Fingerprinting Techniques, Pattern Matching

UNIT- IV **[9 Lectures]**

Data Structures: The Fundamental of Data-structures, Random Treaps, Skip Lists, Hash Tables Graph Algorithms: All Pairs Shortest Path, The Min- Cut Problem, Minimum Spanning Trees

UNIT – V **[9 Lectures]**

Geometric Algorithms: Randomized Incremental Construction, Convex Hulls in the Plane, Duality, Half- Space Intersections, Delaunay Triangulations, Trapezoidal Decompositions, Parallel and Distributed Algorithms: The PRAM Model, Sorting on a PRAM, Maximal Independent Sets, Perfect Matchings

TEXT BOOKS:

1. Randomized Algorithms: Rajeev Motwani, Prabhakar Raghavan, Cambridge University Press
2. Probability and Computing: Randomization and Probabilistic Techniques in Algorithms and
3. Data Analysis by Eli Upfal and Michael Mitzenmacher.

REFERENCE BOOKS:

1. "Randomized Algorithms for Scientific Computing" – *Michael W. Mahoney*

WEB LINKS:

1. https://onlinecourses.nptel.ac.in/noc20_cs39/preview

COGNITIVE COMPUTING (Professional Elective – VI)

B. Tech. VIII Semester **L T P C**
Subject code:22AM864PE **3 0 0 3**

Prerequisites

1. A study on Computer organization

Course Objectives:

1. To provide an understanding of the central challenges in realizing aspects of human cognition.
2. To provide a basic exposition to the goals and methods of human cognition.
3. To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
4. To support human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.
5. Explore Deep QA, UIMA, and structured knowledge to understand cognitive computing and its business applications.

Course Outcomes: After completion of course, students will be able to:

1. Understand cognitive computing.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and develop the business implications of cognitive computing.
5. Develop the business implications of cognitive computing.

UNIT - I **[10 Lectures]**

Introduction to Cognitive Science: Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition, a dynamical systems approach to cognition.

UNIT - II **[10 Lectures]**

Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics. Exploration of memory representation, retrieval processes, language comprehension in cognitive architectures. Integration of AI-driven models to simulate human cognition and linguistic behavior.

UNIT - III **[10 Lectures]**

Cognitive Modeling: modeling the interaction of language, memory and learning, Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making.

UNIT - IV **[9 Lectures]**

Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, Cognitive Development Child concept acquisition. Cognition and

Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks.

UNIT - V **[9 Lectures]**

Deep QA: Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems.

TEXT BOOK:

1. The Cambridge Handbook of Computational Psychology by Ron Sun (ed.), Cambridge University Press.

REFERENCE BOOKS:

1. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles Cognitive Computing and Big Data Analytics, Wiley
2. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, Cognitive Computing: Theory and Applications: Volume 35 (Handbook of Statistics), North Hollan.

WEB LINKS:

1. https://nptel.ac.in/courses/108105185

CONVERSATIONAL AI (Professional Elective – VI)

B. Tech. VIII Semester **L T P C**
Subject code:22AM865PE **3 0 0 3**

Prerequisites

1. A course on Artificial Intelligence
2. A Course on Natural Language Processing

Course Objectives:

1. To be familiar with the basic knowledge about conversational systems.
2. To understand the different techniques of natural language processing.
3. Study the fundamental role of machine learning in building conversational systems.
4. To know the various applications of conversational systems and its future development.
5. Explore neural dialogue systems, response generation techniques, and challenges in conversational AI.

Course Outcomes: After completion of course, students will be able to:

1. Understand the basic technologies required for building a conversational system.
2. Learn the rule-based dialogue system.
3. Involve AI in building conversational system and build advanced systems that are cognitively inclined towards human behavior.
4. Develop a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.
5. Design and implement neural dialogue systems for conversational AI.

UNIT- I **[10 Lectures]**

Introducing Dialogue Systems: Introduction of Dialogue System, History of Dialogue Systems, Present-Day Dialogue Systems, Modeling Conversation Dialogue Systems, Designing and Developing Dialogue Systems

UNIT- II **[10 Lectures]**

Rule-Based Dialogue Systems: Architecture, Methods, and Tools: Dialogue Systems Architecture, designing a Dialogue System, Tools for Developing Dialogue Systems, Rule-Based Techniques in Dialogue Systems Participating in the Alexa Prize

UNIT- III **[10 Lectures]**

Statistical Data-Driven Dialogue Systems: Motivating the Statistical Data-Driven Approach, Dialogue Components in the Statistical Data- Driven Approach, Reinforcement Learning (RL), Representing Dialogue as a Markov Decision Process, From MDPs to POMDPs, Dialogue State Tracking, Dialogue Policy, Problems and Issues with Reinforcement Learning in POMDPs.

UNIT- IV **[9 Lectures]**

Evaluating Dialogue Systems: Process of Evaluation, Evaluating Task-Oriented Dialogue Systems, Evaluating Open-Domain Dialogue Systems, Evaluation Frameworks- PARADISE, Quality of Experience (QoE), Interaction Quality, Best Way to Evaluate Dialogue Systems.

UNIT- V **[9 Lectures]**

End-to-End Neural Dialogue Systems: Neural Network Approaches to Dialogue Modeling, A Neural Conversational Model, Introduction to the Technology of Neural Dialogue, Retrieval-Based Response Generation, Task- Oriented Neural Dialogue Systems, Open-Domain Neural Dialogue Systems, Some Issues and Current Solutions, Dialogue Systems: Datasets, Competitions, Tasks, and Challenges.

TEXT BOOKS:

1. Michael McTear, "Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots", Second Edition, Moran and Claypool Publishers, 2020.

REFERENCE BOOK:

1. Cathy Pearl, "Designing Voice User Interfaces: Principles of Conversational Experiences", O'REILLY, 2016.

WEB LINKS:

1. https://nptel.ac.in/courses/106105077

INTRODUCTION TO DEEP LEARNING (Open Elective – III)

B. Tech. VIII Semester **L T P C**
Subject code:22AM831OE **3 0 0 3**

Prerequisites

1. A course on 'Machine learning'.

Course Objectives:

1. To learn Machine Learning basics and neural networks.
2. To know regularization techniques deep models.
3. To understand different deep learning algorithms.
4. To understand CNN architecture.
5. To understand the real world application

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

1. Implement deep Learning algorithms and their applications in real-world data.
2. Design and train deep feed forward neural networks with regularization.
3. Apply optimization techniques for training deep models.
4. Analyze and implement convolutional neural networks.
5. Develop deep learning solutions for real-world applications.

UNIT – I **[10 Lectures]**

Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyper parameters 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, Challenges Motivating Deep Learning

UNIT – II **[10 Lectures]**

Deep Feedforward Networks : Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

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.

UNIT – III **[10 Lectures]**

Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second Order Methods.

UNIT – IV **[9 Lectures]**

Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features

UNIT – V **[9 Lectures]**

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing: n-grams, Neural Language Models, High Dimensional Outputs, Combining Neural language models and n-grams, Other Applications: Recommender Systems, Knowledge Representation, Reasoning and Question Answering.

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.

WEBLINKS:

1. https://www.geeksforgeeks.org/introduction-deep-learning
2. https://onlinecourses.nptel.ac.in/noc24_ee04/preview

INTRODUCTION TO GENERATIVE AI (Open Elective – III)

B. Tech. VIII Semester **L T P C**
Subject code:22AM832OE **3 0 0 3**

Prerequisites:

1.A Course on Artificial Intelligence

Course Objectives:

1. To understand the challenges of Generative modeling.
2. To learn about the Generative models for Text.
3. To study the different image Generative models.
4. To outline the different models for generating painting and music.
5. To understand open source models for generating text, image, music.

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

1. List the challenges of Generative modeling.
2. Illustrate the Generative models for Text.
3. Describe the different image Generative models.
4. Outline the different models for generating painting and music.
5. Summarize open source models for generating text, image, music.

UNIT- I **[10 Lectures]**

Introduction to Gen AI: Historical Overview of Generative modelling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, Understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI.

UNIT- II **[10 Lectures]**

Generative Models for Text: Language Models Basics, building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Exploring ChatGPT.

UNIT- III **[10 Lectures]**

Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- Dall-E2 and Dall-E3, GPT-4V, Issues of Image Generation models.

UNIT- IV **[9 Lectures]**

Generation of Painting, Music: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.

UNIT- V **[9 Lectures]**

Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation, Multimodal LLM, Issues of LLM.

TEXT BOOKS:

1. David Foster," Generative Deep Learning", O'Reily Books, 2024.

REFERENCE BOOKS:

1. Altaf Rehmani, "Generative AI for Everyone", BlueRose One, 2024.
2. Denis Rothman, "Transformers for Natural Language Processing and Computer Vision", Third Edition, Packt Books, 2024

WEB LINKS:

1. https://onlinecourses.swayam2.ac.in/imb24_mg116/preview
2. https://www.w3schools.com/gen_ai/
3. https://www.tutorialspoint.com/gen-ai/index.htm
4. https://www.simplilearn.com/tutorials/generative-ai-tutorial